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CREATING ERGONOMICS RISK ANALYSIS ALGORITHM AND RISK ASSESSMENT SOFTWARE BASED FUZZY LOGIC IN HOSPITALS

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Abstract- The aim of this work is to implement ergonomics health and safety management practices in hospitals by creating fuzzy logic-based risk analysis software to identify the hazards and risks faced by employees in a short-term hospital and the measures to be taken to protect employees in hospitals. Methods: In this study, 100 physicians working in hospitals of Turkey have been made descriptive to determine their occupational risks with non-medical personnel. Data were collected by applying a questionnaire consisting of 50 questions. The hospitals have been examined by three occupational health and safety experts and the necessary data were collected. The arithmetic mean of the collected data was taken and actual determinations were obtained. In this study, computer software was developed by creating a fuzzy logic based ergonomics risk assessment analysis model considering various hazards in occupational health and safety in hospitals. The model will greatly reduce the ergonomic risks in hospitals. By this modeling and software, the ergonomic risk assessment and analysis can be done easily in hospitals. Hopefully in the future, by this ergonomic risk assessment and analysis, occupational accidents and occupational diseases in hospitals will not come on the agenda. In this study, suggestions for ergonomic hazards were presented in health institutions. Where possible, work flows between hospital units. These units should be ergonomically arranged during design. Problems related to workflow are identified and ergonomically rearranged in ready-made architectural conditions and office supplies.

Keywords: Risk Analysis, Occupational Health and Safety, Ergonomics in Hospitals.

I. INTRODUCTION

Work-related diseases can arise if there is a mismatch between the physical needs of the work and the physical capacity of the worker. Hospitals have the most common musculoskeletal diseases among work-related diseases [1]. In Europe and the United States, one of every four employees complains of back and muscle pain [2]. In England, it is known that employees are most at risk for disease and injury in the musculoskeletal system [3].

Work-related musculoskeletal disorders are at the forefront in some business lines according to their work characteristics and conditions [4]. One of the most important businesses with high ergonomic risk is health studies [5]. Today, increasing demands for health services and efforts to remove barriers to access to services have forced patients to receive more services and healthcare providers to provide more services [6].

Health workers may be exposed to various risk factors during their duties while patients stay in hospital [7]. For this reason, the working environment needs to be ergonomically regulated in terms of receiving and giving services [8]. Inadequate ergonomic design, which is not suitable in the business environment, causes personal problems such as injuries, stress and fatigue in employees [9]. This not only lowers employee productivity but also prevents the provision of quality care at the desired level and creates new problems that will put patients at risk [10].

Ergonomic structuring of the working environment and the vehicles designed in this environment can reduce the possible disturbances and negative health consequences and contribute to a better health care service [11]. Applying design-oriented strategies in the workplace can reduce costs and create appropriate conditions for providing patient and employee safety [12]. Parallel to this, the services provided in the hospital environment will also accelerate the development of quality understanding [13, 14].

The linkage of ergonomics with healthcare providers and patient safety should not be considered as the process by which ergonomics is harmonized solely with the work environment according to the way employees do business [15, 16].

Relations of employees with others, psychological and physiological satisfaction levels of persons, contacts with working environment; the interaction of variables such as hardware and software elements, tool-use qualifications, and human factors, and the possible effects of communication on patient satisfaction and safety, which are considered to be the ultimate output of health care institutions [17, 18].

II. ERGONOMICS IN HOSPITALS

Employees in the hospital environment are always in interaction with technology, especially fixed and portable instruments [19, 20]. This interaction causes an important influence on human performance [21, 22].

Cognitive, work-related human settlements such as physical, verbal and nonverbal communication, workload and stress, decision making, human-machine interaction, system design, such as lighting, temperature, noise, radiation, confusion/confusion, organizational areas such as employer and employee training, employee supervision, rotational work, regulation of working and rest periods, behaviour modification, use of protective equipment are factors affecting system performance directly in the hospital environment [23, 24].

100 physicians working in hospitals of Turkey were made descriptive to determine their occupational risks with non-medical personnel. Data were collected by applying a questionnaire consisting of 50 questions. The hospital was examined with three occupational health and safety experts and the necessary data were collected. Figure 1 shows the percentages of the ergonomic problems obtained by surveys of employees working in different occupational groups in hospitals.

