Research Article

Enhancing Ergonomics Practices Using Plan, Do, Check, Act cycle in Clinical Laboratories

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Article Info

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Abstract

Background: Musculoskeletal injuries may be directly caused by workplace practices such as poor posture, high frequency static muscle work, repetitive motion and forced exertion. Healthcare professionals are more likely to be exposed to common risk factors related to the nature of their work requiring repetitive tasks, insufficient breaks and long stressful working hours. They are predisposed to musculoskeletal injuries.

Methods: The plan, do, check, act cycle (PDCA) was conducted at the Aga Khan University Hospital, Karachi. The team was assigned with the roles and responsibilities of disseminating accurate information and supervision of relevant ergonomic activities. The goals were enacted upon using videos, songs, and posters as a means of raising awareness of ergonomic practices. Pre and post activity assessment related to knowledge and practice of ergonomics were evaluated.

Results: After conducting micro-lectures and sharing informative videos, flyers and recordings of all micro-lectures via a WhatsApp group, awareness about posture-related musculoskeletal disorders increased from 85% (n=35) pre-audit to 100% post-audit. Knowledge of the 20-20-20 rule was initially 49% (n=33) before the audit and reached 100% (n=41) after awareness and training. Understanding of exercises to strengthen the back, shoulders, and hands improved from 80% (n=33) pre-audit to 100% post-audit. Following these awareness activities, which included multimedia photos and videos, 88% of participants adopted ergonomic practices, up from the previous 34%.

Conclusion: The implementation of a structured training program using the PDCA cycle will significantly enhance ergonomic practices. By integrating multimedia tools such as videos, and posters, a single training intervention led to a marked improvement in participants' ergonomic practices. To sustain and further enhance this progress, ongoing education at regular intervals is essential, as it is likely to continue improving ergonomic knowledge and practices, thereby reducing the incidence of musculoskeletal disorders.

Introduction

Risk management in a clinical laboratory evolves over time as all hazards need to be identified, evaluated, and controlled to minimize risk to each group involved in laboratory operation. More apparent hazards that have been thoroughly studied in clinical laboratories include chemical hazards, biological hazards, toxins etc. while others may be more subtle to notice [1]. Health hazards besides biological hazards, fire hazards, toxins and chemicals in laboratories staff are physical hazards which are direct contributors to musculoskeletal injuries such as poor posture, high frequency static muscle work, repetitive motion and forced exertion imploring a need-based evaluation of each clinical laboratory every term [2].

Musculoskeletal disorders (MSDs) were reported by The Global Burden Disease Study as the second most common cause for disability with a 42.9% increase in the first decade of 2000's [3]. These can be identified from poor work-related ergonomic practices and lack of awareness about them [4]. Lower back pain followed by upper back pain and wrist/hand pain are the most common disorders identified in a cross-sectional study on the magnitude of work-related musculoskeletal disorders and ergonomic risk practices among medical laboratories. [5,6]. The nature of certain tasks such as microscopy may cause more hazard than others indicating stronger need for ergonomic evaluation and prevention [7]. High prevalence of MSDs up to 88% exist in certain workplaces where standing jobs are correlated with significant neck and upper back pain while sitting jobs seem to play a protective role for lower back pain.

A survey to estimate the prevalence of MSDs among healthcare professionals in India identified 73% (95%CI: 67.9-78.1) of participants with MSD in the last 12 months of conducting the survey. This includes a significantly high number of healthcare professionals as compared to the general population with obese females having even higher rates. Overall repeated tasks, >48 hours per week of work, insufficient work breaks and working in the same position for longer hours were the highest risk factors [8]. These risk factors define the nature of work. All healthcare employees, especially those in laboratory medicine, are exposed to raising concerns for the lack of mandatory ergonomics training [9]. The repetitive motions, awkward postures, and lifting of heavy objects commonly found in laboratory work can result in chronic pain, discomfort, and even long-term disabilities.

Many regulatory bodies, such as the Occupational Safety and Health Administration (OSHA) in the United States, have established guidelines and regulations concerning workplace ergonomics. Compliance with these regulations is not only a legal requirement but also essential for maintaining the integrity of laboratory operations [10,11,12].

