

Human Factor and Ergonomics- The Need of the Hour in Healthcare Sector of India

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Abstract: Global changes in economic landscape over the last decade has led to significant shift in the types of work varying across the regions of the world, whether economically advanced nations or economically developing nations. There is a continuing trend of mechanization and automation of work systems, not only in manufacturing but also in the service industry. Looking forward in today's scenario, not only ergonomics but a rigorous approach of proactive ergonomics is needed. A systematic search of the literature published on Human Factor and Ergonomics (HFE) in Healthcare Sector was performed meticulously up to April 2023 using electronic databases such as PubMed and Google Scholar. Ergonomics is concerned with achieving the perfect alignment between the user, instruments, and surroundings by considering the user's abilities and limitations and creating a conducive environment. This can be achieved by designing technology that suits the body's needs. The primary goal of ergonomics is to improve productivity, minimize human error, and enhance safety and comfort in the workplace, focusing on the relationship between humans and their working environments. With advances in ergonomic tools and research, it is easier to save money, increase efficiency, reduce absenteeism, and limit workers' compensation claims. Better policies and their implementation are necessary for companies to prioritize employee health. HFE can help to improve quality of care, clinical efficiency, timely access, reducing cost of care and enhance the satisfaction of patients and clinicians. It also helps manufacturers of healthcare equipment and technology to integrate user-centered design processes.

Key Words: Ergonomics, Health Care System, Human factors, Work Place, Quality of care, Human factor and

Introduction

The HealthCare system is a crucial element in maintaining our well-being by utilizing different resources at various levels. Each country or state has its own distinct health care delivery system that involves various components, including caregivers and beneficiaries, working together towards a common goal. The system is interdependent, and each agent plays a critical role in ensuring that everyone benefits from it. For instance, outpatient settings, critical care units, laboratories, and emergency departments are all linked, creating an integrated system for better compliance.

The health care system is adaptive since it comprises individuals who can learn and adapt due to changes resulting from new advances. However, unpredictability and constant changes in the system result in significant variation in the delivery of health care services. Change in external

Magnitude of subsystems that govern different types of health services for different populations.¹ In order to prevent these changes from disrupt the existing milieu, which occurs due to overwhelming changes in the industry, the system has to cope up and bridge the gaps that arise thereof. Global changes in economic landscape over the last decade has led to significant shift in the types of work varying across the regions of the world, whether economically advanced nations or economically developing nations. There is a continuing trend of mechanization and automation of work systems; not only in manufacturing but also in the service industry.² Looking forward in today's scenario, not only ergonomics but a rigorous approach of proactive ergonomics is needed. Ergonomics should be included in the designing phase itself.

Components of Healthcare System:

- a. Health care providers, which includes hospital, its structure and governing body. Ambulatory Care Providers, Pharmacy providers and suppliers
- b. Health care workforce, which include physicians, nursing staff, other professional component of healthcare workforce, dentist, psychologist, pharmacist, therapist, nutritionist and audiologist.
- c. Health care purchasers which include private and government health insurance, and third- party insurance.

The behaviour of these stakeholders' changes in response to changes in their external environment, such as recent developments in the medical field, shifts in the political and economic climate, modifications in social and cultural norms, as well as changes in population health and disease processes.

Ergonomics- What does it mean?

International Ergonomics Association's has defined human factors or ergonomics as 'the scientific discipline concerned with the understanding of interactions among humans 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.³ Ergonomics is the practice of designing equipment and work tasks to adapt to the capability of the worker, it provides a means for adjusting the work environment and work practices to prevent injuries before they occur.

Human Factors and Ergonomics (HFE):

Human are central element in all engineering design. Due to the demand placed on them by system, any consequences of overload which affect their performance should be acknowledged. Engineers may not be trained to understand the consequences of their design choices in terms of human factor may result in faulty design and problem is aggravated if the work is relegated work to those, who are unaware of the working environment.⁴ Faulty design may not be led to decreased productivity; it can lead to non-

acceptance of resulting in wastage of resources, time and money.

Applying Ergonomics in the Healthcare Sector:

