

T.C.
DOKUZ EYLÜL ÜNİVERSİTESİ
SAĞLIK BİLİMLERİ ENSTİTÜSÜ

**EVALUATION OF WORK RELATED
MUSCULOSKELETAL DISORDERS AND
ERGONOMIC AWARENESS AMONG
PHYSIOTHERAPISTS**

BARIŞ GÜRPINAR

**THESIS OF MASTER OF SCIENCE PROGRAM IN
PHYSICAL THERAPY AND REHABILITATION**

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ABBREVIATIONS

WRMDS: Work related musculoskeletal disorders.

IEA: The International Ergonomics Association

NOISH: The National Institute for Occupational Safety and Health

LBP: Low back pain

Appx: Appendix

Leg.&Reg: Legislations & regulations,

W.E.R: Workplace ergonomic requirements,

S.o.A: Safety of application;

SD: Standard deviation

PT: Physiotherapist

SUMMARY

EVALUATION OF WORK RELATED MUSCULOSKELETAL DISORDERS AND ERGONOMIC AWARENESS AMONG PHYSIOTHERAPISTS

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The purpose of the study is to determine whether ergonomic awareness changes with the previous work related musculoskeletal disorders (WRMDs) experiences. For that reason, 102 physiotherapists (PT) actively working in Izmir surveyed about their WRMDs experiences and ergonomic awareness.

A four paged self administrative questionnaire was distributed to the PTs in drop and collect method. Questions investigated musculoskeletal symptoms, specialty areas, task and job-related risk factors, and responses to injury. Additionally Ergonomic Awareness Scale (EAS) was included for ergonomic awareness scores.

There was no significant relationship reported between ergonomic awareness score and WRMDs history ($p=0,189$). Mean EAS score of all PTs ($n=102$), were found $40,91 \pm 14,44$ out of hundred points. EAS score of PTs with ($n=78$) and without WRMDs ($n=24$) experience was $55,6 \pm 14,8$ and $60 \pm 12,7$ respectively.

Results of the study showed WRMDs experience would not necessarily improves ergonomic awareness. Ergonomics is a complex subject with different interrelated aspects which must be dealt with every level of authorities and organisations. Prevention from WRMDs cannot be achieved with individual efforts and attempts, therefore ergonomic awareness training programs should be introduced at undergraduate and postgraduate levels.

Key words: Work related musculoskeletal disorders, WRMD, physiotherapists, ergonomic awareness.

ÖZET

FİZYOTERAPİSTLERDE MESLEĞE BAĞLI MUSKULOSKELETAL RAHATSIZLIKLARIN VE ERGONOMİK FARKINDALIĞIN DEĞERLENDİRİLMESİ

Fzt. Barış GÜRPINAR

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Bu çalışmanın amacı fizyoterapistlerde ergonomik farkındalık ile daha önce geçirilmiş mesleğe bağlı muskuloskeletal rahatsızlıklar (MBKR) ile arasında bir ilişkinin incelenmesidir. Bu nedenle İzmir de aktif olarak çalışan 102 fizyoterapist MBKR ve ergonomik farkındalıkları konusunda anket çalışmasına alınmışlardır.

Fizyoterapistlere kendilerinin cevapladıkları dört sayfalı anketler bırak ve topla metoduyla ulaştırılmıştır. Anket soruları muskuloskeletal semptomlar, çalışma alanı, görev ve iş ile ilgili risk faktörleri ve yaralanmaya cevapları incelemektedir. Bunun yanı sıra anketlerde ergonomik farkındalık skorunun elde edilmesi için Ergonomik Farkındalık Skalası (EFS) da bulunmaktadır.

Ergonomik farkındalık skoru ile MBKR öyküsü bulunması arasında istatistiksel olarak anlamlı bir ilişki bulunamamıştır ($p=0,189$). Tüm fizyoterapistlerin ($n=102$) ortalama EFS skorları yüz tam puan üzerinden $40,91 \pm 14,44$ bulunmuştur. MBKR öyküsü bulunanlarda ($n=78$) ve bulunmayanlarda ($n=24$) ise sırasıyla $55,6 \pm 14,8$ ve $60 \pm 12,7$ olarak hesaplanmıştır.

Bu çalışmanın sonuçları göstermiştir ki MBKR öyküsü ergonomik farkındalığı arttırmamaktadır. Ergonomi birbirinden farklı ve birbirini etkileyen başlıklardan oluşan karmaşık bir konudur bu nedenle kurum ve kuruluşların her seviyesinde bunu konuyla ilgilenilmelidir. MBKR'ler den korunma kişisel girişim ve çabalarla sağlanamamaktadır bu nedenle lisans ve lisansüstü seviyelerde ergonomik farkındalık eğitim programlarına başlanmalıdır.

Anahtar kelimeler: mesleğe bağlı muskuloskeletal rahatsızlıklar, MBKR, fizyoterapist, ergonomik farkındalık.

INTRODUCTION AND PURPOSE

Recently the number of researches, reported work related musculoskeletal disorders (WRMDs) in physiotherapist, has increased. The professions, like physiotherapists, working with physically depending patients, are more exposed to mechanical load, therefore, susceptible to WMSD (1-16) Researches show that prevalence of WMSDs in physiotherapists is higher than 60% (1,2,16). It is difficult to understand the importance and consequences of the subject due to limited studies in Turkey. Kayihan et al reported 75 % of physiotherapists experienced WMSD in 1996 (10) where as Salık and Özcan reported 85% in a study with 120 physiotherapist 8 years later (13). Beside these two studies, no researches were found considering the cause and effects of WRMDs in Turkish physiotherapists. Reasons of WMSD can be listed as; patient lifting, working in the same posture for long time, patient transfers, task repetition and manual technique specific to physiotherapy (1-16)

Cromie reported (2001) that physiotherapists believe they are not as susceptible as any other occupation group to WMSD due to their musculoskeletal knowledge and experiences. Mostly (94%) they trust their education on injury prevention (16). However some studies proved that physiotherapists would not reflect the advance level of ergonomics and biomechanics skills to their working posture.

Ergonomic guidelines for physiotherapists are not present in Turkey likewise resources to improve ergonomic awareness. In order to create health and safety friendly working environment for physiotherapists “ergonomic guidelines” must be establish instead of counting on personal knowledge and experiences. On the contrary, the hypothesis of this study was ergonomic awareness had no relationship with personal experiences of WRMDs.

Purposes of the study were

- Ø To understand the relationship between WRMDs and ergonomic awareness.
- Ø To evaluate ergonomic awareness of physiotherapists.

GENERAL INFORMATION

1. Ergonomics

1.1 Definition of Ergonomics

Ergonomics should be seen as an approach, or a philosophy of taking account of people in the way we design and organize systems, products, equipment and jobs. In order to create health and safety friendly working environment for physiotherapists “ergonomic guidelines” must be establish instead of counting on personal knowledge and experiences. Ergonomic guidelines for physiotherapists are not present in Turkey likewise resources to improve ergonomic awareness.

Recent occupational health studies express the importance of setting standards and rising ergonomic awareness in improving health and safety at work. The framework of hazard identification, risk assessment, risk control and review is believed as a reliable system to establish safer working environment. This approach prevents work related accidents and disorders by increasing the ergonomic knowledge and awareness.

As technology develops we hear more about ergonomics in a wider range from a handle of a pot to cell phones or from an office chair to car manufacturing machines. Until World War II systems were designed without taking into account, either the user or the context of system operation however ensuring safety and adequacy of purpose has been gradually comprehended (16). Although designing, developing and integrating ergonomics or safety engineering is regarded as a costly implication, today ergonomics has many influences on our daily and working life and surely will have more as extended life expediency, advanced technology, fast life style and newly introduced gadgets express the importance of this science field.

Ergonomic Society defines ergonomics as an approach which puts human needs and capabilities at the focus of designing technological systems. The aim is to ensure that humans and technology work in complete harmony, with the equipment and tasks aligned to human characteristics. Designing tasks and jobs so that they are effective and take account of human needs such as rest breaks and sensible shift patterns, as well as other factors such as intrinsic rewards of work itself. Designing equipment and systems including computers, so that they are easier to use and less likely to lead to errors in operation - particularly important in high stress and safety-critical operations such as control rooms.

1.2. Domains of Ergonomics

Mac Leod (2003) believes that improvement in ergonomics would be achieved with a better appreciation and anticipation of changes to system effectiveness and human work. Designing an effective and ergonomic friendly system requires the consideration on relations between many factors (17). (fig.1)

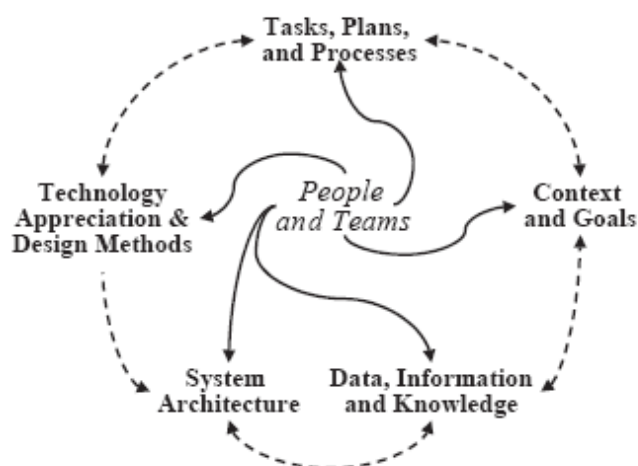


Fig. 1. Interrelated considerations on human centred design.

Ian Mac Leon, Real-world effectiveness of Ergonomic methods, (2003)

As represented in the figure, designing a good human machine system design processes involves consideration on many interrelated factors.

The context of task, plans, processes and the goals of the teams must be designed with data, information and knowledge gained. The approach to plans and processes needs an appreciation of the operational requirements of the system.

Village published a discussion paper on ergonomic regulation in 2001 (18) which has a thorough research on regulation and legislation of ergonomics in many different countries and pointed variety aspects and power groups of ergonomics nature of regulation also the acceptance of those rules by labour and employer groups.

The paper provides a list of features that may influence the configuration of ergonomics regulations (18);

- Ø the process of regulation development and stakeholder input (for example, negotiation, public forums, comment periods)
- Ø whether the regulation will be performance based, or specification based

- ∅ whether the approach will be proactive, or after injuries have occurred
- ∅ whether the regulations will be specific to activities (eg. manual handling, VDT work) or focused on reducing all WMSDs regardless of activity
- ∅ whether regulations will include risk factors other than physical (repetition, posture, etc.) such as work organisation and psychosocial factors
- ∅ whether regulations will be accompanied by a code of practice, or best practice materials
- ∅ whether regulations will be implemented in all industries regardless of size and type
- ∅ whether regulations will accompany, follow, or come before codes of practice, guidance documents and other resources for industry
- ∅ the strategy for enforcement (for example, accompanied by consultation, phased in over time, etc.)
- ∅ the level of enforcement which is influenced by numbers of inspectors, training for inspectors in ergonomics and priorities of inspectors
- ∅ provision of assistance to companies apart from regulation enforcement (consultation, education, etc.)

The International Ergonomics Association (IEA) considers ergonomics as a scientific discipline concerned with the understanding of interactions among human and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance (IEA 2000).

IEA studies ergonomics in different domains however these domains are not mutually exclusive and they evolve constantly; new ones are created and old ones take on new perspectives. Currently there are three domains, physical, cognitive and organisational ergonomics, are introduced.

Physical ergonomics concerns with human anatomical, anthropometric, physiological and biomechanical characteristics as they relate to physical activity such as working postures, materials handling, repetitive movements, work related musculoskeletal disorders, workplace layout, safety and health.

Cognitive ergonomics is more related to mental process namely, work stress, mental work load and decision making as they affect interactions among humans and other elements of a system.

Additionally organisational structures, policies, and processes are in the interest of *organisational ergonomics* which includes the working topics of design of working times, teamwork and quality management.

2. Why Is Ergonomics Important in Healthcare?

Ergonomics have two fold importances in healthcare because it has two sides as providers and receivers. Providers need to feel safe and free from injury to provide the best care for those whom they are responsible for. Receivers should get the best treatment possible without any further detriment.

IEA points out that ergonomics concern with human well-being and overall system performance and in health care both topics conclude in human well being; therefore it is needed to be investigated thoroughly. MacLeod expressed that ergonomics and its involvement can decrease risk and overall costs, plus promote improvements to the general quality of the system with relation to its acceptance and operation (17). This statement confirms that ergonomics is even more important for the health services seeking for cost effective and global standardizations in services researches report that benefits exceed costs (18).

