

## EVALUATING WORK PERFORMANCE AND ERGONOMIC POSTURES IN TAILORING: A HOLISTIC ASSESSMENT

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**Abstract:** Tailors engage in a variety of activities, crafting new garments from patterns or modifying existing clothing to meet customer specifications. The inherent nature of their work often leads to the adoption of awkward postures and repetitive motions, resulting in musculoskeletal discomfort and occupational health concerns. This study aimed to comprehensively assess the tasks undertaken by tailors and the work postures they assumed, particularly during sewing machine operations. Conducted in Pantnagar, Uttarakhand, India, the study involved 60 male respondents in the tailoring profession. The postural analysis, evaluated using RULA and REBA scores, revealed that over 65%, 60%, and 58% of respondents faced high-risk levels during ironing, stitching, and cutting activities. A significant number reported experiencing musculoskeletal discomfort due to the inherent demands of tailoring. These findings underscore the need for tailors to recognize and address the risks associated with their workstations, tasks, and postures. To enhance safety and health measures, a novel, cost-effective workstation design is proposed for tailors.

**Keywords:** RULA and REBA Assessment, Workstation Design, Musculoskeletal Discomfort, Posture Assessment, Tailor Occupation, Textile Industry.

### INTRODUCTION

The inception of the textile industry in India dates back to the first half of the 20th century, experiencing substantial growth over the past four decades. This industry primarily focuses on the production of yarn and cloth, as well as the subsequent design, manufacturing, and distribution of clothing. The intricate process of creating a complete garment involves various stages such as spinning yarns, assembling cotton bundles, fabric preparation, and the cutting and stitching of the fabric. Moreover, the textile sector encompasses self-employed garment workers, commonly known as tailors, who operate in their own workshops and exclusively tailor garments to meet customers' preferences. The key tasks undertaken by tailors at their workstations include customer interactions, measurements, fabric cutting, stitching, finishing, ironing, and the final inspection of the tailored garments.

Tailors are confronted with a markedly elevated risk of muscle pain and injuries compared to workers in other professions, as the prevalence of postural discomfort tends to escalate with years of employment. Contributing factors to this heightened risk include repetitive movements, exertion of force, stress, strain, and exposure to vibrations, all of which are

associated with increased injury rates. Despite advancements in technology within the textile sector, tailors persist in utilizing foot treadle and hand wheel sewing machines. The continued reliance on these manually powered machines has been linked to accidents, attributed to the sustained and repetitive pressure applied by the hands and feet during operation.

Tailors dedicate extensive hours, often from morning until late at night, to their workplace. The workspace is crucial, encompassing the local environment where workers invest significant time and effort in performing their tasks. This personal connection to the workspace engenders a sense of ownership among workers. Any discrepancy between the worker and the work environment can lead to both mental and physical stress, posing occupational risks. Despite the prevalent belief in the inevitability of accidents in the fast-paced realm of tailoring, it's essential to recognize that injuries entail tangible losses—monetary, temporal, and in terms of productivity. Achieving compatibility between workers and their workstations is paramount. When designing these workspaces, factors such as clearance, reach, and overall comfort for the workers must be meticulously considered to promote a harmonious and efficient work environment.

The tailor's profession entails monotonous and highly repetitive tasks carried out in a seated working posture, characterized by a curved upper back and a bent head focused on the sewing machine. The job demands visual precision, concentration, and accuracy. **Maier, E. et al.** (2002) conducted research on working conditions in garment workstation units, aligning with outcomes expected in environments with poor ergonomic features—such as constrained postures, repetitive motions, and intense visual demands. **Ranney et al. (1995)** highlighted the adverse effects of sewing machine operations on body posture throughout the workday in garment manufacturing. Anecdotal evidence points to challenges like congestion, excessive heat, humidity, and suboptimal furniture and workstation design. Prolonged sitting in unnatural postures is prevalent, often with seats lacking backrests. This study aims to integrate ergonomics with tailoring activities, exploring the impact of physical work demands and assessing potential risk factors for musculoskeletal symptoms in tailoring workers. The objectives include studying the existing workstation design, analyzing tasks performed with sewing machines, and evaluating various work postures adopted by tailors during machine operations.

## **MATERIAL AND METHODS**

Purposively random sampling design was used to select the study area and the selection of the respondents from Pantnagar, of U. S. Nagar District of Uttarakhand state. Total sample

sizes of 60 male respondents were taken for the present study. These 60 respondents were working in 14 tailor boutique shops.