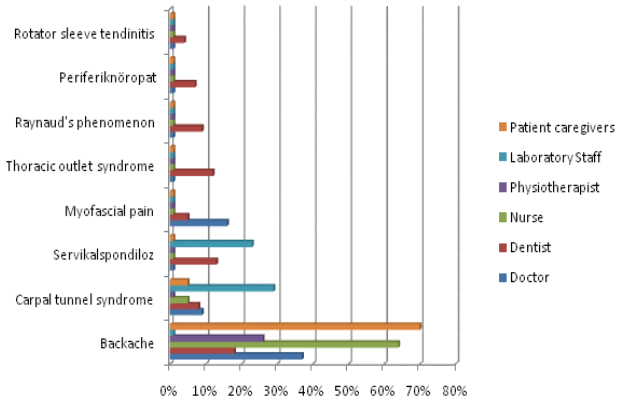

Figure 1. Percentage of ergonomic problems obtained by questionnaires to employees working in different professions in hospitals

As you can see from the survey, the most common musculoskeletal system in health care workers is back pain. Also; In an effort to keep a falling patient, lifting patients alone increases muscle, tendons, joints and ligaments. Problems with upper extremity are seen in dentists and laboratory workers. The general forms of work create a severe strain on the bones and soft tissues of the neck and shoulder region of dentists.

Laboratory workers show neck stresses especially when working at the microscope for long periods of standing, sitting and working in unsuitable 48 positions. There are ergonomic environmental hazards arising from the hospital environment and working conditions, as well as problems arising from the way employees work and move incorrectly. As an example to these threats; slippery and wet floors, uneven floor surface, floor level difference, obstructed and narrow passages, shift work, inadequate lighting, noisy environment.

III. ERGONOMICS RISK ASSESSMENT ANALYSIS IN HOSPITALS

The matrix method, which is widely used in these methods. This is a method of analyzing the severity of risk and the possibility of its components [25]. Determination of hazards that may or may not be present in hospitals [26]. Figure 2 shows risk analysis modelling, how risk Assessment and analysis can be done.

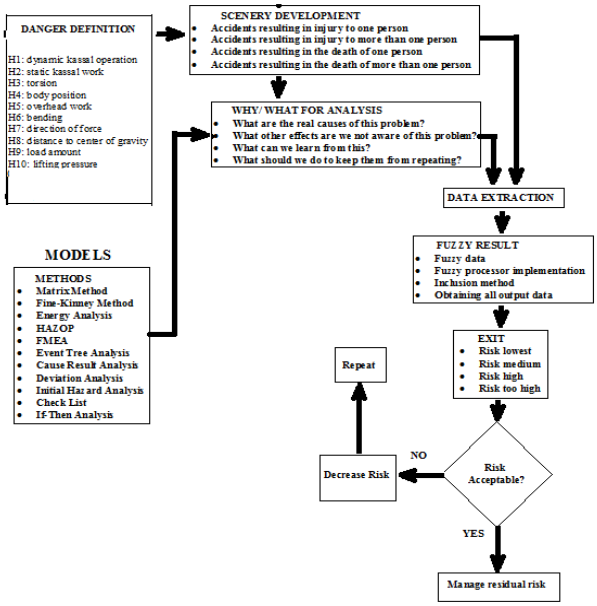

Figure 2. Creating risk analysis modelling

In this method; the risk that a danger will arise is analyzed by how often the likelihood of emergence can be seen and how serious the negative consequence of violence may be.

The locations and hazards are determined as the following:

L1: Archive
L2: Material supply unit
L3: Computing
L4: Employee rights and security unit
L5: Laundry
L6: Document
L7: Income accrual-invoice
L8: Expense accounting
L9: Illness service
L10: Signature-approval unit
L11: Statistical unit
L12: Performance and quality unit
L13: Salary accrual
L14: Staff service
L15: Buy
L16: Social service unit
L17: Vehicle drive unit
L18: Technical service
L19: Cashier's desk
L20: Operating room
L21: Nutritionist
L22: Pharmacy
L23: Visualization