Carayon (19) reports the issues below about health care and patient safety improve with the understanding and the implication of ergonomics.

- Medical errors and adverse events: identification, management, review and recovery
- Workload and demands experienced by healthcare providers:
Striving to attain cost effective and in global standards health care bring extra workload of reporting, analysis and development of solutions of patient safety problems.
- Human and organisational reliability and resilience of systems, processes and technologies:
Due to knowledge imbalance between service provider and receiver in health care and high value and vulnerability of the service, many organisations focus to gain trust and reliance of the buyers. Crayon defences that with the improvement

in ergonomics reliability and resilience at various levels, such as individual level, the team level and the organisational level will be accomplished.

- Transitions of care

Health care is multidisciplinary approach patients could be treated by a group of health care professions and /or referred from one to another. In this process information may get lost; responsibility for the patient's care could be unclear or misunderstandings could occur. These errors can be identified and prevented with a better cooperation between health care workers and the system.

- Medical devices and healthcare information technology

Developing technology introduces new appliances and techniques very often especially in health care. To understand and be master in using these technologies and devices needs hard work and time. There are advantages and disadvantages of using novel medical devices and information technology they can be very supportive and helpful to increase any work load, at the same time they can be very hazardous and time consuming.

- Human Factor and Ergonomics interventions for improved patient safety in a variety of care settings.

Many ergonomics researches have done in hospital base and among certain health care professions however there are different settings ad numerous of health care professions must be taken into consideration.

In this study ergonomics in health care is investigated according to IEA classification Cognitive, organisational and physical ergonomics in health care.

2.1. *Cognitive Ergonomics in Health Care*

Cognitive ergonomics concerns about the psychological aspects of; work environment, working conditions and work itself as well as psychological load of work such as work stress, mental work load, decision making, pressure and role conflict.

Health professions with high level of work load would either push themselves to their limits to meet the work demand or compromise their duties. In either way they feel drained, incompetent and worthless in other words they experience *burn out syndrome* (20) one of the most important job stressors threatens cognitive ergonomics in working environments.

Felton (1998) explain the term of burn out as loosing the meaning of job itself, having the feeling of *run down*, or difficulty in concentrating on task therefore making more mistakes (21). The more common identification of burn out syndrome is made by Maslach in 1996 as a syndrome of feelings of emotional exhaustion, depersonalization, and reduced personal accomplishment (22).

According to a research, burn out syndrome has many factors, including situations in which work demands cannot be met because of a lack of resources such as social support from co-workers and supervisors, job control, participation in decision making, utilization of skills, and reinforcements such as rewards (23). Similarly another research reported that the most common work factors in health care associated with psychological ill health were work demand (long hours, workload, and pressure), lack of control over work, and poor support from managers (24). Kamrowska A. (2007) grouped sources of burn-out sources into 3 categories in the vocational group of physicians which are individual, interpersonal and organisational (25).

Similarly Demerouti et al. (2000) studied those factors in two different categories of working conditions; job demands and job resources which have an indirect impact on life satisfaction among nurses. Job resources are referring working conditions that potentially evoke stress-reactions among nurses when they are lacking or insufficient namely supervisor support, feedback, participation, control, rewards and task. While, job demands are related to nurses' personal limits and abilities such as physical workload, cognitive workload, time pressure, patient contact, environment condition and shift work (26).

On the other hand Cooper C.L. (1989) reports demands of the job and patients' expectations, interference with the family life, constant interruption at work and home, practice administration are the job stressors which indicate job dissatisfaction and low or lack of mental well being among healthcare workers (27).

Today health service sector manages more patients than ever, diagnoses of new disorders, introducing of new treatment methods and developed treatment techniques involve more patients and increases patients' turnover. Additionally raising expenditure of health costs results in cut offs in the health care workers. This, subsequently, leads shortage in healthcare workers and intensiveness in their work which negatively affects job satisfaction.

In a systematic literature review about reducing work related physiological ill health and sickness absence Michie and Williams suggest that poor psychological health and sickness

absence of the health care team would affect patient care's quantity and quality negatively and this is due the structure of health care service (24). The health care is provided by staff, whose number is merely enough, working in teams so any ill health and sickness absence in one of those team members is like to cause increased work and stress for other staff. Additionally, the systematic review includes some other non-health care sectors which levels of psychological ill health are lower than health care workers however the relation between work factors and psychological ill health are similar.

In the light of this data it is undoubtedly true that emotional stress is quite high in every aspect of health care sector additionally work environment and conditions do not ease the psychological load of the health care professions.

2.1.2 Cognitive ergonomics in physical therapy

Cognitive ergonomics is concerned with the design and use of tools, and with the design of the work situation as a whole. It studies two main subjects, cognitive fitness of the work and cognitive fitness of the worker.

Cognitive fitness of the work refers how suitable is the task to understand, to make decision on and to perform. Recently, many researchers have been conduct in software design and aviation industries. Interventions in this area aim to improve understandability and usability of the devices and systems. Situational awareness and eye-tracking studies are some of the most common studies in this field.

Physiotherapists are not only doing the work they also think, plan and decide about the work. Therefore cognitive ergonomics is an essential subject for physical therapy occupation. However cognitive ergonomics of physical therapy has not been subjected on many researches. The techniques used in physiotherapy require great deal of manual skills and cognitive engagement of the physiotherapists. For example resisting to a patient during a PNF (proprioceptive neuromuscular facilitation) pattern must be done with a "just enough" power to allow a smooth but challenging movement. It takes time and needs experience to understand the patients' strength. PTs should practise and exercises to determine the sufficient power for each patient. Similar problems could occur during manual manipulation techniques, stretching and manual muscle testing. On the other hand PTs deal with very subjective issues such as pain, wellness, fatigue even shortness of breath; these subjects are difficult to explain and understand. Even though there are some tools to evaluate these subjects usually there is an ambiguity between the patient and PT.

Another topic of cognitive ergonomics is cognitive fitness of the worker. How fit is the workers' mind is the main question that cognitive ergonomics is dealing with.

Studies about physiotherapists have reported moderate to elevated levels of stress [28–30], and occupational stress has been reported as a negative feature that diminishes the attractiveness of physiotherapy as a career [31].

Mostly studies on cognitive ergonomics among physiotherapists have focused on the identification of stressors. Issues related to lack of professional autonomy, lack of organisation in the hierarchical command chain, lack of professional and social recognition, disorganisation in task distribution and interpersonal conflicts with superiors were identified as the main sources of stress.

2.2. Organisational Ergonomics in Health Care

Organisational ergonomics also known as macro-ergonomics focuses on optimizing socio-technical systems and organizing structures, policies and processes in order to maximize efficiency. This domain addresses more subjective aspects of the workplace such as communication, crew resources and management, work schedule design, teamwork, participatory design, cooperative work, new work paradigms, quality management. This paper studies organisational ergonomics in health care in four different levels; international, national, organisational, and profession groups.

The new order of the world necessitates the collaboration of different power groups and stakeholders on variety of implications and legislations. Producing an American brand X-Ray machine in China which is in use European Countries, restricting animal testing of an application because the pressure of animals rights groups, or accepting the regulations stated by USA or EU bodies by other countries. There are supranational organisations to establish an international consistency also elucidate the crucial interaction between international organisations. Namely “White Papers” outlines the government policies, WHO coordinates international health activities and to help governments improve health services or economic unions such as European Union which allows national health policies of members however sets minimum standards over the products consumed in these countries. Therefore those regulations and legislations need to be considered thoroughly to fit in different systems and cultures, in other words organisational ergonomics is essential to health organisations due its supranational nature. International level organisational ergonomics of the health care is

mainly depend on communication, quality management and design of work, where its particular concern is setting policies and standards over practices and characteristics of health care.

Health care service is a massive topic of in every country's politic agenda. Many politicians pledge to ameliorate health care system and many of them resigned due to insufficient improvement or misapplications. Health care service has a big share of the national budget plus holds a vast market for the investors therefore there are various powers affecting the system. Under these strong powers and pressure groups it is almost impossible to stay steady. In addition to stakeholders' manipulation power, developing technology also urges to never-ending changes in healthcare system. Constant change in health care system is another notion which complicates organisation in health care system. Aspects of continuity, confidentiality, interdisciplinary knowledge share etc. collaborate the changes and increase the resistance. Therefore not to affect the harmony between system and human factor changes must be imply only after comprehensive analyze of the current practice to understand the troubling issues in the organisation and management of delivery of health care. Plsek argued in 2001 that detailed targets and specifications on health delivery, nor over controlling and compelling to change do not help. Instead systems should understand and utilize the attractors and positive dimension of variations in organisations (32). The national level of organisational ergonomics must consider health care in whole and its interactions within it self and with other related bodies. Patients should arrive to the health facilities; get the equal rights and treatments with free of problems and mistrust. Besides health care professional should feel secure and satisfied during their working hours, likewise the owners and directorates of the organisations need to be sure that their budget is not the determining issue and they are not alone with their problems.

Today health care service is much more than a doctor with a black case. It is an all-inclusive service industry just like hotel and restaurant business or banking, hospitals provide health service rather than producing any products. However contrary to the service industry clients do not have much information about what they are buying as well as provides they could not be very certain about what they would be offering until they meet the client. Besides epidemics and natural/ accidental disasters even escalates this unpredictability. Moreover, there are numerous types of highly educated occupations, working as a team in health care service. Besides, organisations differ in size, ownership status, level and type of staffing, and

technological sophistication. The complex structure of the hospital is not only including number of professions but there are also many different managerial lines every profession has its own department.

Hignett (2003) describes organization complexity in three groups; in those the first one involves only one management line and one profession such as education and prisons (33). The second group includes one management line however more than one professions military can be an example for this group. In the third group there are numbers of professions and many managerial lines as in hospitals.

Today there are numerous researches on the organisational structure of a health care organisation (33-35) trying to understand and analyze the way it is and to determine the way it should be. Organisational ergonomics at organisation level, such as hospitals, concerns the relationship between administrative informational, therapeutic, diagnostic, and support services.

Pesronjee (2005) claims that, a hospital's success is largely depending on the quality of work of its employees (36). There are many stress factors on health care workers although they seem the issue for cognitive ergonomics; organisational ergonomics is closely related to this topic. Precise job descriptions, task guidelines, meticulous schedules and democratic management are some keys to resolve, manage, and prevent workplace conflict.

Moreover the transitions of data and communication between and within teams have great importance both for quality of care and the harmony of the work system. Successful teams recognize the professional and personal contributions of all members; promote individual development and team interdependence; recognize the benefits of working together; and see accountability as a collective responsibility. Teamwork is influenced by organizational culture. An organizational philosophy on the importance of teamwork can promote collaboration by encouraging new ways of working together; the development of common goals; and mechanisms to overcome resistance to change.

Oandasan et al (2006) claims that teams work most effectively when they have a clear purpose; good communication; co-ordination; protocols and procedures; and effective mechanisms to resolve conflict when it arises. Teams function better when they are working in an organizational culture that supports teamwork and they have strong leadership and effective administrative support (37).

Rafferty et al (2001) reported that teamwork within nurses associates with the quality of care, autonomy and synergy rather than conflict (38). Besides improving team climate may reduce intentions to leave and turnover among hospital employees (39).

2.3. Physical ergonomics in Health Care

NIOSH describes ergonomics as finding a best fit between worker and job conditions which concerns about the capabilities and the limits of the human body regarding person's task, tool used and the job environment. The main goal of the ergonomics is to make sure workers are uninjured, safe, and comfortable, as well as productive. As it can be derived from the description the main concern of the ergonomics is physical integration between the task and the human. Work-Related Musculoskeletal Disorders (WMSDs) also known as Occupational Overuse Syndrome, Cumulative Trauma Disorders or Repetitive Motion Injuries in literature are the focus of most ergonomics regulations. WHO identifies the term of musculoskeletal disorders as health problems of the locomotor apparatus, i.e. of muscles, tendons, the skeleton, cartilage, ligaments and nerves. Musculoskeletal disorders include all forms of ill- health ranging from light, transitory disorders to irreversible, disabling injuries. The goal of physical ergonomics is to minimize work-related musculoskeletal disorders, errors, inefficiencies and optimize worker well-being.

More people are employed in the health care sector than in any other industry in the United States of America. Health care workers are exposed to a wide variety of hazards, including biological, chemical, physical and psychological stressors. Concerns about exposure to contagious diseases such as HIV, Hepatitis B and C, and tuberculosis have influenced the career choices of many health professionals. Physical hazards, especially ergonomic ones, account for the majority of the disability faced by health care workers. Chemical exposure and psychosocial stresses are also present in health care institutions. The exposure encountered in health care facilities is potentially dangerous to health care workers as well as to their family members and unborn children.