Descriptive data for the study was gathered through the utilization of a pre-coded interview schedule and anthropometric measurements. The experimental phase involved the collection of data employing RULA (Rapid Upper Limb Assessment) and REBA (Rapid Entire Body Assessment). Three key activities—cutting of the fabric, stitching of the fabric, and ironing the stitched garment—were chosen for RULA and REBA assessments. For each of these activities, 20 respondents were selected to perform the tasks.

### **RULA (Rapid Upper Limb Assessment)**

It is a survey method developed by **Mc Atamney and Corlett, (1993)** for use in ergonomics investigation of workplaces where work related upper limb disorders are reported. A coding system is used to generate an action list which indicates the level of intervention required to reduce the risks of injury due to physical loading on the operator.

### **REBA (Rapid Entire Body Assessment)**

REBA was proposed by **Hignett and McAtamney (2000)** and use as a quick assessment of the postures of the upper limbs as well as lower limbs along with muscle function and the external loads experienced by the body. A coding system is used to generate an action list which indicates the level of intervention required to reduce the risks of injury due to physical loading on the operator.

## **RESULT AND DISCUSSION**

### **Physical characteristic of the respondents**

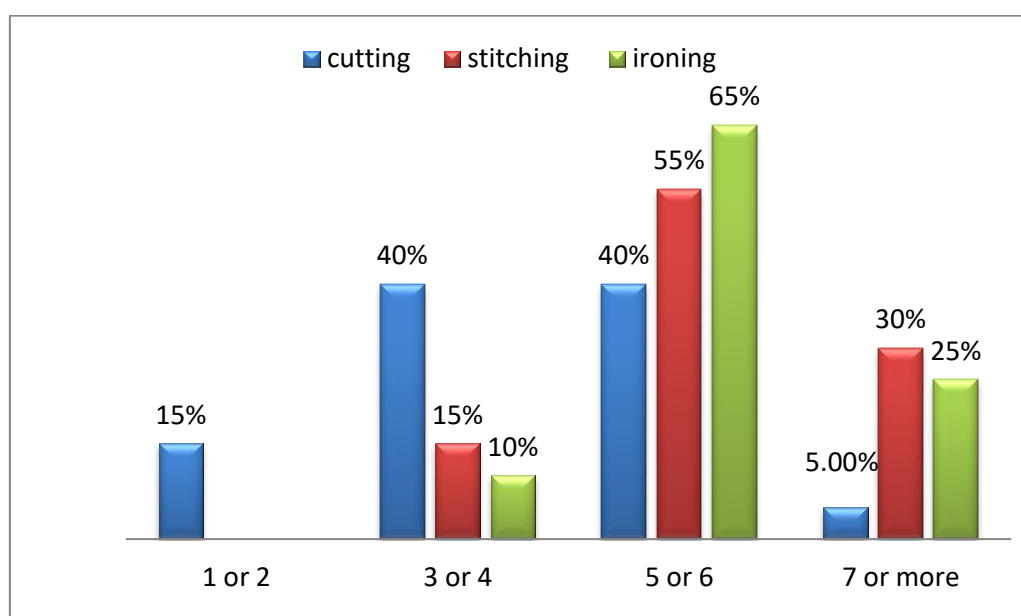
Table-1 illustrates that the respondents engaged in tailoring activities had a mean age of 32.75 years  $\pm$  4.38. The height of the respondents averaged 156.6 cm  $\pm$  5.59, while their mean weight was 61.37 kg  $\pm$  4.46. Notably, a significant portion of the respondents (45%) possessed 20 to 30 years of experience in the tailoring occupation.

**Table 1- Physical characteristic of the respondents**

<b>S. No.</b>	<b>Respondents</b>	<b>Mean</b>	<b>SD</b>
<b>1</b>	Age (years)	32.75	4.38
<b>2</b>	Height (cm)	156.6	5.59
<b>3</b>	Weight (kg)	61.37	4.46