Bone & Mineral diseases research group (https://www.aku.edu/mcpk/research/Pages/bone-mineral-diseases.aspx) at Aga Khan University is committed to improve bone health in Pakistan to attain SDG Goal 3, for promoting and ensuring good health and well-being for all ages in musculoskeletal health.

Ergonomics audits serve as a proactive measure for continuous improvement within the laboratory. By regularly assessing the ergonomic environment, laboratories can identify emerging risks and implement preventive measures promptly. As technologies and workflows evolve, ongoing audits ensure that ergonomic considerations remain integrated into the fabric of laboratory operations, adapting to changing needs and requirements over time. Locally applied methods including checklists, questionnaires and repertory grids have been shown to help understand the effects of ergonomics training within workplaces [13]. A clinical audit was conducted to assess current knowledge of ergonomics and improve ergonomic practices among the laboratory personnel through multimedia approach where educational material was shared after the pre assessment including videos, songs and posters. Assessment of understanding was also evaluated to see if multimedia approach was beneficial overall without the previously studied use of a professional trainer in most settings.

Methods

A Clinical Audit was conducted at the Section of Chemical Pathology, Aga Khan University Hospital Clinical Laboratories, Karachi Pakistan, between October- December based on plan, do, check, act (PDCA) cycle [14]. The audit was focused on assessing ergonomic practices for medical laboratory technologists. Objectives were focused on workstation posture, pipette techniques, accurate use of equipment without strain, and sufficient breaks between repetitive procedures. A team was assigned with roles and responsibilities including planning & supervision of relevant ergonomic activities. The team included medical technologists (quality and safety coordinators), and pathologists.

A questionnaire was designed for pre, and post activity assessment related to knowledge and practice of ergonomics with only binary responses. Knowledge and application of ergonomics and MSDs was assessed. Specific questions were about micro breaks during computer work, knowledge of exercises to strengthen back, shoulders or hands, sufficient temperature control at workplace and the 20-20-20 rule [15].

After pre audit eight micro lectures were conducted weekly, each no longer than 5 to 10 minutes, placed in the regular workday. This ensured that attendees would be encouraged to attend these attentively. Physical corrective exercises were instructed and recorded. Recordings were made available to anyone on leave during the workday. Relevant physical activities explored in the lectures included appropriate posture while using computer and/or telephone, exercises of shoulders, legs, neck, and arm in between working, and correct posture when using micro-pipettes. By effectively incorporating multimedia into the teaching process the audit team was able to create a more engaging, effective learning environment.

An e-poster competition was organized to elicit effective understanding and active participation of attendees. Evaluation of the program with a post assessment test was taken on the same binary and Likert Scale. Data was analyzed on SPSS and extracted on MS excel sheet. To increase interactive learning participants had an e-poster competition at the end with the best poster.

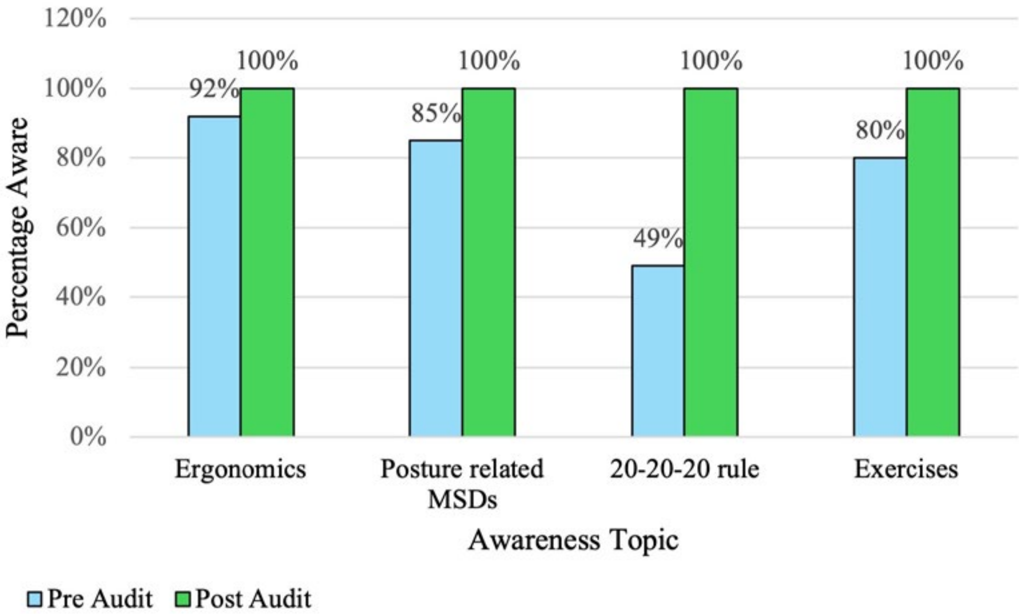
Results

The participants (n=41) included faculty pathologists (n=4), technologists (n=36), associate technologist (n=1). The mean age of the participants was 35 ± 5.93 years.