Looking forward in today's scenario, not only ergonomics but a rigorous approach of proactive ergonomics is needed. Ergonomics should be included in the designing phase itself. Planning ahead on risk assessment and ergonomic analysis can definitely focus on the less studied problem.⁵ The unexplored potential of the workforce can be utilized which can pay high dividends in term of performance levels and job satisfaction. Satisfaction with the work system can increase productivity, improve safety and quality of work definitely improves. Resource's constraint must not be a factor affecting the performance and putting a lot of pressure on the healthcare professionals. To add to these physical discomforts at workplace can be stressful. Reducing fatigue, stress increases the effectiveness and improves all dimension of health of patient and health providers with quality enhancement. If the task, function and atmosphere are designed taking care of user capability and limitation, it can lead to optimum allocation of resources and desired output without compromising the health.⁶ In health care, human factors knowledge can help in designing the processes that are a better fit for doctors and nurses. Human factors analysis can guide in safe prescribing practices, good communication in teams and better hand over information to other health-care professionals. This basic task has become quite complicated with increasing complexity of health-care services and systems. It is believed that more focused approach by health-care providers and how they interact with environment can reduce the mistakes. The human factor system should be created in a manner that supports individuals in their work, rather than placing blame on them for errors that can lead to frustration and low morale. A systematic approach is adopted to develop systems that minimize potential risks and prevent future errors. This approach can be applied to a single product, such as a medical device, or to the entire care delivery process or organizational structure, including leadership and supply-chain management. Human factor engineering involves studying all the factors that impact system performance, including the physical environment, tasks, tools and technologies, and organizational conditions.⁷

After analyzing these factors, systems are redesigned to improve patient safety and team performance. Safety can be incorporated into the production process through job design, equipment selection and use, operational procedures, work schedules, and other factors. Technology can also be used to shift workloads and enhance performance. Apart from designing, major challenges are the market readiness and to accept it and in the supply of high-quality applications. HFE can help to improve quality of care, clinical efficiency, timely access, reducing cost of care and enhance the satisfaction of patients and clinicians.^{8,9} It also helps manufacturers of healthcare equipment and technology (e.g., design of health information technology) to integrate user-centered design processes.^{8,10} HFE takes into account the physiological, psychological, affective, cognitive aspect along with physical, social, cultural environment.¹¹ It addresses issues on individual /local (e.g., humans using tools or performing tasks, humans as part of technical processes or organizations) to community/national/international level (e.g., humans as part of networks of organizations, regions, countries).¹² Studies done have reported that work style is associated with pain and decreased productivity.^{13,14}

The healthcare sector at home has limitation in a way that it is cumbersome to set ergonomic workstation, travelling, shortage of staff. Continued focus on worker and patient safety, including prioritizing adequate time to complete physically demanding tasks over productivity, is critical, especially in the home setting.¹⁵ To disseminate knowledge globally apart from deep lecture practical solutions like a 10-minute program that are cost effective also can be practiced to build the skill of corporate global employee so that maximum potential of the sector can be tapped, using advance computation technology in this complex field.¹⁶ Support from peers and communication are the ideal tool for initiating, implementing and maintaining the principles of ergonomics.¹⁷ Mostly the riskier occupation is of construction worker, driver, agriculture and healthcare worker.^{18,19} In healthcare, those most often work-related musculoskeletal disorder occur in surgeons, nurses, therapists, and dentists in which sex predilection is there with most of injury in females. The need for relevant data to support this is lacking in our field data and with majority of

women work force entering in system it becomes a major concern. Also, the economic burden of WMSD should be taken in account rather than seeing this as a health issue. Research on causal factors that can lead to human error in healthcare have been studied and it is found that multifaceted approach is best in health care that involves, workplace, equipment, training and the most important in this regard is the safe patient handling and mobilization program, arranging workstation to meet the needs, for easy transfer between the different station, staff that are a good fit to job, to avoid burn out and also pandemic has taught lesson that SPHM team can also assist in station where multiple individual are transferred without injury.^{17,20,21}

Modern World Implementation of HFE and Scope for further development:

Taking in account the complexity of healthcare systems and processes, need to promote HFE systems approaches was proposed by Waterson, Vincent, Gopher, Bogner, Carayon, and Karsh.^{22,23,24,25,26,27} An example of an HFE systems approach is the SEIPS (Systems Engineering Initiative for Patient safety) model that builds on the macro ergonomic work system model of Smith and Carayon^{28, 29,30} and integrates the well-known Structure-Process-Outcome model of healthcare quality.³¹ Health Management Information System is important backbone for reporting in health care system but no reporting is done regarding ergonomics from individual or organizations. Report from individuals provides valuable feedback directly from frontline workers. While reports from organizations shows its commitment for corrective changes. Reporting from health care since past is mainly medication related errors, but it should be comprehensive covering other part also. Organization can improve their performance by comparing analysis from past and also with other organization. Effort to understand pattern of errors and new approach to prevention can be sought out. Best practices should be identified and implemented within existing infrastructure if feasible. After the improvements marketing strategies can be planned accordingly by collaborating with decision makers. A comprehensive vision for the integration of HF/E into healthcare is provided by the Model for the Integration of Ergonomics in Healthcare Systems (MIEHS) for coverage, robustness, integrity, and resilience at the micro, meso and macro level.³²

Currently, the primary means of establishing standards for healthcare and professionals is through the licensing and accreditation process. While patient safety and errors may not be the explicit focus of this process, there is a responsibility to create and maintain a safe environment. Entities such as the Quality Council of India (QCI) and its National Accreditation Board for Hospitals and Healthcare (NABH) have developed comprehensive healthcare standards for hospitals and healthcare providers, with the goal of optimizing the operations of healthcare organizations. Furthermore, organizations like the International Ergonomics Association (IEA) and Human Factors Transforming Healthcare (HFTH) have the potential to effectively utilize human factors principles to enhance patient care and provider performance.