### RULA scores Assessment

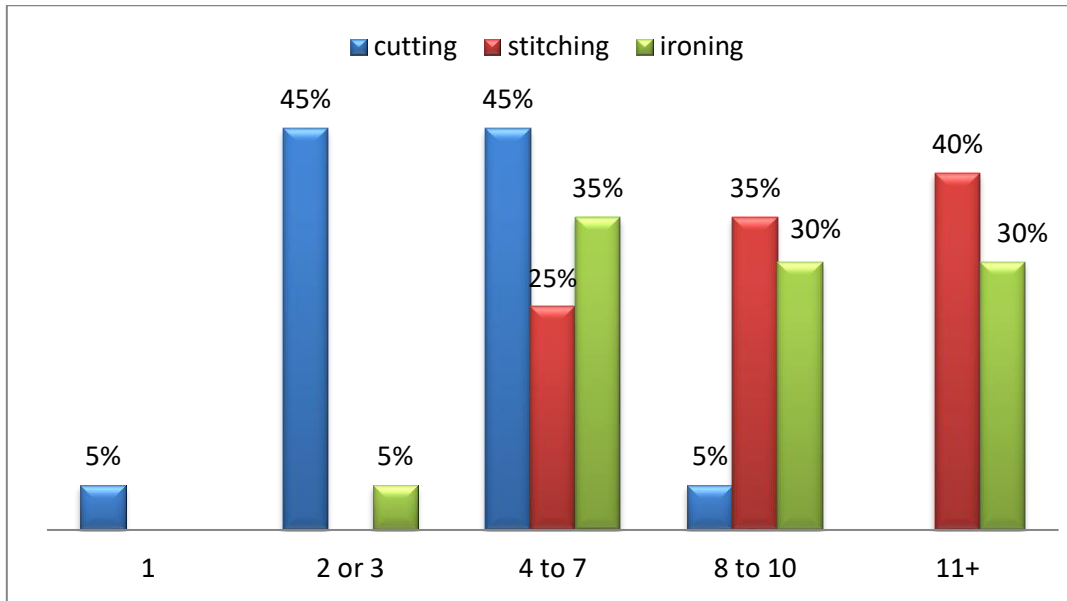
The RULA scores reveal significant insights into the ergonomic aspects of the activities. During cutting, 40% of the respondents garnered scores in the range of 3 or 4, and 5 or 6, signaling the need for prompt changes and further investigation. Only 15% of respondents achieved scores within the safe zone (Figure-1). In stitching, the majority (55%) received scores in the range of 5 or 6, while 30% scored 7 or more, indicating a high-risk scenario (Figure-1). For ironing, a majority (65%) fell within the 5 or 6 score range, while 25% scored 7 or more. Notably, no respondents achieved scores within the safe zone during ironing activity (Figure-1). These findings highlight critical areas requiring attention and potential intervention to mitigate ergonomic risks associated with tailoring tasks.



**Figure 1 - RULA score in various activities**

### REBA scores Assessment

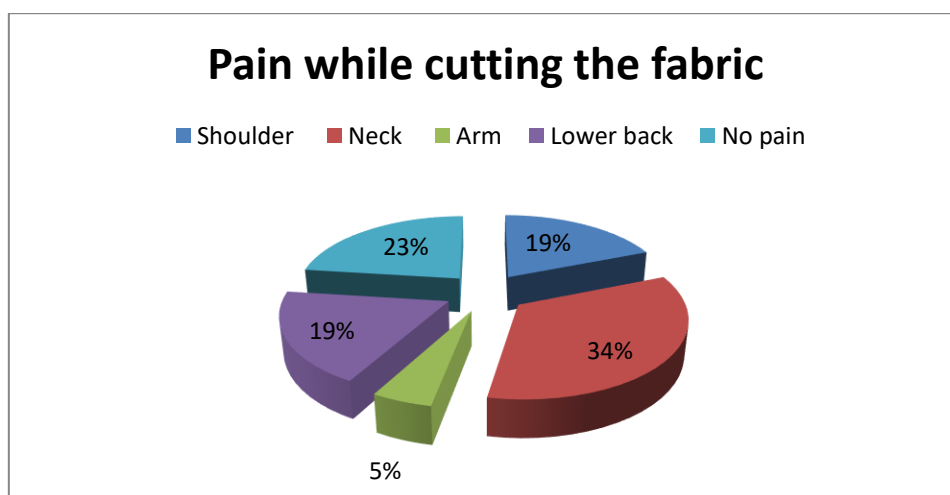
The REBA scores provide valuable insights into the ergonomic conditions during different activities. In the cutting activity, 45% of the respondents obtained scores in the range of 2 or 3 and 4 or 7, while 5% scored in the high-risk range of 8 to 10. For stitching, a significant majority (40%) received scores of 11 or more, indicating a very high risk, and about 35% fell within the 4 to 7 score range, signifying a medium risk (Figure 2). In ironing activity, 30% of the respondents scored 11 or more, indicating a very high risk, with none in the low-risk or safe zone (Figure 2). These findings underscore the critical need for interventions to address ergonomic concerns during cutting, stitching, and ironing activities among tailors.