Bureau of Labour Statistics reported 317,440 WMSDs in 2008 of which 66,240 related to transportation and material moving occupations with the highest number of WRMD (40). Production occupations and healthcare support occupations had 42,720 and 29,640 WRMD cases respectively. The rate of WMSDs in health care and social assistance was 530 cases per

100,000 workers. The corresponding numbers in the UK are 27.594 with the rate of 105.1 per 100,000 employees, the cause with the highest rate, over one third, was slipping or tripping, followed by handling, lifting or carrying which has the rate of two fifths(41).

Turkish Statistical Institute published the data about WMSD in 2008 for the first time. The paper reported significantly higher numbers. The rate for work related accidents happened in last 12 months was 2,900 where as the rate for work related illness was 3,700 per 100,000 employees (47). However, it should be kept in mind that the number of unregistered employment was estimated as 8.868.000 in 2007 (43). Moreover, due to reporting and claiming system is very new and uncommon in Turkey, assuming the real number was higher than the formal report, would not be misrepresentation.

Epidemiological studies have repeatedly shown relation between work-related psychosocial factors and WMSDs, and the role of psychosocial factors and stress in these disorders has received increased attention. Several reviews have reported relationship between WMSDs and work-related psychosocial factors such as high workload/demands, high perceived stress levels, low social support, low job control, low job satisfaction and monotonous work (44).

Costa and Vieira two physiotherapists identified the risk factors of WMSDs in 2009. They divided and organized articles according to the affected body part, type of risk factor (biomechanical, psychosocial, or individual) and level of evidence (strong, reasonable, or insufficient evidence). Their extensive study pointed out that the most commonly reported biomechanical risk factors with at least reasonable evidence for causing WMSD include *excessive repetition, awkward postures, and heavy lifting* (45).

Zontek et al (2009) examined the effect of psychosocial factors (i.e., stress, job satisfaction, organizational climate, safety climate, and training) on direct care workers' injuries which is the highest rate in the United States (46). Another study by Magnavita (2009) found that symptoms from the low back were significantly related to psychological demands, and depression score; symptoms from the upper back were related to age, anxiety and depression; symptoms from the neck were related to psychological demands, authority over decisions, gender and anxiety. Musculoskeletal disorders seemed to be related both to job strain and to individual and emotional factors (47).

Health care workers exposed to numbers of different psychological stress in their work life (48-51) as well as physical factors such as manual patient handling, applying excessive

forces during pushing and/or pulling of objects, required use of awkward postures during patient care, and working long hours and shift work(44,47,48,50,52-54).

2.3.2. *Physical ergonomics in physical therapy*

Increasing number of researches, have reported that musculoskeletal disorders are common in workers in the health care industry. Especially the group of health professions, like physiotherapists, occupational therapists, rehabilitation nurses, and support workers, who work with physically impaired patients, are more susceptible to work related musculoskeletal disorders. Exposure to risk factors for WMSDs is likely to result from patient care activities that include lifting patients, transferring patients, and the performance of manual therapy. Each activity involves the application of relatively high levels of force, and each activity may have to be performed in hazardous postures. All of these activities are commonly done by physiotherapists.



Figure 2: Lifting Technique for sit to stand

Recently hoists have being used to prevent WRMDs and occupational accidents. In some countries lifting patients without lifting aid equipment is restricted however most of the

physical therapy centres in Izmir had neither hoists nor any other lifting aids. The centres and even hospitals barely have wheelchairs and walking frames, thus physiotherapists rely on their physical power and limits to ambulate the patients. In figure 2 a five year experienced physiotherapist demonstrates sit to stand lifting technique. This technique was found high level risk for injury by Worker's Compensation Board and recommended not to perform and advice to use a mechanical aid (65).

There is little information on the work-related musculoskeletal injuries of physiotherapists and no information on injuries of student physiotherapists. There are few researches show that prevalence of WRMDs among physiotherapists Bork¹ et al. 61% 1996; Cromie⁶ 91% 2000; 55% West¹⁶ 2001; Rugej⁸ 73.7% 2003 (LBP); Shehab¹⁴ 70% (LBP) 2003; Salik and Özcan¹³ 85% 2004; Glover⁹ 68% 2005; McMahon⁵⁵ et al. 65% (thumb) 2006; Siqueira¹⁵ 78.8% (LBP) 2008; Adegoke⁵⁶ 91.3% 2008, injuries to the low back were the most prevalent. Other commonly injured areas were the wrists, hands, upper back and neck. Lifting patients, bending, twisting, stooping, carrying, pushing or pulling, prolonged standing and working in a hospital setting were factors associated with WRMDs.

Additionally, hydrotherapy, electrophysical agents and lifting are, anecdotally, the most commonly reported work hazards for physiotherapists. Hydrotherapy exposes the skin to water and its constituent chemicals and contaminants. These may produce irritations which can become dermatitis or fungal infections. Some electrophysical agents were accepted as having risks for users namely; shortwave and microwave diathermy. Both are radiofrequency electromagnetic radiations and users, as well as patients, are exposed to risks associated with fields surrounding this type of equipment. However one study on female physiotherapists reported that they were unlikely to have an increased risk of negative reproductive outcomes because of their exposure to electrophysical agents yet physiotherapists who perform hydrotherapy, however, had an increased risk of skin complaints (57).

Cromie reported (2001) that physiotherapists believe they are not as susceptible as any other occupation group to WRMDs due to their musculoskeletal knowledge and experiences (7). Mostly (94%) they trust their injury prevention education (58). However studies proved that physiotherapists would not reflect the advance level of ergonomics and biomechanics skills to their working posture. This contradiction could be the indicator of low ergonomic awareness as well as the inconvenience of the work environment and/or inadequate variety of

patient selection. Figure 3 gives some examples of the positions that physiotherapist should hold during their session.



Figure 3: Working postures of physiotherapists

As the figure represent physiotherapists should perform their treatments in awkward positions, it is obviously seen that the physiotherapists cannot alter their working postures as they do not have any other option. Even though their ergonomic awareness was high they would not avoid WRMDs due to lack of equipments. Height adjustable plinths and hoists must be mandatory for physiotherapy clinics to prevent working in the same and/or awkward position for a long time.

Today, although, every school of physiotherapy include courses about anatomy, physiology and pathophysiology of musculoskeletal system under the name of human anatomy, kinesiology, movement science, etc. there is no school or faculty which offers ergonomics or manual handling courses. In a study among Nigerien physiotherapists, the respondents were asked if they had previous ergonomic training to which 55.6 % replied as they had ergonomic training (56). However, the curriculum given in Medical Rehabilitation

Therapists (Registration) Board of Nigeria official web site contains no courses on ergonomics (57).

Siqueira et al (2008) asked the participant physiotherapist if they work in ergonomic adequacy, 82% of the physiotherapists expressed they work in inadequate ergonomic condition, yet the paper does not provide any further information about the adequacy of work ergonomics (15).

The study conducted by West (2001) reported that 55% of the physiotherapists experienced WRMDs of which over half (56%) of the initial episodes of injury occurred within five years of graduation yet only 6% think that inadequate training on injury prevention was a risk factor (16). Similarly the studies of Glover(9) et al.(2005), Cromie(6) (2000) and Bork(1) (1996) reported that only 14%, 3.1% and 1.2 % respectively of all therapists who had experienced WRMDs responded that inadequate training in injury prevention was a major contributing factor in the development of their work-related symptoms.

Even though the studies present that there is a high prevalence of WRMD, and no undergraduate education on ergonomics and/or manual handling. Yet most of the physiotherapists do not feel the inadequate training on injury prevention as threat to their health and safety.

Many national or commercial bodies organize manual handling courses and guidelines in the aim of providing a good understanding of the requirements of the Manual Handling Operations Regulations and associated legislation within the workplace and facilitating the knowledge and skills required to meet clients' manual handling needs and promote staff safety.

These programs are usually one day courses with the basic applications of chair manoeuvres, bed manoeuvres, small equipment demonstration, hoisting, and use of other equipment. On the other hand occupational health and safety in physiotherapy is much more complicated matter.

When investigating risks for WRMDs regulations aim hazard identification, risk assessment, risk control and the review of the effectiveness of the implemented control measures. It is also well documented that programs such as worker participation, training and education, program evaluation, surveillance and early reporting as well as management commitment. Studies clearly showed that when workers believe that they work in an

organisation which commits to safety in remarkable way then they concern more about their own health and safety (53-54).

Today almost all of the physiotherapists in Turkey are working in the clinics with stable height equipment (table, mats, plinths and etc.) and lack of manual handling aids (Figure 4). Generally it is very difficult to find even walking frames or crutches therefore physiotherapists must use the methods which were abounded due to high risk of injury.



Figure 4: Working conditions of physiotherapists

Cromie et al (2001) proposed the contents of guidelines in physiotherapy practice to reduce the risk of WMSDs within the framework of the legislative requirements (7). The proposed guidelines are grouped in eight categories;

- a) All physiotherapists must familiarise themselves with requirements of the legislation governing occupational health and safety (and in particular manual handling) in their jurisdiction. As a minimum, they should know the principles of risk management, and be able to apply hazard identification, risk assessment, control and review in their workplace.
- b) The majority of physiotherapists experience WRMDs. The low back, neck, upper back and upper limbs are most vulnerable to injury, and therapists must identify factors in the workplace, and away from work, that increase risk of injury to these areas.
- c) Established ergonomic guidelines for space, equipment, furniture and environmental conditions should be mandatory in the design of physiotherapy workplaces.

- d) The physiotherapist's job must be designed to ensure variety in the physical demands of work. This may be done by:
- scheduling different activities throughout the working day and week, and by including a variety of techniques and treatment options into therapy sessions;
 - scheduling adequate and regular rest breaks involving a change in posture as well as activity level;
 - seeing a range of clients with various conditions;
 - participating in policy development in health care to ensure reasonable workloads and adequate work environments; and
 - increasing the range of treatment techniques at the therapist's disposal, aiming for variety in physical demands.
- e) Mechanical aids and equipment should be used whenever appropriate. Therapists must be trained in their use.
- f) Training must not be the sole or primary means of controlling risk. Training in injury prevention must contain the risk management model of controlling risk, and include 'in principle' preventive measures rather than training in specific methods or techniques.
- g) Risk assessment and control must be ongoing. Once implemented, these guidelines must be examined for their effectiveness, and modified where necessary. Risk management and review must be carried out at both an individual and institutional level.
- h) Prospective physiotherapists must recognise the physical demands and constraints of the job. Students and qualified physiotherapists need to choose career paths congruent with their physical abilities. Physiotherapists should maintain an appropriate level of personal fitness for their work.

Similarly Hignett (2003) reviewed the researches on reducing musculoskeletal injuries associated with handling patients and concluded that interventions which predominantly based on technique training have no impact on working practices or injury rates (14). The findings show that the most common strategies used for preventing work related injuries are equipment provision/purchase, education and training (e.g. risk assessment, use of equipment, patient assessment), risk assessment, policies and procedures, patient assessment system,

work environment redesign, work organisation/practices changed. The paper suggests that these top seven factors could form the basis of a generic programme which should be developed and extended in order to be responsive to local organisational and cultural factors. On the other hand, Hignett expressed that interventions are more likely to succeed if they are based on a risk assessment programme.

Ergonomics in healthcare is a complex matter moreover, the researches illustrate that physiotherapists are susceptible to WRMDs due to nature of their work. Yet most of the papers concern about the prevalence and severity of the injury physiotherapists rather than ergonomic structure of the work (1-16). Ergonomics in physical therapy is a multifaceted matter that individuals' efforts of practitioners would not be enough for the solution. WRMDs must be dealt at every level of the organisations rather than rely on physiotherapists' individual skills and experiences. This study tests the hypothesis of there is not a relationship between WRMDs and ergonomic awareness. Additionally, aims to estimate the prevalence of WRMSD of physiotherapist, investigate the distribution of musculoskeletal disorders in different variables, including age of therapist, years in practice and clinical specialty as well as to evaluate ergonomic awareness of physiotherapists working in Izmir.

MATERIALS and METHODS

The survey (Appx. 3) conducted between November 2009 and January 2010 among physiotherapists working at different physical therapy centre/departments in Izmir. The drop and collect method was used to reach the respondents who were informed in advance about the design of the survey to avoid misunderstandings.

