A REVIEW ON ERGONOMIC TOOLS TO ASSESS PHYSICAL RISK IN GARMENT MANUFACTURING INDUSTRIES

[1]BELLIAPPA C.C, [2]ARUN N, [3]RAJESWARA RAO KVS, [4]N.S NARAHARI

[1,2]Under Graduate Student-VIII Sem, [3] Associate Professor, [4] Head of the Department
[1,2,3,4]Department of Industrial Engineering and Management, R. V. College of Engineering, Bangalore
Email: bellichengappa92@gmail.com, narun54@gmail.com

Abstract: India's garment industry is one of the mainstay of the national economy. It is also one of the largest contributing sectors of India's exports worldwide. Textile and garments sector is one of the important sectors among the various constituents of the manufacturing sector in India, mainly due to its contribution towards employment. It is the second largest employment provider after agriculture, both direct and indirect employment put together. The textiles and garments sector alone employed 20% of the workforce in the organized manufacturing sector. The textile industry currently contributes about 14 per cent to industrial production, 4 per cent to GDP, and 17 per cent to the country's export earnings, the report stated. During the year 2012-13, garments accounted for almost 39% of the total textiles exports. The total textile exports during 2012-13 was valued at Rs 137619.44 crore as against Rs 129829.30 crore during the corresponding period of financial year 2011-12, registering an increase of 6.00 percent in rupee terms. In US dollar terms, the same was valued at US$ 25263.74 million as against US$ 27328.06 million during the corresponding period of previous financial year registering a decline of 7.55 percent in US$ terms.

According to global and in particular Asian literature reports it is seen that ergonomics science consists of methods and models for analyzing tasks, designing work, predicting performance, collecting data on human performance and their interaction with work components in the environment in which this interaction takes place. The tools deal with the analysis and evaluation of musculoskeletal factors. It also includes measurement of discomfort, observation of posture, analysis of workplace risks, measurement of work effort and fatigue, assessing lower back disorder, and predicting upper-extremity injury risks. There are many different tools and techniques that are used for assessment; this paper highlights assessment tools that are most relevant for assessing physical risks faced by workers in garment manufacturing industries.

Keywords-Ergonomics, Garment industry, Muscoskeletal disorders, Physical risks

I. INTRODUCTION

Garment manufacturing is a labor-intensive activity involving repetitive and skilled manipulation of fabric. Recent reports and observational studies suggest that poorly-designed workstations contribute to cumulative trauma disorders (CTDs), such as musculoskeletal disorders of the neck, shoulders and upper limbs, collectively known as repetitive strain injuries (RSIs).

There are six methods namely Physical Methods, Psycho-physiological Methods, Behavioral Cognitive Methods, Team Methods, Environmental Methods, Macro ergonomics Methods to analyze and evaluate ergonomic factors in general. This paper focuses on only the tools which can be used for physical risk assessment in garment manufacturing industries.

II. PHYSICAL METHODS

Physical method include tools which deal with the analysis and evaluation of musculoskeletal factors, measurement of discomfort, observation of posture, analysis of workplace risks, measurement of work effort and fatigue, assessing lower back disorder, and predicting upper-extremity injury risks.

The use of physical methods to assess how work is being performed is crucial to the work of many ergonomists. The physical methods can be used to obtain essential surveillance data for the management of injury risks in the workforce. It is generally accepted that many musculoskeletal injuries begin with the worker experiencing discomfort. There are various types of physical methods such as self-report surveys, postural evaluation tools and fatigue quantification tools .Some of the relevant tools in the context of garment manufacturing industry are discussed.