Awareness about ergonomics pre audit was 92% (n=38) and post audit 100%. Awareness about posture related MSDs was 85% (n=35) pre audit and 100% post audit. Knowledge of the 20-20-20 rule was only 49% (n=33) preaudit and 100% (n=41) post audit. Knowledge of exercises to strengthen back, shoulder and hands increased from 80% (n=33) pre audit to 100%. After creating awareness through multimedia photos and videos, 88% followed ergonomics practice which was previously only 34% people, 88% were following the 20-20-20 rule which pre audit only 49% followed, 83% people were taking micro breaks. 73% were doing back, shoulder and hand exercises from a pre audit 54% and, 90% thought the workplace was adequate. Pre audit 36% of people had poor posture with was reduced post intervention to 29%. Not many technologists were exercising to strengthen their back (43%), shoulder (73%) or hand (54%) (Figure 1 A and Figure 1 B).

Figure 1: Comparison of Pre vs Post Audit Findings Amongst Laboratory Personnel in Awareness & Practice (n=41).

1A: Pre vs Post Audit Findings in Awareness



1B: Pre vs Post Audit Findings in Practice

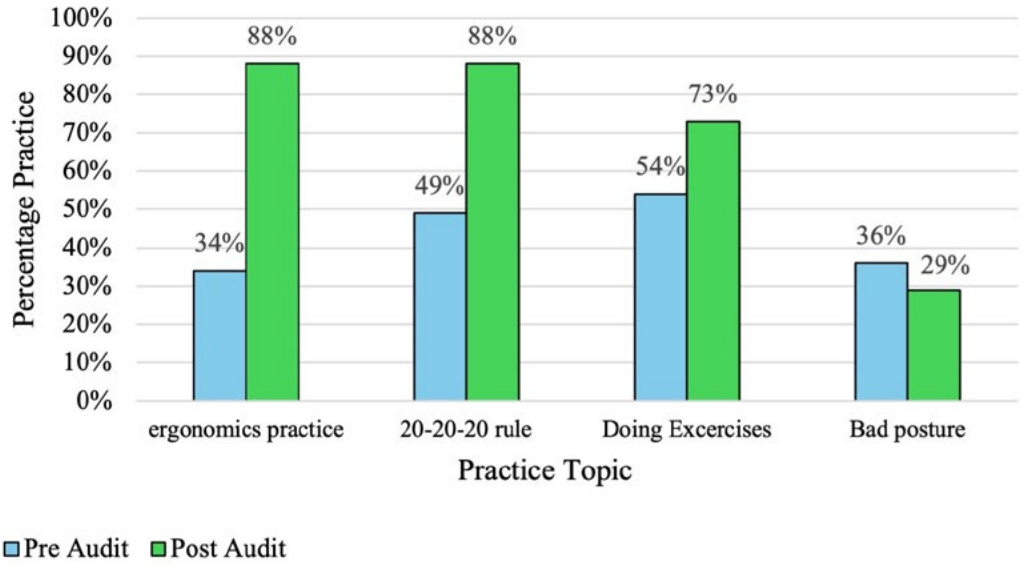


Table 1 shows the findings of the feedback provided by the participants. Eighty per cent reported gaining good information and learning. Ninety-eight per cent recommended conducting similar activities in future. Majority participants 'understood' ergonomics and principles taught with 41% 'well understood' meaning and principles or ergonomics, 27% 'well understood' common injuries, only 24% 'well understood' proper vs improper practices and, 24% 'well understood' injury causing areas and postures.

Table 1: Post Audit Feedback Survey Findings from Participants on Ergonomics Awareness and Practices.