The respondents were informed about the purpose and structure of the survey likewise convinced on confidentiality of their personal information and they were directed to sign informed consent form (Appx. 2) prior to participate. The research has been approved by the Ethic Committee of Clinical and Laboratory Researches of Dokuz Eylül University (Appx. 4).

1. Data collection

Data was collected with drop and collect method with a short visit to physiotherapy centres and hospitals. Respondents were given 4 pages, 10 minutes self administered questionnaires. Questionnaires are distributed in the beginning of the visit and collected before leaving.

The survey was questioning WRMDs experienced previous 12 months therefore the inclusion criteria of the study was working actively in previous 12 months.

The survey was composed of 3 main parts. In the first part there were questions about age and gender of therapist, years in practice and clinical specialty. Demographic features are important dependant in WRMDs history of physiotherapists. Age and gender were included the survey because younger therapists are more vulnerable to WRMDs as the onset of the most serious work related musculoskeletal injury generally occurred before age of 30, on the other hand senior physiotherapists tend to have continuous muscular and articular overloads. Female gender also found as a risk factor for WRMDs in physical therapy profession (1,2,6,9,14-16).

The respondents were asked their current work settings and work status due to understand the intense of the work load and the type of injury pattern. Additionally, the survey included the year of graduation as well as the span of interval from work to estimate the total time was exposed to occupational strains.

The second part of the survey consisted of questions about work related musculoskeletal disorders. WRMDs occurrence was asked if the respondents had had *work related pain last*

more than 3 days, the most common structure used in literature. West and Gardner (2001) justified the structure as the time was long enough to improve the remembering of respondents (16). The body parts affected, the reason of injury, whether the participant had treatment following the injury were asked both for the first WRMD and in last 12 months. The affected body parts and reasons for injury were given at a table from which respondents chose utmost three items from the tables, the tables were derived from the studies on WRMDs (1,2,6,8,9,16,56). The literature reports that the onset of the injury predominantly occurs within the first five year of the experience a question points the time of the first injury was also included.

To have a better understanding on physiotherapists' behaviours over injury the treatment method that they had following a WRMD was added. Respondents were asked whether they had consulted with a doctor or they performed their treatment based on their professional knowledge or they had any treatment at all.

Cromie (2002) reported that having the character of caring and knowledgeable was highly valued among colleagues, patients and relative of the patients. To determine whether the cultural feature of the physical therapy occupation was similar in Turkey; physiotherapists were asked how they would react in the case of a treatment technique which was very important for their patient however hazardous for them.

1.2. Ergonomic Awareness Scale

1.2.1. Item pool

There are no defined scales on ergonomic awareness therefore one was developed with the assumption of ergonomic awareness represent the knowledge of the ergonomic aspects and the application of ergonomic attention throughout the treatment sessions. This assumption is supported by Brown and Ryan (2003) who defined awareness and attention under the umbrella of consciousness (61):

“Consciousness encompasses both awareness and attention. Awareness is the background “radar” of consciousness, continually monitoring the inner and outer environment. One may be aware of stimuli without them being at the center of attention. In actuality, awareness and attention are intertwined, such that attention continually pulls “figures” out of the “ground” of awareness, holding them focally for varying lengths of time”

In the light of the description the level of knowledge on clinical working ergonomic principles, was the indicator of ergonomic awareness. Clinical working ergonomic principles to be included were taken from literature review of working ergonomics in physiotherapy. PubMed PEDro, OvidSP, BioMed, Googlebooks and Googlescholar were searched with the terms of physiotherapy, physical therapy, ergonomics, work related musculoskeletal disorders, occupational injury, ergonomics and awareness. Inclusion criteria for relative articles were to be published between 1999 and 2009 and written in English and Turkish. The articles about physical therapy on WRMDs and articles were not about WRMDs in physiotherapists were excluded.

The articles included were analyzed to find what was important to prevent WRMDs in physiotherapy and what the main principles of working ergonomics in physical therapy were.

According to the literature review 8 principles were identified;

Ø *Legislations* (2 questions):

Occupational laws and legislations may vary between states but they provide a framework to ensure that all parties in the employment agreement (employer, employee, designers) meet minimum standards for injury prevention (7,18). The regulations and legislations generally lead a standard to reporting and compensation process high level of ergonomic awareness must include acceptable knowledge on responsibilities and requirements of the legislation governing occupational health and safety.

The ergonomic awareness scale contains following questions to measure the legislation aspect of ergonomic awareness.

- ✓ My responsibilities and requirements of the legislation governing occupational health and safety
- ✓ My employer's responsibilities and requirements of the legislation governing occupational health and safety

Ø *Vulnerability to WMSDs* (2 questions): In order to implement the risk management model it is helpful to understand the common injuries experienced by therapists, and the risks to which they are exposed. Most common WRMD site of physiotherapists are the low back,

neck upper back and upper limbs (1,6,8,9,13,14,15,16,56). Identifying and taking into the consideration of the vulnerability of the body parts essential for the ergonomic work.

The ergonomic awareness scale contains following questions to measure the vulnerability aspect of ergonomic awareness.

- ✓ Precaution for upper & lower back, neck and upper extremity injuries may occur in treatment session.
- ✓ Proper manual handling during patient transfer.

Ø *Design of work place* (2 questions): Design of the physical environment is an important principle in the prevention of WMSDs (7,9,16). Elimination of extreme postures and force, or prolonged static postures, should be considered when designing the physical environment, as should space and lighting (7). Knowing the optimum physical conditions of work and over viewing potential risks at working area before each session provide better working ergonomics.

The ergonomic awareness scale contains following questions to measure the design of work place aspect of ergonomic awareness.

- ✓ Over view hazards for my patient and myself before each therapeutic session
- ✓ Characteristics of physical environment (space, equipment, furniture, light, temperature etc).

Ø *Design of work itself* (2 questions): Scheduling variety into tasks, and organising the work to maximise efficiency, may provide a way of reducing risks associated with poor work flow (5,7). Using different techniques and working posture options and scheduling adequate breaks to avoid extreme postures and static work increases ergonomic working.

The ergonomic awareness scale contains following questions to measure the design of work itself aspect of ergonomic awareness.

- ✓ Choosing the “right working posture” during my treatment sessions.
- ✓ Scheduling the timing and span of my breaks during my treatment sessions.

Ø *Mechanical aids* (2 questions): Deciding and using proper mechanical aids decrease physical work load and save physiotherapists from awkward postures (1,7,50). Aids and equipment alone, without training in their proper use, are unlikely to be effective in

reducing the risk of injury (7). This aspect has the conflict of accessing the equipment they may know the necessity of the mechanical aid still do not possess the equipment. Therefore questions were asked in theoretical way rather than practical usage. The ergonomic awareness scale contains following questions to measure the mechanical aids aspect of ergonomic awareness.

- ✓ Deciding the appropriate mechanical aids and equipment to decrease my physical load.
- ✓ The proper use technique for mechanical aids and equipment.

Ø *Risk management* (2 questions): Hazard identification, risk assessment, risk control and review summed up as risk management. Risk management approach is one of the essential principals of ergonomics and physiotherapists should recognise, identify, record and be persuasive to a hazardous condition for both themselves and their patients (7, 18,50). The ergonomic awareness scale contains following questions to measure the risk management aspect of ergonomic awareness.

- ✓ Hazard identification.
- ✓ Risk assessment.

Ø *Review of risk management* (2 questions): Managing the problems once would not be enough for preventing WRMDs (7,50). This process should be continuous as well as repeated when ever was necessary. Physiotherapists must be a part of this process in order to comprehend and identify risks and precautions.

The ergonomic awareness scale contains following questions to measure the review of risk management aspect of ergonomic awareness.

- ✓ Systemic risk control
- ✓ The procedure of my organisation for controlling and correcting a report hazard.

The composed scale intended to measure ergonomic awareness of the respondents by measuring the knowledge level on the important aspects of clinical ergonomics in physiotherapy. Knowledge level was asked to the respondents in 14 questions ranked in four points Likert scale as *I don't know at all, Know very little, I know, I thoroughly know*.

To understand the construct validity and internal consistency of the scale factor analysis was used. Factor analysis is common method used in studies to examine how underlying constructs influence the responses on a number of measured variables (59-61).

1.2.2. Factor Analysis

Factor analysis is a statistical technique that can be used to analyse interrelations among a large number of items while trying to explain these variables in terms of their common underlying dimension.

1.2.2.1. Construct Validity

Two items were distracted (*The procedure of my organization for controlling and correcting a reported hazard and Choosing the “right working posture” during my treatment sessions*) as they grouped under two dimensions at the same time and all statistic analysis was re-conducted following to the distraction.

Validity is the degree to which an instrument measures what it is supposed to measure. Kaiser-Meyer- Olkin Measure of sampling adequacy was calculated 0,81 which expected to be higher than 0,5 for an appropriate sampling size. Barlett’s Test of Sphericity was carried out to understand the correlation between varieties and calculated 0,000 which is expected to be lower than 0.01 to be significant.

In communalities, extraction values higher than 0,5 indicates that each item show correlation within whole. None of the extraction values of this study was lower than 0,5. Following to distraction of questions 24 and 27 the scale had 68% cumulative descriptiveness.

The initial eingenvales showed three dimensional structure with %68 cumulative explanatory which expect to be higher than %50. Scree plot showed three dimensional structure, there were three factors before the break of the line in other saying there were 3 factors with eigenvalues higher than 1.

In factor analysis to indicate which item assembles under which component principal component analysis (PCA) with varimax rotation was conducted. The factors were grouped as expected. The items showed highest factor value under the first component listed below and this component named as *legislation and regulation* dimension.

Item No1: My responsibilities and requirements of the legislation governing occupational health and safety,

Item No2: My employer's responsibilities and requirements of the legislation governing occupational health and safety,

Item No3: Hazard identification,

Item No4: Risk assessment,

Item No5: Systematic risk control.

The second dimension called *safety of application* and included the items of;

Item No11: Scheduling the timing and span of my breaks during my treatment session.

Item No12: Deciding the appropriate mechanical aids and equipment to increase my physical load.

Item No13: The proper use technique for the mechanical aids and equipment.

Item No14: Proper manual handling during patient transfer.

The last group was about ergonomic requirements of work place and consists of the following items,

Item No6: Over viewing hazards for my patient and myself before starting each therapeutic session.

Item No8: Precautions for upper & lower back, neck and upper extremity injuries may occur in treatment sessions.

Item No9: Characteristics of physical environment (space, equipment, furniture, light, temperature etc).

1.2.2.2. Internal Consistency

Reliability

Internal consistency is a measure of homogeneity of a scale. It indicates the extent to which in a scale are intercorrelated and thus measure the same construct. The internal consistencies of the dimensions created were examined using Cronbach's α . Cronbach's α value is expected to be higher than 0,7 to indicate a good internal consistency. Cronbach's α of each dimension were given in Table 1

Table 1: Cronbach's Alpha values of dimensions

Dimension	Cronbach's' Alpha
Legislation & Regulations	0,89
Ergonomic requirement of Work Place	0,72
Safety of application	0,81.

Item-total correlations between individual items and the sum of the remaining items on a factor were calculated. Corrected item total correlations value higher than 0,4 indicates that individual item describes the dimension. There was no corrected item total correlation value was found in this study.

The LISREL Confirmatory Factor Analysis 8.54 a versatile and power program for fitting structural equation models and multilevel models to observe data was used for descriptive factor analysis. LISREL also proved the reliability of the scale. Although all values were not in the limits of good consistency, most of them were found between the acceptable values (Table 2).

Table 2: The LISREL Confirmatory Factor Analysis Values

Consistency Value	Good Consistency	Acceptable Consistency	Values of the scale
Chi-Square	$0 \leq \chi^2 \leq 2df (51)$	$2 \leq \chi^2 \leq 3df (51)$	87.17
p –value	$0.05 \leq p \leq 1.00$	$0.01 \leq p \leq 0.05$	0.00120
χ^2 / Degrees of Freedom	$0 \leq \chi^2/df (51) \leq 2$	$2 \leq \chi^2/df(51) \leq 3$	1.709
Root Mean Square Error of Approximation	$0.00 \leq RMSEA \leq 0.05$	$0.05 \leq RMSEA \leq 0.08$	0.084
Standardized Root Mean Square Residual	$0.00 \leq SRMR \leq 0.05$	$0.05 \leq SRMR \leq 0.10$	0.0646
Comparative Fit Index	$0.97 \leq CFI \leq 1.00$	$0.95 \leq CFI \leq 0.97$	0.958
Goodness of Fit Index	$0.95 \leq GFI \leq 1.00$	$0.90 \leq GFI \leq 0.95$	0.874
Adjusted Goodness of Fit Index	$0.90 \leq AGFI \leq 1.00$	$0.85 \leq AGFI \leq 0.90$	0.808
Normed Fit Index	$0.95 \leq NFI \leq 1.00$	$0.90 \leq NFI \leq 0.95$	0.912

Following factor analysis of the measurement 2 items were distracted from the scale “*The procedure of my organization for controlling and correcting a reported hazard and Choosing the “right working posture” during my treatment sessions*” as they grouped under two dimensions at the same time. Consequently validity and reliability of the scale measured in good degrees.