2.1 Plibel:

PLIBEL is a simple checklist screening tool intended to highlight musculoskeletal risks in connection with workplace investigations. Time aspects as well as environmental and organizational considerations also have to be considered as modifying factors. The checklist was designed so that items ordinarily checked in a workplace assessment of ergonomic hazards would be listed and linked to five body regions. Whenever a question is irrelevant to a certain body region, and/or if documentation has not been found in the literature, it is represented by a gray field in the checklist and need not be answered. A workplace assessment using PLIBEL starts with an introductory interview with the employee and with a preliminary observation. The assessments focus on representative parts of the job, the tasks that are conducted for most of the working hours, and tasks that the worker and/or the observer look upon as particularly stressful to the musculoskeletal system. Unusual or personal ways of doing a task are also recorded. When an ergonomic hazard is observed, the numbered area on the form is checked or a short note is made. In the concluding report, where the answers are arranged in order of importance, quotations from the list of ergonomic hazards can be used. Modifying factors duration and quantities of environmental or organizational factors are then taken into consideration. Usually PLIBEL is used to identify musculoskeletal injury risk factors for a specific body region, and only questions relevant to that body region need be answered. It observes a part, or the whole, of the body and summarizes the actual identification of ergonomic hazards in a few sentences. It is simple and is designed for primary checking. For labor inspectors and others observing many tasks every day, it is certainly enough to be equipped and well acquainted with the checklist. PLIBEL method is a general assessment method and is not intended for any specific occupations or tasks.

2.2 NIOSH Survey:

This self-report method allows the ergonomist to easily assess measures of musculoskeletal discomfort in numerous body regions, such as the intensity, frequency, and duration of discomfort.

Musculoskeletal discomfort surveys collect information on the location of discomfort by reference to specific body regions or by use of partial- or whole-body diagrams that designate specific regions to be assessed. Less commonly, body maps are shaded by respondents to identify regions of discomfort. The number of regions targeted varies in relation to the interests of the study. Two different display formats have been used for identifying body parts in the NIOSH studies. For nearly one half of the studies partial-body diagrams provided multiple views of designated regions of interest. Each of these targeted regions was accompanied in the survey with a series of questions and rating scales for assessing multiple facets of discomfort at that location. In most of the remaining studies only a single attribute of discomfort (usually intensity) was rated. Thus it was possible to target all regions of interest in a single integrated diagram, with a space for recording ratings contiguous to each designated region. Rear-view perspectives of the body are presented in most of these whole-body diagrams.

The survey begins with a single question that screens for the presence of one or more of six symptoms (pain, aching, stiffness, burning, numbness, or tingling) in each body region. An affirmative response is then followed by a rating of this "problem" using as many as three severity measures (duration, frequency, and intensity). Research has shown the NIOSH survey to be sensitive to a wide range of physical stressors across many occupations, and to have prognostic value for more objective measures of musculoskeletal disorders. Widely used in health and safety practices, anthropometric surveys.

2.3 Rapid Upper Limb Assessment (RULA):

Rapid upper-limb assessment (RULA) provides an easily calculated rating of musculoskeletal loads in tasks where people have a risk of neck and upper-limb loading. The tool provides a single score as a "snapshot" of the task, which is a rating of the posture, force, and movement required. The risk is calculated into a score of 1 (low) to 7 (high). These scores are grouped into four action levels that provide an indication of the time frame in which it is reasonable to expect risk control to be initiated.

RULA is used to assess the posture, force, and movement associated with sedentary tasks. Such tasks include screen-based or computer tasks, manufacturing, or retail tasks where the worker is seated or standing without moving about. RULA can be used to assess a particular task or posture for a single user or group of users. RULA is useful in comparing existing and proposed workstation designs as part of a justification or proposal for ergonomic changes. RULA is used to measure musculoskeletal risk, usually as part of a broader ergonomic investigation, compare the musculoskeletal loading of current and modified workstation designs, evaluate outcomes such as productivity or suitability of equipment, and educate workers about musculoskeletal risk created by different working postures.