L24: Laboratory medical board
L25: Sterilization
L26: Family medicine unit
L27: Anesthesia
L28: Gilding unit
L29: Pediatric unit
L30: Diet unit
L31: Infectious diseases unit
L32: Home care unit
L33: Physical therapy and rehabilitation unit
L34: Chest diseases unit
L35: Internal medicine unit
L36: Cardiology unit
L37: Occupational diseases unit
L38: Neurology unit
L39: Mental and neurological unit
L40: Dental department
L41: General surgery unit
L42: Eye diseases unit
L43: Gynecological unit
L44: Ear-nose-throat unit
L45: Orthopedics and traumatology unit
L46: Urology unit
H: Hazards (H1….H10)
H1: Dynamic kassal operation
H2: Static kassal work
H3: Torsion
H4: Body position
H5: Overhead work
H6: Bending
H7: Direction of force
H8: Distance to center of gravity
H9: Load amount
H10: Lifting pressure

The probability and violence rating of emergence of danger are as the following:
- Very small '1': hardly ever
- Small '2': very few (once a year), only in abnormal situations
- Middle '3': little (once every three months)
- High '4': frequently (once a week)
- Very high '5': very often (every day), under normal working conditions

The risks classifications are as the following:
- Extreme risk: The activity should cease immediately and short term safety controls implemented. Notify manager and assess activity.
- High risk: Implement short term safety measures immediately. Notify manager and assess activity.
- Medium risk: Implement short term safety controls.
- Low risk: Implement long term safety controls.

The risk assessment score and membership level are considered using Risk = Violence × Probability.
- The risks with a score of 25 are very high and the membership rate is u_{RISK}= 1.0.
- Risks between 15 and 25 are high risk and membership level is u_{RISK}= 0.8.
- Risks between 8 and 12 are medium risk and membership level is u_{RISK}= 0.6.
- The risks ranging from 3 to 6 are low, and the membership grade is u_{RISK}= 0.4.
- Risks with a score of 1 and 2 are very low, and the membership level is u_{RISK}= 0.2.
- If the score is 0, there is no risk and the membership grade is u_{RISK}= 0.0.

The linguistic variables in hospitals are:
- Very Bad (VB) (0.8,0.9,1.0,1.0)
- Bad (B) (0.7,0.8,0.8,0.9)
- Little Bad (LB) (0.5,0.6,0.7,0.8)
- Medium (M) (0.4,0.5,0.5,0.6)
- Some Good (SG) (0.2,0.3,0.4,0.5)
- Good (G) (0.0,0.2,0.2,0.3)
- Very Good (VG) (0.0,0.0,0.1,0.2)

Once the blur sets are defined and their membership functions are assigned, the rules are written for each combination of control variables. These rules relate input variables to output variables by using If-Then expressions in decision-making. The condition 'If' is a prelude to the result of each rule. In general, each rule is shown as 'If', and then 1024 combined rules are created when identical result expressions are issued. Creating software on a risk assessment analysis is shown in Figure 3.

- If H1 is VB and H2 is M and H3 is M and H4 is M and H5 is M and H6 is M and H7 is M and H8 is M and H9 is M and H10 is M then RISK is VERY HIGH else
- If H1 is M and H2 is VB and H3 is M and H4 is M and H5 is M and H6 is M and H7 is M and H8 is M and H9 is M and H10 is M then RISK is VERY HIGH else
- If H1 is M and H2 is M and H3 is VB and H4 is M and H5 is M and H6 is M and H7 is M and H8 is M and H9 is M and H10 is M then RISK is VERY HIGH else
- If H1 is M and H2 is M and H3 is M and H4 is VB and H5 is M and H6 is M and H7 is M and H8 is M and H9 is M and H10 is M then RISK is VERY HIGH else
- If H1 is M and H2 is M and H3 is M and H4 is M and H5 is VB and H6 is M and H7 is M and H8 is M and H9 is M and H10 is M then RISK is VERY HIGH else
- If H1 is M and H2 is M and H3 is M and H4 is M and H5 is M and H6 is VB and H7 is M and H8 is M and H9 is M and H10 is M then RISK is VERY HIGH else
- If H1 is M and H2 is M and H3 is M and H4 is M and H5 is M and H6 is M and H7 is VB and H8 is M and H9 is M and H10 is M then RISK is VERY HIGH else
- If H1 is M and H2 is M and H3 is M and H4 is M and H5 is M and H6 is M and H7 is M and H8 is VB and H9 is M and H10 is M then RISK is VERY HIGH else
- If H1 is M and H2 is M and H3 is M and H4 is M and H5 is M and H6 is M and H7 is M and H8 is M and H9 is VB and H10 is M then RISK is VERY HIGH else
- If H1 is M and H2 is M and H3 is M and H4 is M and H5 is M and H6 is M and H7 is M and H8 is M and H9 is M and H10 is VB then RISK is VERY HIGH else
- .....