RESULTS

The questionnaires were distributed in November 2009 to 102 physiotherapists who work at different centres in Izmir. All questionnaires were filled correctly, the gender breakdown of respondents was, 81.4 % female (n = 83) and 18.6% male (n = 19) (Table1), the average age of respondents was 30.7 years (S.D. = 7,23487). More than half of the respondents (55,95) were between the age of 20-30 while only 9,8 % of them older than 40 years of age (Figure 5). Most respondents (92.2%) were working full-time, as only 7.8% were working part-time. Only 13.7% of the respondents suspended from work (Table 3). The working field distribution of the physiotherapists was, 14.7% neurologic rehabilitation especially with learning disabled children, 9.8 % working with orthopaedic disorders mainly hand rehabilitation, nearly half of the physiotherapists (54%) were employed at private centres where they practice neurologic, orthopaedic, musculoskeletal rehabilitation and electrophysical agents (Figure 6).

Table 3: Demographic distribution

	Frequency	Percentage
Male	19	18.6 %
Female	83	81.4 %
Full-Time	94	92.2 %
Part-Time	8	7.8 %
Suspension from work		
Yes	14	13.7 %
No	88	86.3 %

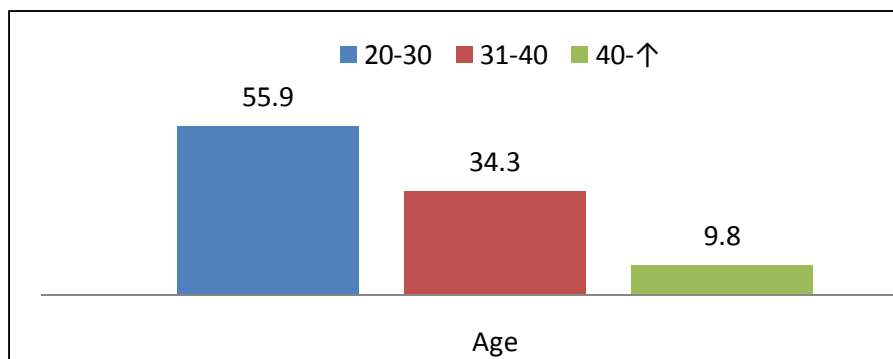


Figure 5: Age group distribution.

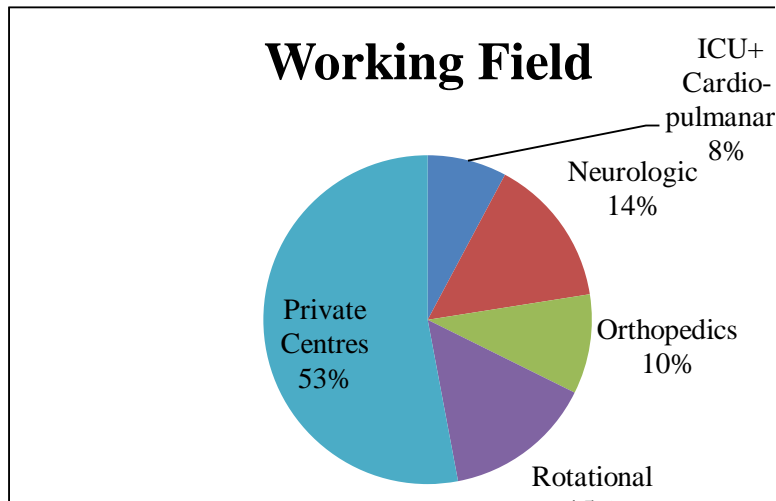


Figure 6: Distribution of working fields

Demographic features of the physiotherapists with WRMDs

78 physiotherapists reported that they had WRMDs experience some time during their career. 17 out of 19 male respondents and 67 of 83 female respondents had work related injury. Almost half of the injured physiotherapists were between the age of 20-30, and 92.3% of them were working in full time position. Half of the physiotherapists with WRMDs were working for private centres (Figure 7).

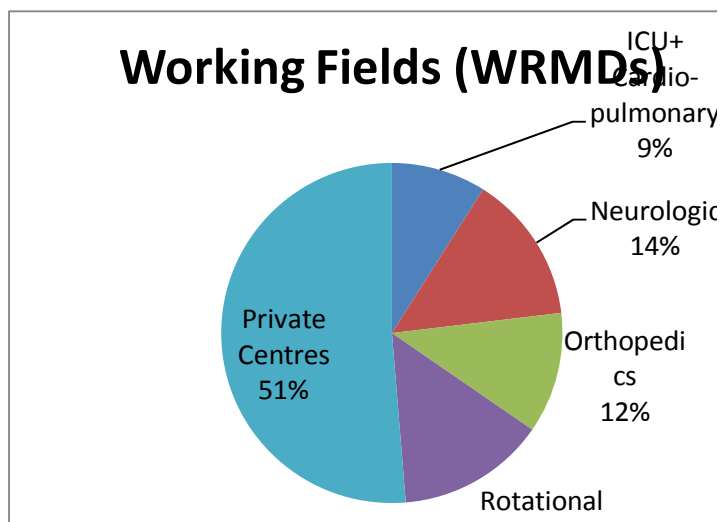


Figure 7: Distribution of working fields of PT's with WRMDs.

Table 4. Perceived Job Strains

Job Risk Factor	General job strain		Reason of first injury		Reason of injury in last 12 months	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Working in the same positions for long periods (leg, standing, bent over, sitting, kneeling).	58	19,3	30	18	19	21,1
Working with more than 20 degrees of flexion/rotation of the spine for long periods.	21	7	14	8,4	6	6,7
Continuing to work while injured or hurt.	21	7	18	10,8	12	13,3
Performing the same task over and over.	37	12,3	24	14,4	10	11,1
Performing manual orthopaedic techniques (joint mobilizations, soft tissue mobilization).	31	10,3	19	11,4	9	10
Treating an excessive number of patients in one day.	24	8,0	15	9	7	7,8
Lifting or transferring dependent patients.	29	9,6	15	9	5	5,6
Unanticipated sudden movement or fall by patient.	13	4,3	6	3,6	2	2,2
Not enough rest breaks or pauses during the workday.	9	3,0	4	2,4	1	1,1
Bending or twisting my spine more than 20 degrees while working.	5	1,7	6	3,6	3	3,3
Reaching or working away from your body.	6	2,0	3	1,8	5	5,6
Working near or at your physical limits.	13	4,3	6	3,6	5	5,6
Carrying, lifting, or moving heavy materials or equipment.	2	0,7	2	1,2	3	3,3
Assisting patients during gait activities.	8	2,7	3	1,8	1	1,1
Work scheduling (overtime, irregular shifts, length of workday).	11	3,7	2	1,2	2	2,2
Working with confused or agitated patients.	12	4,0	0	0	0	0
Inadequate training on injury prevention.	1	0,3	0	0	0	0

Perceived Job Strain

Physiotherapists were asked to indicate three reasons, out of 17 given in a list, which physically constrain them at work. The distributions of the percentages of job strains perceived by physiotherapists were given Table 4. The physiotherapists found working in the same position for a long time was very burdensome and injurious as well as performing the same task over and over. Besides, physiotherapists stated that working with their hands, any type of manoeuvre they perform, also caused job related physical stress (Table 4).

Injury during career

Reported career prevalence of work-related musculoskeletal injury among physiotherapists in Izmir was 68% [n=78], the occupation year of first injury was between 0-5 years in 57% of them (Table 5). The physiotherapists who experienced injury were also asked the reason of injury and effected body part. Respondents were allowed to choose at most three reasons and body parts. “*Working in the same positions for long periods*” was the reason with the highest percentage (18% n=30), followed by “*Performing the same task over and over*” (14.4%, n=24). The most susceptible area to the first injury was *lower back* experienced by 39 physiotherapists (29.8%). However 69.2% of the physiotherapists chose not to visit a medical doctor and 39.7% reported that their treatment was applied by a colleague or themselves (Table 6).

Table 5. Occupation year of the first injury

Year of occupation	Frequency	Percentage
0-5	57	73.1
6-10	17	21.8
11-15	2	2.6
16- 20	2	2.6
20- +	-	-

Injury in the Last 12 Months

Previous 12-month 54 physiotherapists had work related pain lasted more than 3 days. The prevalence of the injury was 69.2% among the physiotherapist who had injury background and 52% for overall. The reason for the second injury was similar with the first

injury reason (Table 4). Likewise lower back was the location with the highest frequency (n=22, 25%) (Table 6). 81.5% of the physiotherapists preferred not to go medical doctor, of that 51.9% had treatment by a colleague or themselves (Table 7).

Localization of the Injury

Respondents generally suffered from low back pain as it was the most common injury area both for injury during career and injury in the last 12 months. Second most common injury site for the whole career span was wrist however physiotherapists had neck problem during last 12 months as the second most common WRMD. Shoulder, neck and upper back were the following body parts injured most during respondents ' career. On the other hand upper back, wrist, and shoulder were consecutively the most common injury sites that physiotherapists suffered in previous 12 months (Table 6).

Table 6. Localization of the pain

Localization	first injury		last 12 months	
	Frequency	Percent	Frequency	Percent
Neck	17	13	15	17
Upper back	15	11,5	14	15,9
Lower back	39	29,8	22	25
Shoulder	18	13,7	9	10,2
Elbow	7	5,3	4	4,5
Wrist	19	14,5	10	11,4
Hand	5	3,8	3	3,4
Hip	7	5,3	4	4,5
Knee	3	2,3	5	5,7
Ankle /foot	1	0,8	2	2,3

Responses to injury

Most injured respondents preferred physiotherapy treatment informally from another colleague or they carried out their own treatment (39%, 31/78), this figure was considerably high for the injury occurred in last 12 months (51.9%, 28/54).By contrast, only 30.8% (n=24) consulted a doctor the corresponding figure was 18.5% (n=10) for the last 12 month injury (Table 7).

Table 7. Treatment method of injury.

Had treatment?	First injury		Injury in last 12-month	
	Frequency	Percent	Frequency	Percent
No	23	29,5	16	29,6
Yes, I went to a medical doctor.	24	30,8	10	18,5
Yes, without going to a medical doctor, my treatment was done by me or any other physiotherapist	31	39,7	28	51,9

Hazardous Treatment Technique Applications

Respondents were asked “How would they behave in the case of a treatment technique which is very important for your patient however hazardous for themselves” 61.8 % physiotherapists declared that they knew how to protect themselves therefore they would not hesitate to apply the technique. The distribution according to injury occurrence is given at Table 8.

Table 8: Application of hazardous technique

	TOTAL		WITH INJURY		WITHOUT INJURY	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
I <u>would</u> apply the technique if it is necessary for my patient because I know how to protect myself.	63	61,8	45	57,7	18	75
I <u>would not</u> apply the technique because maintaining my proficiency is depending on my health	39	38,2	33	42,3	6	25
TOTAL	102		78		24	

The answers of the scale were ranked from 0 (I don't know at all) to 3 (I know thoroughly) yet the overall score was converted to 100 points in order to get more explanatory results. The mean score of the scale was 57,32 (SD:14,51) (Table 9). The distributions of the answers to each aspect of ergonomic awareness were given below (Figure 8, Figure 9, Figure 10).