2.4 Rapid Entire Body Assessment (REBA):

Rapid entire body assessment (REBA) was developed to assess the type of unpredictable working postures found in various industries. Data are collected about the body posture, forces used, type of movement or action, repetition, and coupling. A final REBA score is generated to give an indication of the level of risk and urgency with which action should be taken. In the spectrum of postural analysis tools, REBA lies between the detailed event-driven systems and time-driven tools. REBA was designed to be used as an event-driven tool due the complexity of data collection.

REBA can be used when an ergonomic workplace assessment identifies that further postural analysis is required and the whole body is being used. Posture is static, dynamic, rapidly changing, or unstable. Animate or inanimate loads are being handled either frequently or infrequently. Modifications to the workplace, equipment, training, or risk taking behavior of the worker are being monitored pre/post changes.

2.5 Muscle Fatigue Assessment: Functional Job Analysis Technique:

This muscle fatigue assessment method (MFA), also known as the functional job evaluation technique, was developed by Rodgers and Williams (1987) to characterize the discomfort described by workers on automobile assembly lines and fabrication tasks. This can be extrapolated to garment manufacturing as well. This MFA method works best for evaluating production tasks having fewer than 12 to 15 repetitions per minute with the same muscle groups, but it will underestimate postural loads that are sustained continuously for more than 30 sec. It is not appropriate for use if fatigue is not likely to occur on a task, e.g., performing an occasional heavy lift. Any task that is beyond the capacity of more than half of the potential workforce should be fixed based on that very high effort level. Fatigue should only be a consideration if the effort is initially within reasonable guidelines.

The MFA method can define which jobs might be appropriate for people to work on for a short term during initial return-to-work after an injury or illness. By rating all body parts on a task, those tasks that might exacerbate a muscle or joint problem can be separated from those tasks that should be acceptable for the injury or illness of concern during a short-term rehabilitation period. This reduces the need for general work restrictions and minimizes the chance of re injury. MFA identifies fatigue-producing patterns of work and shows how to improve them and prioritizes these improvements. MFA is less effective if done by one analyst rather than a team of people on the production floor. It is very sensitive but not very specific in detecting the potential MSD (musculoskeletal disorder) risks.

CONCLUSION

Tools are a necessary part of any ergonomic assessment. There is an abundance of tools that are capable of analyzing tasks, designing work, predicting performance, collecting data on human performance and interaction with artifacts and the environment in which this interaction takes place. Despite the vast number of methods, there are still several significant challenges faced by the developers and users of ergonomics methods. These challenges include developing methods that integrate with other methods, linking methods with ergonomics theory, making methods easy to use, providing evidence of reliability and validity, showing that the methods lead to cost-effective interventions.

REFERENCES

[1] Kourinka, I., Jonsson, B. Et al. (1987), Standardized Nordic questionnaire for the analysis of musculoskeletal symptoms, Appl.Ergonomics, 18, 233–237.

[2] Lowe, B., Moore, J.S., Swanson, ET al.(2001), Relationships between upper limb loading, physical findings, and discomfort associated with keyboard use, in Proceedings of the Human Factors and Ergonomics Society 45th Annual Meeting, Santa Monica, CA, pp. 1087–1091.

[3] Marley, R. and Kumar, N. (1994), An improved musculoskeletal discomfort assessment tool, in Advances in Industrial Ergonomics and Safety VI, Aghazadeh, F., Ed., Taylor & Francis, London, pp. 45–52.

[4] NIOSH (1989a), Health evaluation and technical assistance report: Cargill Poultry Division, Buena Vista, GA, Report HETA 89-251-1997, U.S. Department of Human Services, Public Health Service, Kemmlert, K. (1996a), Prevention of occupational musculo-skeletal Med.,Suppl. 35, 1–34.

[5] Neville Stanton, Alan Hedge, Karel Brookhuis, Eduardo Salas, Hal Hendrick (2005), Handbook of Human Factors and Ergonomics Methods, CRC Press LLC, pp. 22-23, 27-29, 31-32, 34-35, 41-42, 65-66, 76-77, 104-105.

★★★