Figure 3. Creating software on a risk assessment analysis

IV. CONCLUSION

Ergonomic Risks, which is one of the five risk factors related to the concept of Occupational Health and Safety, were evaluated. The Ergonometric Risk Analysis Software was created by using Fuzzy Logic method.

In this study, it complained of back pain, especially as Turkey has done surveys were carried out in hospitals fuzzy logic-based applications. The aim of this work is to implement health and safety management practices in

hospitals by creating fuzzy logic-based risk analysis software to identify the hazards and risks faced by employees in a short-term hospital. The measures is taken to protect employees from them. By creating fuzzy logic-based risk analysis software for the healthcare sector in the mid-range, it leads to health and safety management practices in hospitals. It provides a health and safety guideline for the health sector by establishing long-term fuzzy logic-based risk analysis software and resources for sectoral legislation studies.

Occupational health and safety determinations were made to obtain the data necessary for risk analysis. The information, documents and questionnaire data obtained from the staff to be used in the investigation are correct. The literature information on which the research is based is scientific. What are the risks and ergonomic hazards that health workers face throughout the hospital, affecting their health and safety? What are the ergonomic hazards and risks that health workers face in their hospital units, affecting their health and safety? What is the level of ergonomic health and safety risks that health care workers face? What are the precautions to be taken to protect healthcare workers from the ergonomic health and safety hazards they face? Research manpower, time and financial impossibilities Turkey due to Ankara, Adana and Mersin is bordered by three government hospitals in the province. The results of the research are also limited to the working environment conditions of the hospitals analyzed and the employees working in these hospitals. Suggestions for ergonomic hazards were presented in health institutions.

The aim of this study is to implement ergonomics health and safety management practices in hospitals by creating fuzzy logic-based risk analysis software to identify the hazards and risks faced by employees in a short-term hospital and the measures to be taken to protect employees from them. practices in hospitals. 100 physicians working in hospitals of Turkey were made descriptive to determine their occupational risks with non-medical personnel. Data were collected by applying a questionnaire consisting of 50 questions. The hospital was examined with three occupational health and safety experts and the necessary data were collected. The arithmetic mean of the collected data was taken and actual determinations were obtained.

In this study, computer software was developed by creating a fuzzy logic based ergonomics risk assessment analysis model considering various hazards in occupational health and safety in hospitals. The model will greatly reduce the ergonomic risks in hospitals. By this modeling and software, the ergonomic risk assessment and analysis can be done easily in hospitals. Where possible, work flows between hospital units.

These units should be ergonomically arranged during design. Problems related to workflow are identified and ergonomically rearranged in ready-made architectural conditions and office supplies. Where possible, work flows between hospital units. These units should be ergonomically arranged during design. Problems related to workflow are identified and ergonomically rearranged in ready-made architectural conditions and office supplies.

Ergonomic stress factors such as force, repetition, bad posture, vibration contact stress should be evaluated in terms of duration, frequency, etc. Workplace observations, periodic media measurements, employee surveys should be done; health problems should be evaluated epidemiologically. A medical management program should be administered by an educated staff about musculoskeletal system diseases. This program should provide an intervention room for accident attendants, keep records of diseases and accidents, and provide early diagnosis and treatment of employees who, have an accident or illness. An accident or sick employee must be systematically monitored until they are ready to return to duty.

An early reporting system should be established for the indication of back pain and other musculoskeletal disorders. Complaints and suggestion programs should be established. Ergonomic hazards should be trained on correct lifting-carrying and posture rules to protect healthcare workers. Ergonomic hazards and control methods should be included in the orientation training program for newly recruited personnel. Exercises should be arranged and updated. Regular inspections should be carried out regularly to check whether the control and prevention measures have been implemented or not.

Hopefully in the future, by this ergonomic risk assessment and analysis, occupational accidents and occupational diseases in hospitals will not come on the agenda. In this study, suggestions for ergonomic hazards were presented in health institutions.

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BIOGRAPHY

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