Table 9: Ergonomic Awareness Scale Scores

	TOTAL	Legislations & Regulations	Workplace Ergonomic Requirements	Safety of Application
Valid	102	102	102	102
Mean	56,67	40,91	67,42	68,30
Median	58,33	46,66	66,66	66,66
Std. Deviation	14,44	23,13	14,52	14,97
Minimum	25,00	00,00	33,33	33,33
Maximum	91,67	86,67	100,00	100,00

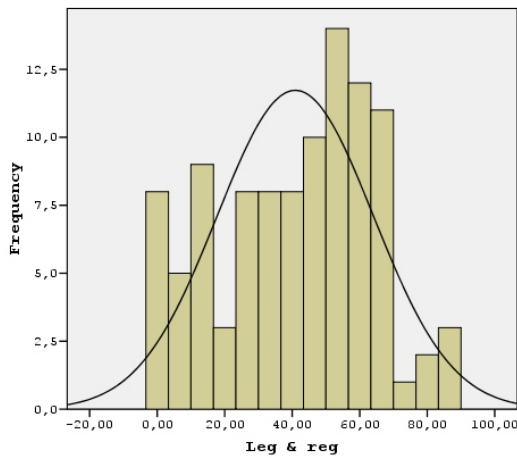


Figure 8: Distribution of Answer of Legislations & Regulations Dimension

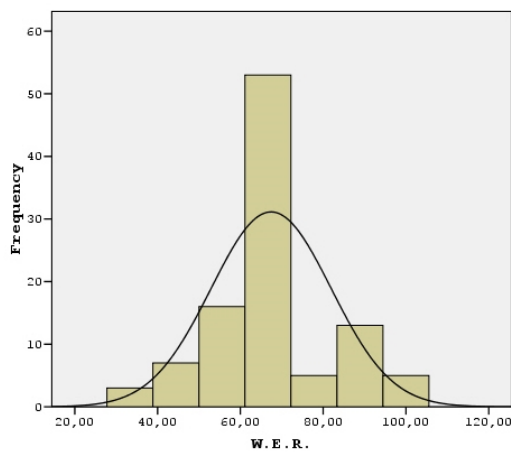


Figure 9: Distribution of Answer of Workplace Ergonomic Requirements Dimension

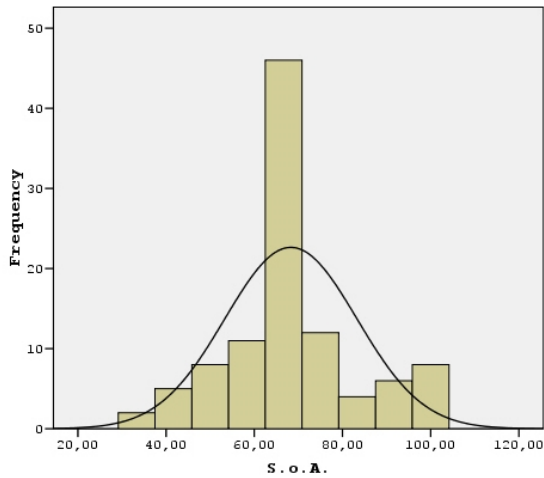


Figure 10: Distribution of Answer of Workplace Safety of Application Dimension

The statistic analysis showed that there is no significant difference in ergonomic awareness between physiotherapists who have experienced WRMDs and who have not experienced. The statement is relevant for WRMDs occurrence both in career span and previous 12 months ($p > 0.05$; with 95% confidence interval) (Table 10-Table 11).

Table 10: Ergonomic Awareness score and WRMDs during Career

Dimensions	WRMDs	N	Mean	SD	P
Leg.&Reg	Yes	78	38.5	23.5	0.062
	No	24	48.6	20.2	
W.E.R	Yes	78	66.6	14.9	0.342
	No	24	69.9	12.8	
S.o.A	Yes	78	68.6	15.7	0.633
	No	24	67.0	12.4	
TOTAL	Yes	78	55.6	14.8	0.189
	No	24	60.0	12.7	

Leg.&Reg: Legislations & regulations, W.E.R: Workplace ergonomic requirements, S.o.A: Safety of application; WRMDs: Work related musculoskeletal disorders; SD: Standard deviation

Table 11: Ergonomic Awareness score and WRMDs in last 12 months

Dimensions	WRMDs	N	Mean	SD	P
Leg.&Reg.	Yes	54	40.7	22.6	0.220
	No	24	33.6	25.2	
W.E.R	Yes	54	67.9	15.3	0.278
	No	24	63.8	13.9	
S.o.A	Yes	54	67.5	15.6	0.356
	No	54	71.1	15.9	
TOTAL	Yes	54	56.4	14.7	0.450
	No	24	53.7	15.3	

Leg.&Reg: Legislations & regulations, W.E.R: Workplace ergonomic requirements, S.o.A: Safety of application; WRMDs: Work related musculoskeletal disorders; SD: Standard deviation

DISCUSSION

Musculoskeletal disorders are the most common work related disorders occur among physiotherapists. Non-musculoskeletal injuries such as stress related illnesses, cold, flu, chest infection, dermatitis, emotional trauma, infertility, needle stick injury, depression and anxiety, were reported 8% among Australian physiotherapist these disorders included. If stress related illnesses, depression and anxiety, emotional trauma group under one topic this group accounts for the largest group within the non-musculoskeletal injuries (16). Burn out syndrome and emotional exhaustion effect almost half of the physiotherapist population at a low to moderate level (62-64). In another study 59.5% of the respondents reported that they had some adverse health outcome as a consequence of working as a physiotherapist. According to the study Influenza had the highest prevalence with 35.1% followed by dermatitis/rush (22.8%) other work related adverse health outcomes listed as unspecified infection (12.5%), fungal skin infection (10.6%). The study also suggested that early miscarriage and maternal exposure to TENS and interferential therapy in the six months before conception, and to interferential in the first trimester, were statistically significant. However this result was not supported by some clinical factors such as; limited number of subjects, missing data, lack of dose response relationship, lack of biologic explanation and possible ambiguity in the questionnaire (3).

The findings of current paper reported that at least one in three physiotherapists (68%) who responded to the survey had experienced a work-related musculoskeletal injury (pain lasting more than three days that they considered was caused by their work as a physiotherapist) during their career. This figure does not conflict with the literature as many researcher reported similar rates (Table 13). Cromie et al. reported 91% WRMDs in 2000 among Australian physiotherapists (6), however West and Gardener's study showed 55% just one year later among the physiotherapist in Queensland (16). This might be due to the structure of the question evaluating the WTMDs, Cromie asked the question whether they had ever experienced work-related pain or discomfort whereas West and Gardener preferred the structure of whether they had experienced a work-related injury (pain lasting more than three days that they considered was caused by their work as a physiotherapist) during their career. Adegoke et al also defined WRMDs as discomfort, injuries or pain due to their work and lasting more than three days, still the study showed 91% of prevalence in last 12 months (56). The difference could be reason of using variety of terms such as discomfort and pain instead of using the term "injury" alone.

Table 13. Literature findings of WRMDs

Researcher	Year	Percentage of injury during career	Percentage of injury during last 12 months	Studied area	Participant number	Country
Bork et al.	1996	N/A	61%	Any part of the body	928	USA
Cromie et al	2000	91 %	80%	Any part of the body	824	Australia
West & Gardner	2001	55%	40%	Any part of the body	219	Australia
Rugelj	2003	73.7%	N/A	LBP	113	Slovenia
Shehab et al.	2003	70%	N/A	LBP	100	Kuwait
Salik & Özcan	2004	85%	N/A	Any part of the body	120	Turkey
Glover et al.	2005	68%	42%	Any part of the body	2511	UK
Mc Mahen	2006	65%	41%	Thumb	961	Australia
Adegoke et al.	2008	N/A	91%	Any part of the body	126	Nigerian
Campo et al.	2008	N/A	57,75%	Any part of the body	952	USA
Siqueira et al.	2008	78.58 %	N/A	LBP	56	Brazil

LBP: Low Back Pain

Many researchers studied WRMDs prevalence for last 12 months along with prevalence of WRMDs occurred in career span to understand the frequency of the incidences (Table 13). The figures show that at least 40% physiotherapists experienced WRMDs every year. This current study shows that 52% of the respondents had WRMDs in the last 12 months of whom 69% had WRMDs history. This figure was one of the highest rates in the relative literature. However there was no information about the relation between injury in last 12 months and previous injury history in the literature. This data is important especially to understand the mechanism of the injury and whether the ergonomic awareness of the physiotherapist has changed.

The studies, including current paper, did not exclude last 12 months injuries while questioning the WRMDs occurred overall career, hence respondents might have referred the same incidence twice. This could be the reason of high percentage of physiotherapists who had WRMDs history and a work related musculoskeletal injury in the last 12 months.

This study shows that low back was the most common site of injury with a career prevalence of 29.8% and last 12 months prevalence was 25%. The wrist was the second site (14.5%) however it was the fourth common site of the injury in last 12 months (11.4%). West and Gardner reported that 86% of the physiotherapists tended to modify their treatment techniques, which may explain the decrease in wrist injury this also could be same for the shoulder injuries (16). However neck and upper-back injuries were more common in last 12 months than they were in career prevalence (Table 6). In the scale of ergonomic awareness 91.2% of the respondents replied the question of "*Precautions for upper & lower back, neck and upper extremity injury may occur in treatment sessions*" as "I know" or "I thoroughly know" only 8.8% respondents reported that they knew the procedures very little. This conflict might be the result of low level of ergonomic awareness or the working conditions of the physiotherapists' were not suitable for them to fulfil the precautions even though they had enough knowledge.

All respondents were asked to indicate the job strains from a given table of 17 job risks, that they have the most difficulty while they work. Also, each injured subject was asked to signify the reason of their injuries. The job risk factors were based on the 17 factors used by Bork et al. (1) which were also used by some other researchers (6,9,16,56).

The findings of this study showed that “Working in the same position for long periods” was the job risks factor that strained physiotherapists mostly. At the same time it was the factor that injured respondents implicated most in the development of their work-related musculoskeletal disorder. However 94.1% of the participant physiotherapists stated that they either know or know thoroughly, choosing the “right working posture” during their treatment sessions.

The respondents reported that *performing the same task over and over* is the second most common job strain. Physiotherapists do not have the legal competency of practise in their own clinic, thus they cannot arrange their client lists. Moreover, most of the physiotherapists work in specialized centres hence they treat similar patients with similar manoeuvres. Physiotherapists should have the legal competence of organizing their own client lists.

Bork et al. composed the job risk factor list in 1996 and they asked their respondents to indicate, on a scale of 0-10, how much of a problem each item was. The later researchers used 4 point Likert method to calculate a mean score from the scale with a range of 1 (lowest value) to 4 (maximum value) (9, 16, 56).

Their results showed that; lifting or transferring dependent patients, treating an excessive number of patients in one day, performing the same task over and over, performing manual orthopaedic techniques (joint mobilizations, soft tissue mobilization), working in the same positions for long periods (leg, standing, bent over, sitting, kneeling), working with more than 20 degrees of flexion/ rotation of the spine for long periods, continuing to work while injured or hurt, were the job risk factors which contribute to job related pain and injury.

Even though, it seems like physiotherapists have similar job risk factors it is reasonable and important to determine the risk factors of national and organizational to deal with ergonomic hazards and misapplications.

Salık and Özcan reported that transferring a patient, performing repetitive task and lifting heavy equipment or patient were the three most common job factors which caused occupational injury (13). Although, this study conducted at same venue as theirs, the figures of this paper represent slightly different results to Salık and Özcan work but similar results with the literature. The respondents reported that working in the same position for long periods, performing the same task over and over performing orthopaedic techniques were the most challenging risk factors. The reason of the difference might be due to structure of the

questionnaire. Most of the injured respondents (69.2%, 54/78) did not choose to consult with a doctor after their WRMDs. Researchers have shown that this is a common attitude among physiotherapists Glover et al. reported that 61% physiotherapists in the UK chose to be treated by a colleague, the rate was higher in Australian physiotherapists (77%, 90/117)(16) and Rugelj reported that although 50.4% of the physiotherapists reported LBP several times 69.9% of the Slovenian physiotherapist never consult with a doctor. On the contrary Salik and Özcan denoted 68% of the Turkish physiotherapists had visited a physician, where as only 27.5% used their occupational knowledge and 19.7% of them selected exercises as treatment method while 51.6% preferred rest and/or medication.

Physiotherapists have a tendency of believing that they would not become injured because they were physical therapists so they knew the right way to perform tasks and avoid WRMDs (5). Additionally the culture of physical therapy embraces that physiotherapists were knowledgeable and capable (5), especially about the nature of musculoskeletal disorders. The nature of the occupational culture might be a reason for physiotherapists not to seek a formal physician consultation. Besides, Cromie et al. emphasised in their paper that according to physiotherapists' belief WRMDs could be prevented as long as they had chosen the right technique and/or performed in the correct way (5). Therefore if they had WRMDs that means that they had not performed their task as it should be. Hence, they conceived the injury as a minor and self correcting problem so they seek no formal treatment.