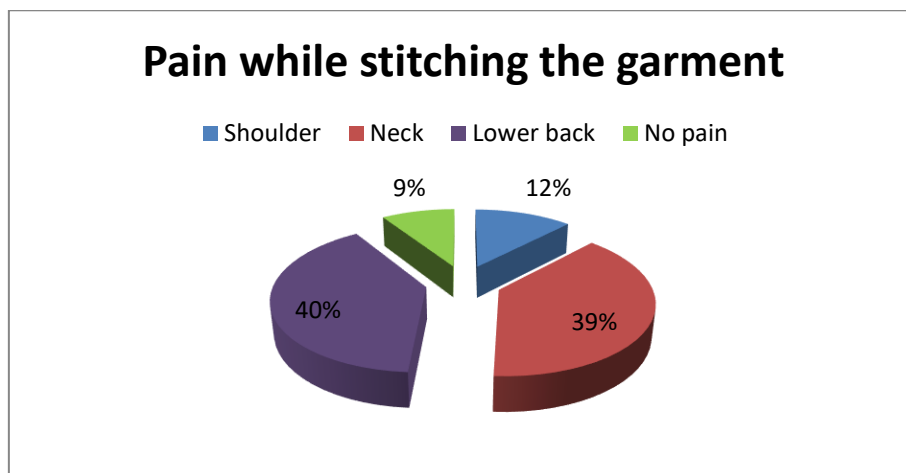
**Figure 2- REBA score in various activities**

### Assessment of Workstation Activities

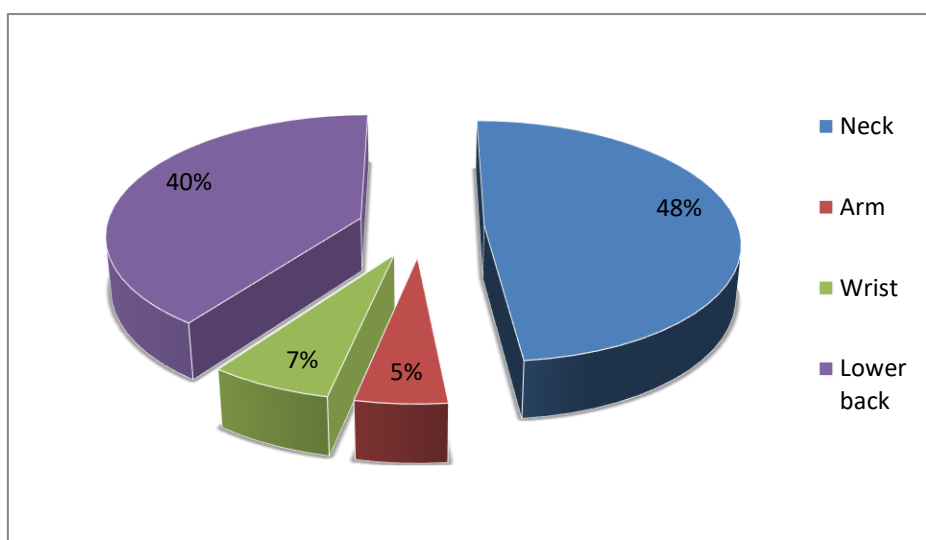
The extended periods of static workstation activities contribute to prolonged sitting, leading to musculoskeletal discomfort, particularly in the neck, shoulder, lower back, and upper back. A majority of respondents experienced pain in the neck and shoulder during cutting activities. Furthermore, participants reported the occurrence of significant lower back pain when engaging in stitching and ironing activities. This discomfort can be attributed to the cumulative effects of prolonged sitting and standing tasks, compounded by the overall stress from a full day of work. Addressing ergonomic concerns in these static activities is crucial to mitigate the musculoskeletal discomfort reported by tailors.



**Figure 3: Pain in different body parts while cutting the fabric**



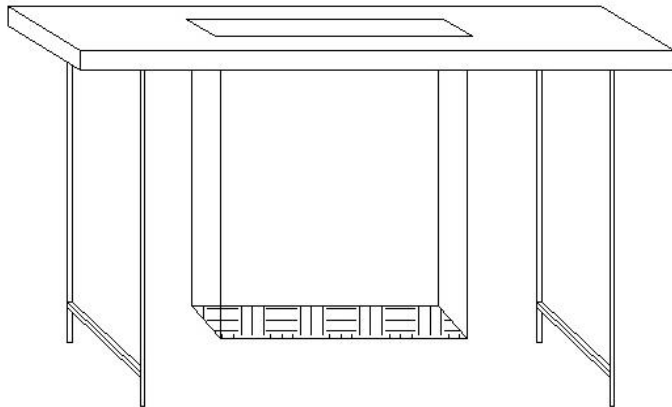
**Figure 4: Pain in different body parts while stitching the garment**