	Very little understood	Little understood	Understood	Well understood
The meaning & implications of ergonomics	0 (0%)	4 (10%)	20 (49%)	17 (41%)
Common injuries cause by improper ergonomics	2 (5%)	5 (12%)	23 (56%)	11 (27%)
Proper ergonomics vs improper ergonomics	1 (2%)	8 (19%)	22 (54%)	10 (24%)
Common area / postures that can cause injuries	1 (2%)	6 (15%)	24 (58%)	10 (24%)
	Poor	**Fair**	**Good**	**Excellent**
How would you rate your current knowledge and use of proper ergonomics practices?	0	6 (15%)	33 (80%)	2 (5%)
Rate the facilitator / micro-lecture presenter?	0	1 (2%)	31 (76%)	9 (22%)
How much information did you learn during this project activity?	0	4 (10%)	33 (80%)	4 (10%)

Discussion

Our study in a group with highly educated workers from a background of allied medicine demonstrated sufficient knowledge of ergonomics practices such as correct posture and muscular excercises at baseline. Awareness sessions further improved overall compliance. Ergonomics when applied at the workplace are proven to improve quality of work life and decrease compensation costs up to 80%. Ergonomic knowledge and implementation can prove to be useful not only for the workforce but also to the employer as workforce efficiency increases [16]. Prioritizing ergonomics helps achieve up to 90% improvement overall and mitigating risks, thus ensuring the health and safety of laboratory personnel. Scheduled breaks with better strategies, for instance the 20-20-20 rule for prolonged screen time exposure show short term improvement in dry eye symptoms [17,18]. Awareness on the topic was perceived positively almost doubling the use of the 20-20-20 technique in our research population. Our findings are consistent with prior data that individuals with ergonomics training have significantly lower pain scores [19].

Electromyography based assessment demonstrated that the type of exercise adopted does not make a significant difference. Easier to follow low intensity desk stretches or strength building can be as impactful as high intensity workouts or training [20]. Consistency in ergonomic practices tends to make a bigger difference overall. Cyclic training programs rather than costly time consuming externally sourced sessions need to be compared in trials. Professional training should be compared to the novice idea of utilizing videos, pictures and posters similar to the multimedia approach opted at our institute [21]. Ergonomics training is more effective for groups that may have some or no idea about ergonomics like trainee medical technologists. Perception of risk and hazards is better in older employees which may be a consequence of developing more MSDs than younger employees. Including ergonomics concepts earlier in the training programs of medical technologists is expected to improve perception of workplace risks in all employees [22]. Our data showed up to 100% of participants recommend ergonomic awareness activities to be carried out at the workplace despite starting at a higher baseline.

The limitation of our study is the small sample size in a private care facility with better environmental control compared to public or government set ups where resource limitation and high patient burden can significantly impair any chance of scheduled breaks or improved practices. Trials may be needed to demonstrate both short- and long-term effectiveness of using multimedia and short lectures instead of professional support for ergonomics eventually. In the future it may be important to monitor and evaluate the effectiveness of implemented interventions through follow-up assessments, employee feedback, and incident reporting. Institutes should continuously review and update the ergonomics program based on new information, changes in technology, and evolving organizational needs. Efforts should be directed to establish mechanisms for ongoing communication and feedback between laboratory management, safety personnel, and frontline staff to sustain a culture of ergonomic awareness and continuous improvement.

Conclusion

Laboratory personnel have a good understanding of the importance of ergonomics and relevant practices, however a significant increase in knowledge and daily practices occurs with awareness about exact techniques. Some principles such as the 20-20-20 rule and incorrect posture may be less valued than exercises. Reinforcement is a good way to reintroduce them into daily practice. A single training exercise can improve ergonomic practices by 100%. Continuous education at specified intervals is expected to improve ergonomics knowledge and practices across the board and decrease musculoskeletal disorders. Implementing the identified ergonomic improvements according to the action plan in the medical technologist training program and making it part of continuous education program, ensuring clear communication, training, and support for affected personnel may be a game changer in the overall dynamics. Investigating professional vs multimedia approach towards ergonomics training may pave the way for future training.

Disclosure

The author(s) declare that (s)he has no relevant or material financial interests that relate to the research described in this paper.

Ethical Approval

Our study involved human subjects and is following the ethical principles for medical research involving human subjects, in accordance with the Declaration of Helsinki.

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