In this study respondents were also asked whether they would apply the technique if it is necessary for their patients. Most of the physiotherapists (61.8%, 63/102) answered they would not hesitate to apply because they are competent to protect themselves against WRMDs, moreover the percentage was not very different (57.7%, 45/78) for the physiotherapists with injury background. This data also support the findings of Cromie et al. (5) where they studied the culture of physical therapy and concluded that the cultural values of physical therapy occupation make it difficult for them to avoid WRMDs. As they need to be diligent, hard working and caring for their patient besides appear knowledgeable and skilled by remaining injury free.

Previous researches on WRMDs among physiotherapists have focused on the prevalence, affected body parts, onset and coping mechanisms of the injury. As the results showed physiotherapists are considerable susceptible to WRMDs regardless, the country, organisation and field they work. The nature of the occupation might be the explanation of

this vulnerability additionally as Cromie et al. (5) discussed the culture of physical therapy makes the situation more difficult. The culture of physical therapy puts the pressure of taking care of their patients and a false sense of safety regarding their education.

Therefore, even though physiotherapists are extremely knowledgeable over musculoskeletal disorders and mechanism of the injury, their ergonomic awareness hinders by the culture of the occupation. The level of ergonomics awareness is probably the most important matter to avoid WRMDs due to it is a proactive intervention rather than a reactive one.

Today many organisations and formal bodies strive to raise ergonomic awareness of the employees to avoid WRMDs, however in physical therapy occupation, which has high rate of WRMDs and the pressure on professionals that hinders the awareness, the precautions are depending only on personal skills and knowledge.

Most of the developed countries do not have modules under the name of ergonomics or work safety in their physical therapy education programme. Moreover there are no profession-specific guidelines or health and safety regulations on work environment and equipment.

Today almost all of the physiotherapists in Turkey are working in the clinics with stable height equipment (table, mats, plinths and etc.) and lack of manual handling aids. Generally it is very difficult to find even walking frames or crutches therefore physiotherapists must use the methods which were abounded due to high risk of injury. Under these circumstances physiotherapists must be aware of their working posture and manual handling techniques. However there are no studies on evaluating the ergonomic awareness of physiotherapists or any other profession. Therefore there are no instruments to gauge the ergonomic awareness. The scale used in this study was formatted from the paper of Cromie et al. (7) on which they propose an occupational health and safety guideline. The scale attempted to evaluate how much do physiotherapists know about the important aspects of ergonomics. Evaluating the knowledge is not the aim of this paper hence respondents were asked at what level they believe their knowledge was. The method gave the opportunity to understand how the respondents rank their information about the elements of ergonomics and to compare the alleged awareness with practice.

The scale was meant to be in a form of covering seven main components of ergonomics; legislations, vulnerability to WMSDs, design of work place, design of work

itself, mechanical aids, risk management, review of risk management. However after statistical examination descriptive factor analysis showed that questions were grouped in three dimensions. Following a review it was interpreted that dimensions were grouped under the topics of;

- Ø Legislation and regulations
- Ø Work place ergonomic requirements
- Ø Safety of application.

On the other hand two questions needed to be deducted according to their alpha values. The item asked about the procedures of the organization for controlling and correcting a reported hazard was deducted because it was grouped under two dimensions legislations/regulations and safety of application. The other item which needed to be deducted was about choosing the “right working posture” during treatment sessions due to it fell under two dimensions, work place ergonomic requirements and safety of application. It could be explained with the physical circumstances of the work place physical therapists may actually know their proper working posture yet the physical conditions would not allow to get that posture.

The rest of the scale was found acceptable after a thorough statistical analysis, and the overall score was converted to 100 point to increase clarity. The overall score was calculated as 56,67 and STD:14,44 the breakdown of the dimensions were 40,91 and STD: 23,13 for legislation and regulation; work place ergonomic requirement was found fairly higher as 67,42 and STD: 14,52 and safety of application had the highest score with 68,30 and STD:14,97.

Legislations and regulations dimension had the lowest score considering physiotherapists in Turkey never encounter with information about health and safety regulation or labour law, it is very reasonable and predictable having a score under 50. The questions under this category were involving employers’ and employee’s responsibilities and requirements of the legislation governing occupational health and safety, identification, assessment and systematic control of the risks.

Questions referring to work place ergonomic requirement were included procedures on risk assessment before treatment session, precautions taken for vulnerable parts of the body and appropriateness of the physical environment. Respondents scored fairly high in this dimension of the ergonomic awareness scale. The items about risk assessment before the

treatment sessions and precautions taken for the vulnerable parts of the body were the subjects which physiotherapists are commonly familiar with. On the contrary respondents reported that their WRMDs were the result of not following these two basic rules. The result of this study showed that *working in the same position for a long period* and *performing the same task over and over* are the two most common injury reasons. The contradiction might be the result of the lack of power that physiotherapists has on their work condition. They could surely aware of the ergonomic necessities however, due to working conditions and fear of losing their job they might have been compromised with non-ergonomic conditions. Another argument could be that they believed that they knew how to protect themselves yet in fact they were not very competent at ergonomic requirements. This argument also supports Cromie's work on culture of physical therapy. Respondents might have believed that it was politically true to know the ergonomic rules otherwise their skills and competence would be questioned.

Safety of application dimension was the topic where respondents had the highest score. The questions of the dimension were about choosing and the proper usage of the aids and equipments for the mechanical load besides accurate timing for breaks and manual handling techniques. Even though, the rate of the WRMD counters with the data, more than 80% of the respondents reported that they knew or they thoroughly knew each items. During the visits of the treatment centres it was observed that the centres were not sufficiently equipped and physical therapists performing manual handling techniques rated high level of risk according to Workers' Compensation Board UK (65). Physiotherapists generally count on their or patients' relatives physical strength during transfers and ambulation activities. On the other hand, treatment plinths and tables were not height adjustable, so physiotherapists need to adopt their working posture during performing a therapeutic manoeuvre, or applying an electrophysical agent. As a consequent, physiotherapists are compelled to work at an awkward position for a long period. The result of this study also showed that working in the same position was the activity caused strain and WRMDs more than any other risk factors.

The results of this study showed that statistically there was no significant difference in ergonomic awareness level among the respondents who had WRMDs history and who had not ($p=0,189$ career span, $p= 0,450$ last 12 months). On other words experiencing WRMDs does not necessarily mean being more careful and alert to ergonomic requirements. According to the culture of physical therapy, physiotherapists are highly skilled and knowledgeable on musculoskeletal disorders and injury mechanisms. This could be an explanation for not

changing their attitudes towards ergonomic requirements and not seeking for more ergonomic friendly working conditions after injury. They tend to believe their professional knowledge was enough to protect themselves from WRMDs hence they would not cogitate about ergonomics.

Another reason of the non significant change of the ergonomic awareness levels between injured and non injured physiotherapists could be related to legal issues. Physiotherapists generally work as a subordinate of a physical therapy doctor, in small groups, therefore they would not apply sanction on changing the working conditions, and eventually they compromise with their working condition.

CONCLUSION

1. WRMDs prevalence among physiotherapists in Izmir was 68% [78/102] which shows compatibility with the corresponding literature.

2. More than half of the injuries (first injury) (57%) occurred in the first five year of the career, of those 69.2% [54/78] had injury in last 12 months. Overall injury rate for previous 12 months was 52% [78/102].

3. The most gruelling activities of the job were reported as “*Working in the same positions for long periods*” and “*Performing the same task over and over*” as they were the most common reasons of injury onset.

4. Lower back was the body part that physiotherapists had injured most (29.8%) which followed by wrist (14.5%) and shoulder (13.7%).

5. Results clearly showed that physiotherapists were reluctant to consult with a doctor, rather had their treatment by themselves or with a help of a colleague. This might be reason of either the type of injury as physiotherapists are reasonably competent with the treatment of musculoskeletal injuries or the culture of physical therapy profession. They believed their professional knowledge and skills would prevent them from the WRMDs, if they had an injury related to work they assume this would depreciate their competence.

6. More than half of the physiotherapists (61.8%, 63/102) claimed that they would know how to protect themselves so they would not hesitate performing any technique even they knew it could harm them.

7. The ergonomic awareness scale used in this study was found reliable and the total score converted to 100 points. The overall score for the participants was 56.67 the scores for each dimension were also calculated. First dimension was focused on legislations and regulations about ergonomics at which physiotherapists had the lowest score of 40.91 on the contrary safety of application was the topic at which they were most confident with the score of 67.42. The third dimension had questions about work place ergonomic requirements participants were scored 68,30. However, this was the first attempt in the literature to measure the ergonomic awareness, therefore there was no information or data to compare and contrast. Besides, participants were asked what they believed about their level of knowledge on ergonomic component, yet to gauge the awareness it is best to conduct the survey before and after giving the information so participants could distinguish what they had known and what was the amount of actual information.

8. The results of the study supported the hypothesis of the study there was no significant relationship was found between WRMDs history and ergonomic awareness score. This result may be interpreted as prevention from WRMDs cannot be achieved with individual efforts and attempts. Ergonomics is a multifaceted subject and must be dealt in a multidisciplinary approach.

To conclude, WRMDs have prevalence among physiotherapists, the culture of the physical therapy occupation may make it difficult for them to do their jobs in a way that minimizes the risk of WMSDs moreover may repress ergonomic awareness. Ergonomics is a complex subject with different interrelated aspects which must be dealt with every level of authorities and organisations. The assumption of physiotherapists were extremely educated about ergonomics provides a false sense of security which makes physiotherapists more vulnerable to WRMDs. Ergonomic awareness training programmes should be introduced at undergraduate and postgraduate levels, as many other high risk WRMDs occupations.

In future conducting researches which;

- Ø with higher sample size,
- Ø excluding last 12 month injuries from overall occupational life to avoid duplications,
- Ø compare surveys before and after an information presentation such as sittings or workshops within continuous professional development programmes, and
- Ø establish scales that vary according to organisations where physiotherapists work, would contribute the literature and appreciation the role of the ergonomic awareness in WRMDs prevention.

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Appendix-1

Informed Consent Form

The study you participate is a scientific research which considers evaluating work related musculoskeletal disorders and ergonomic awareness of physiotherapists. Physiotherapists are one of the professions which have the highest prevalence of WRMD although they are expertise of human body and its movements. The reason for this problem could be poor *environmental ergonomic* of working places. Environmental ergonomic, is arranging individuals' physical environment to improve efficiency and performance by minimizing the environmental stress such as comfort health and safety on person. In order to deal with this problem we need to understand the reasons behind it here we ask you to reply three groups of questions which could have relationship with work related musculoskeletal disorders among physiotherapists.

The survey study will be conducted between 01.06.2009 and 01.12.2009 among physiotherapists working in İzmir. 10 minutes self administrated questionnaire has three main parts. In the first part there are questions about your demographic features, part two is related to occurrence mechanism of work related musculoskeletal disorders. In the third part you would be asked to answer to *ergonomic awareness* questions. You can get more information about the research and evaluation from the physiotherapist whom contact details are given below.

You may choose not to participate in this survey. The information you provide to this research will keep restricted and will not be used out of purpose.

I have read and receive the information which must be given to the volunteers before starting the survey mentioned above. I have asked all the questions I had. I totally understand all written and verbal information in detail. In this circumstance I voluntarily agree to participate in this research.

Participant

Date:

Signature

Informer Researcher

Name –Surname: Barış Gürpınar

Date: Signature:

Deputy of organization who witnesses the consent

Name-Surname: Doç. Dr. S. Ufuk Yurdalan

Date: Signature:

Appendix-2

**EVALUATION OF WORK RELATED
MUSCULOSKELETAL DISORDERS AND
ERGONOMIC AWARENESS AMONG
PHYSIOTHERAPISTS**

1. Demographic features

- 1) Gender/Age
- 2) Year of graduation:
- 3) Starting date of current job:
- 4) Have you ever had an interval of work?years.
- 5) Type of working: Full time:

Part time:days/week.hours/day

- 6) Current work of specialty:
(You may choose more than one area).

A	Intensive Care Units	
B	Cardiopulmonary Rehabilitation Units	
C	Neurological Rehabilitation Units	
D	Electro-Physical Agent Units	
E	Orthopedic Rehabilitation Unit	

2. Occupational injury report

A	Neck
B	Upper back
C	Lower back
D	Shoulder
E	Elbow
F	Wrist
G	Hand
H	Hip
I	Knee
J	Ankle /foot

Table I: Localization of the pain (For question number 10, 14, 17)

A	Working in the same positions for long periods (leg, standing, bent over, sitting, kneeling).
B	Working with more than 20 degrees of flexion/ rotation of the spine for long periods.
C	Continuing to work while injured or hurt.
E	Performing the same task over and over.
F	Performing manual orthopedic techniques (joint mobilizations, soft tissue mobilization).
G	Treating an excessive number of patients in one day.
H	Lifting or transferring dependent patients.
I	Unanticipated sudden movement or fall by patient.
J	Not enough rest breaks or pauses during the workday.
K	Bending or twisting my spine more than 20 degrees while working.
L	Reaching or working away from your body.
M	Working near or at your physical limits.
N	Carrying, lifting, or moving heavy materials or equipment.
O	Assisting patients during gait activities.
P	Work scheduling (overtime, irregular shifts, length of workday).
R	Working with confused or agitated patients.
S	Inadequate training on injury prevention.