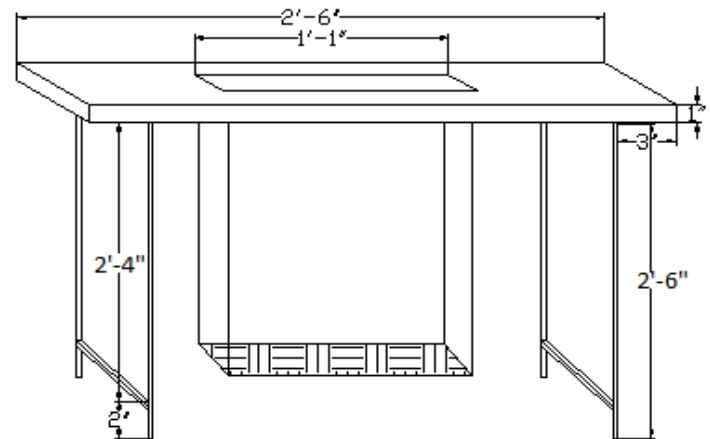
**Figure 5: Pain in different body parts while ironing the stitched garments**

The presented figures illustrate the pain experienced by tailors in various body parts during three significant activities: cutting fabric, stitching fabric, and ironing the stitched garment at their workstations. Tailors reported a heightened frequency of pain, particularly when engaged in work with a moderate intensity level. A noteworthy observation is that some respondents encountered difficulties in comfortably reaching their workstations to perform various tailoring activities. This underscores the importance of addressing ergonomic challenges to enhance the overall well-being and comfort of tailors during their work.

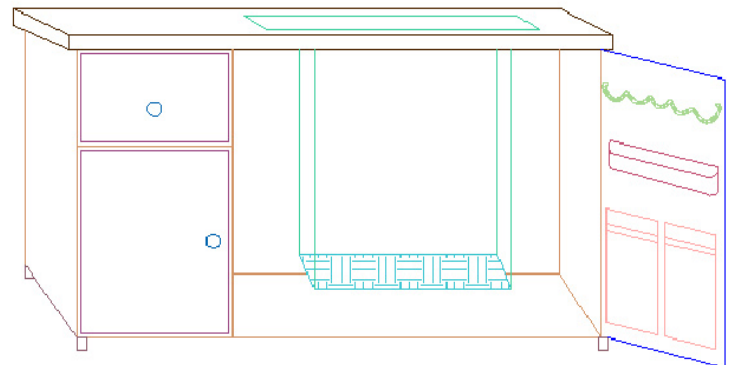
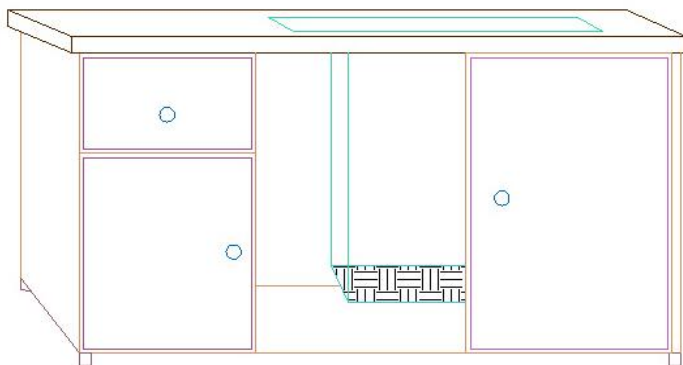
The design of the workstation was done by taking the problems into considerations that were encountered during the survey. Workstation was designed through Auto CAD, so that tailors can safely and comfortably achieve their goal -to correct their body posture and reduces MSDs caused due to faulty posture.



**Existing workstation design**



**Measurement of existing workstation**



**Design of proposed workstation**

### **Conclusion**

Tailors, engaged in manual work involving repetitive tasks like fabric cutting, stitching, finishing, and ironing, often find themselves adopting awkward postures throughout the continuous garment preparation process at their workstations. The assessment using the RULA and REBA scales revealed that none of the respondents maintained an acceptable posture for sustained periods. A majority of respondents demonstrated postures deemed unacceptable, warranting further investigation and immediate intervention to prevent the onset of musculoskeletal disorders. The identified risks associated with these adverse conditions highlight the potential impact on the health of tailors. Consequently, an

ergonomically optimized workstation was devised, incorporating recommended features to facilitate a smoother workflow for tailors and mitigate the risks posed by improper postures.

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