Table II: The onset of the pain (for question number 7, 11, 15)

- 7) Please indicate 3 reasons which physically constrain you at work.
(Select from Table II. Put as in letters in the box)

--	--	--

- 8) Have you had work related pain last more than 3 days?

a) Yes

b) No (Please go to question 18)

- 9) In which year of your occupation you had first work related pain last more than 3 days

a) 0-5

b) 6-10

c) 11-15

d) 16- 20

e) 20- +

10) Localization of first work related pain last more than 3 days:

(Select from table I. Put as in letters in the box. May choose more than one area).

--	--	--

11) The reason of first work related pain last more than 3 days

(Select from table II. Put as in letters in the box. May choose more than one reason).

--	--	--

12) Did you receive treatment for the pain?

a) No.

b) Yes, I went to a medical doctor.

c) Yes, without going to a medical doctor, my treatment was done by me or any other physiotherapist.

13) Have you had work related pain last more than 3 days in last 12 months?

a) Yes

b) No (Please go to question 18)

14) Localization of work related pain last more than 3 days in last 12 months.

(Select from table I. Put as in letters in the box. May choose more than one area).

--	--	--

15) The reason of first work related pain last more than 3 days

(Select from table II. Put as in letters in the box. May choose more than one reason).

--	--	--

16) Did you receive treatment for the pain?

a) No.

b) Yes, I went to a medical doctor.

c) Yes, without going to a medical doctor, my treatment was done by me or any other physiotherapist.

17) In the case of a treatment technique which is very important for your patient however hazardous for you.....

a) I would apply the technique if it is necessary for my patient because I know how to protect myself.

b) I would not apply the technique because maintaining my proficiency is depending on my health.

3. Ergonomic Awareness

		I don't know at all	Know very little	I know	I thoroughly know
1	My responsibilities and requirements of the legislation governing occupational health and safety				
2	My employer's responsibilities and requirements of the legislation governing occupational health and safety				
3	Hazard identification				
4	Risk assessment				
5	Systematic risk control				
6	Over viewing hazards for my patient and myself before starting each therapeutic session.				
7	The procedure of my organization for controlling and correcting a reported hazard.				
8	Precautions for upper & lower back, neck and upper extremity injuries may occur in treatment sessions.				
9	Characteristics of physical environment (space, equipment, furniture, light, temperature etc)				
10	Choosing the "right working posture" during my treatment sessions.				
11	Scheduling the timing and span of my breaks during my treatment session.				
12	Deciding the appropriate mechanical aids and equipment to increase my physical load.				
13	The proper use technique for the mechanical aids and equipment.				
14	Proper manual handling during patient transfer.				

Appendix-3

FİZYOTERAPİSTLERDE ÇALIŞMA ORTAMININ ERGONOMİK OLARAK DEĞERLENDİRİLMESİ VE ERGONOMİK FARKINDALIĞIN ÖLÇÜLMESİ

1. Demografik özellikler

- 1) Cinsiyet/Yaş:
- 2) Mezuniyet yılınız:
- 3) Şu anki işinize başlama yılınız:
- 4) Mesleğinize ara verdiniz mi? Kaç yıl?:yıl.
- 5) Çalışma şekli: Tam zamanlı:

Yarı zamanlı: Haftadagün. Gündesaat

6) Şu anki çalışma alanınız:

(Birden fazla alan seçebilirsiniz).

A	Yoğun bakım üniteleri	
B	Kardiyopulmoner Rehabilitasyon Ünitesi	
C	Nörolojik Rehabilitasyon Ünitesi	
D	Elektro- Fiziksel Ajanlar Ünitesi	
E	Ortopedik Rehabilitasyon Ünitesi	
F	Muskloskeletal Ünitesi	

2.Yaralanma Öyküsü

A	Boyun
B	Sırt
C	Bel
D	Omuz
E	Dirsek
F	El bileği
G	El
H	Kalça
I	Diz
J	Ayak/ ayak bileği

Tablo I: Ağrı bölgesi
(10, 14 nolu sorular: cevaplamak için kullanın)

A	Aynı pozisyonda uzun süre çalışmak. (ayakta, oturarak, eğilerek, dizlerimin üstünde).
B	Omurgamda 20 dereceden fazla fleksiyon ve /veya rotasyon açısı olan pozisyonda uzun süre çalışmak.
C	Yaralanmadan dolayı ağrım mevcutken çalışmaya devam etmek.
E	Aynı işi tekrar tekrar yapmak.
F	Manüel tedavi tekniklerini uygulamak. (Ellerinize uyguladığımız herhangi bir teknik).
G	Bir günde çok fazla hasta tedavi etmek.
H	Hastaları kaldırmak veya transferlerini yapmak.
I	Hastalar tarafından yapılan ani ve beklenmeyen hareketler yada düşmeler.
J	Gün boyu yetersiz mola vermek.
K	Çalışırken omurgayı normalden 20 derecen fazla bükme yada eğmek.
L	Uzanmak yada gövdemden uzakta çalışmak.
M	Kişisel limitlerimin sınırında yada üzerinde çalışmak.
N	Ağır araç ve gereçleri taşımak, kaldırmak ya da hareket ettirmek.
O	Hastalara yürüme aktiviteleri sırasında yardımcı olmak.
P	Çalışma programının uygun olmaması. (fazla mesai, düzensiz vardiyalar, çalışma gününün uzunluğu).
R	Ajite ve disoryente hastalarla çalışmak.
S	Kaza önleme eğitiminin yetersizliği.

Tablo II: Ağrı sebebi (7, 11, 15 nolu sorular: cevaplamak için kullanın)

7) Meslek hayatınızda sizi fiziksel olarak zorladığınızı düşündüğünüz 3 sebebi yazınız.

(Lütfen Tablo II den seçiniz. Harf olarak karşılığını yandaki kutuya yazınız).

--	--	--

8) Meslek hayatınızda işinizden kaynaklandığına inandığınız 3 günden fazla süren ağrınız oldu mu?

a)Evet

b) Hayır (Lütfen 17.soruya geçiniz).

9) İlk olarak 3 günden fazla süren ağrınız olduğunda mesleğinizin kaçınıcı yılındaydınız?

a) 0-5

b) 6-10

c) 11-15

d) 16- 20

e) 20-+

10) **İlk olarak 3 günden fazla süren ağrınızın bölgesi:**

(Lütfen Tablo I 'den seçiniz. Harf olarak karşılığını yandaki kutuya yazınız. Birden fazla alan seçebilirsiniz).

--	--	--

11) **İlk olarak 3 günden fazla süren ağrınızın sebebi:**

(Lütfen Tablo II den seçiniz. Harf olarak karşılığını yandaki kutuya yazınız. Birden fazla sebep seçebilirsiniz).

--	--	--

12) **Ağrınız için tedavi gördünüz mü?**

- a) Hayır.
b) Evet bir uzman doktora başvurdum.
c) Evet, uzman doktora başvurmadan tedavimi ben veya bir başka fizyoterapist uyguladı.

13) **Son 12 ayda işinizden kaynaklandığına inandığınız 3 günden fazla süren ağrınız oldu mu?**

- a)Evet
b)Hayır (Lütfen 17.soruya geçiniz).

14) **Son 12 ayda işinizden kaynaklandığına inandığınız 3 günden fazla süren ağrı bölgesi:**

(Lütfen Tablo I den seçiniz. Harf olarak karşılığını yandaki kutuya yazınız. Birden fazla alan seçebilirsiniz).

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15) **Son 12 ayda işinizden kaynaklandığına inandığınız 3 günden fazla süren ağrı sebebi:**

(Lütfen Tablo II den seçiniz. Harf olarak karşılığını yandaki kutuya yazınız. Birden fazla sebep seçebilirsiniz).

--	--	--

16) **Ağrınız için tedavi gördünüz mü?**

- a) Hayır.
b) Evet bir uzman doktora başvurdum.
c) Evet, uzman doktora başvurmadan tedavimi ben veya bir başka fizyoterapist uyguladı.

17) **Hastanız için gerekli ama sizin için güvenli olmayan bir tedavi tekniğini**

- a) Hastam için gerekliyse uygulardım çünkü ben kendimi korumanın yolunu biliyorum.
b) Benim için riskli ise uygulamazdım çünkü mesleğimi devam ettirebilmem sağlıklı olmama bağlıdır.

3.Ergonomik Farkındalık (Lütfen uygun olan seçeneği işaretleyin)

		Hiç bilmiyorum	Çok az biliyorum	Biliyorum	Tam olarak biliyorum
1	İşyerlerinde sağlık ve güvenlik şartlarının iyileştirilmesi konusunda <u>benim</u> üzerime düşen yasal yükümlülüklerimi				
2	İşyerlerinde sağlık ve güvenlik şartlarının iyileştirilmesi onusunda <u>işverenin / kurumun</u> üzerine düşen yasal yükümlülükleri				
3	Ergonomi risklerinin belirlenmesini				
4	Ergonomi risklerinin bildirilmesini				
5	Ergonomi risklerinin sistematik olarak kontrolünü				
6	Tedavi programına başlamadan önce bana ve/veya hastaya zarar verebilecek durumları gözden geçirme yöntemini				
7	Çalıştığım yerde riskli olduğu belirlenen bir durumun kontrol ve düzeltilmesi için uygulanan prosedürü				
8	Tedavi seansı sırasında bel, boyun, sırt ve üst ekstremitelerimin yaralanmasına karşı alınacak önlemleri				
9	Çalışma ortamının fiziksel özelliklerinin (alan, ekipman, mobilya, ısı, ışık vb) ergonomik koşullara uygunluğunu				
10	Tedavi seansım süresince “doğru çalışma postürü” nün seçimini				
11	Tedavi seansımında molaların zaman ve süresinin doğru ayarlanmasını				
12	Fiziksel iş yükümü azaltacak yardımcı cihaz ve ekipmanın doğru seçimini				
13	Fiziksel iş yükümü azaltmak için seçilen cihaz ve ekipmanın doğru kullanım tekniğini				
14	Hasta transferi sırasındaki doğru manüel tutuş ve kaldırma tekniklerini				

Appendix-4
Approval of the Ethical Committee

DOKUZ EYLÜL ÜNİVERSİTESİ TIP FAKÜLTESİ
KLİNİK VE LABORATUVAR ARAŞTIRMALARI ETİK KURULU

Etik Kurul Üyeleri

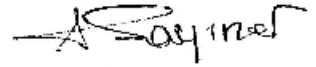
Prof.Dr.A.Arzu SAYINER
Prof.Dr.Tunç AIKIN
Prof.Dr.Mustafa SEÇİL
Doç.Dr.M.Hakan ÖZDEMİR
Doç.Dr.Vesile ÖZTÜRK
Doç.Dr.Murat DUMAN
Doç.Dr.Güven ASLAN
Doç.Dr.Servet AKAR
Yardı.Doç.Dr.Murat ÖRMEN
Öğr.Gör.Uzm.Dr.Ahmet Can BİLGİN
Funus KARSLI

DOKUZ EYLÜL ÜNİVERSİTESİ TIP FAKÜLTESİ DEKANLIĞINA;

Etik Kurulumuzun 18 Haziran 2009 tarih ve 46/14/2009 no.lu toplantısında; 193/2009 Protokol numaralı Sağlık Bilimleri Enstitüsü Sınır Bilimleri Anabilim Dalı Öğretim Üyelerinden Doç.Dr. S.Ufuk YURDALAN proje yöneticisi Dr. Barış GÜRPINAR'ın sorumlusu olduğu, "**Fizyoterapistlerde mesleğe bağlı kas iskelet rahatsızlıklarının incelenmesi ve ergonomik farkındalığın ölçülmesi**" isimli projenin uygulanmasında etik açıdan sakınca yoktur.

Katılanların oy birliği ile karar verilmiştir.

Bilgilerinizi ve gereğini arz ederim.



Prof. Dr.A.Arzu SAYINER
Klinik ve Laboratuvar Araştırmaları
Etik Kurul Başkanı

Etik Kurul Sekreteri
Hatice İĞÇİ

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