Newer advances like Radio Frequency Identification (RFID) have successfully been applied in several industries such as manufacturing, retail and logistics for tracking and data-collection. This has several opportunities for increased safety, operational efficiency and cost savings, by tagging inventory, assets, patients and personnel. There is need to embrace more automated methods in the health care system.

Application of HFE in the course of the COVID-19 Pandemic:

a) Touchless procedures: To prevent the spread of infections, healthcare facilities are adopting touchless check-in methods, using kiosks and displays that do not require physical contact. These touchless methods have become a necessity to reduce exposure and comply with hygiene protocols.

b) Reduced waiting times: To minimize exposure and reduce waiting time, patients are being encouraged to book appointments online and check-in in advance. This has resulted in fewer crowds in waiting rooms, thus reducing exposure to both patients and healthcare staff.

c) Telemedicine: Telemedicine is being used extensively to provide access to primary and specialty care while preventing the spread of diseases. The use of telemedicine is being encouraged to improve the efficiency and reach of healthcare staffs, and the national digital health mission may provide further impetus to this trend.

d) Upgraded facilities: Negative pressure rooms are being built in hospitals to isolate patients with

infectious conditions and prevent the spread of diseases. However, such rooms require foresightedness and significant investments, as many hospitals are not equipped to handle high volumes of patients requiring these rooms.

e) Upgraded intensive care: In response to the COVID-19 pandemic, healthcare facilities have upgraded their intensive care units to comply with pandemic protocols. Healthcare design has changed to include considerations for social distancing and storage of personal protective equipment (PPE) supplies around patients' rooms.

Ergonomics and Artificial intelligence: HFE interventions must look into outcomes for healthcare provider rather than merely patient safety and an economic analysis should be done.³³ With the introduction of AI (Artificial intelligence) in the health care sector, we have to imbibe deep the thought that AI is a member in the team apart from professional and patient, rather than seeing this as a separate thing. It is to be considered at the time of designing and implementation, as it is at par with human expertise and must be considered as a valuable member.³⁴ There are some challenges also that it may impact the performance of teams, it may take over task where human touch is absent and patient may not find it welcoming, so keeping in mind those we can maximize its utility.³⁵ From the system perspective it is not only work, but in health care the psychological needs are also to be taken care of. Health care organisation have begun to employ clinically embedded HFE professional to work with health care professionals so that they sustain a system-based intervention.³⁶ Rather than seeing AI as a technology-based tool its utility is when it is seen from a system perspective It is time to move beyond this technology-centric view, and considering it as a team from the outset so that it is incorporated in the much wider health care system.

The Downside to HFE and ways to overcome the challenges: Irony is newer technology though a welcome, can introduce new errors; thus, the health system should anticipate the trouble and continuous redesigning and introspection. Use of predictive modelling to anticipate demand and lead to optimum allocation of resources. These predictions can lead to smoothing of workflow. Need of the hour is to organize health care to predict and anticipate the needs based on local conditions, knowledge of the natural history of illness and patient needs. These problems can deal with by adopting appropriate strategies.

Continuous Monitoring: While designing any equipment or application careful selection of the technology that are in accordance to the ergonomics and are usable can be ensured. Monitoring and Evaluation of the whole process can generate report that may be useful for the manufacturers and vendors of healthcare technologies. Timely sharing of information result in the usability of technologies they purchase. E.g., faulty design if used can lead to increase error and people may be ready to disuse them and rectify those. Continuous monitoring helps in identify potential problems and work-arounds. End or process evaluation can lead to escape from the faulty design and corrections.

Evidence driven health care delivery (EBD): The use of evidence-based principles can ensure safe and efficient healthcare outcomes. Electronic processes for tasks such as patient registration, medication ordering, information handovers, patient transfers, and medication charting can help reduce errors caused by human memory. To achieve timely and transparent delivery of healthcare, identifying and addressing the components of a problem is necessary. Making tasks easier for healthcare practitioners can lead to improved satisfaction and patient safety. The focus of evidence-based design is on patient-related outcomes as well as staff factors such as convenience, ease, satisfaction, worker safety, and productivity.

Team involvement, Capacity building and creating human resources for HFE specialist: Healthcare administrators must understand and incorporate HFE in current and future healthcare system. So that the working environment and system should be more proficient and precise.

Conclusion:

In the healthcare system, ergonomics plays a significant role in designing interactive medical devices, minimizing medication errors, enhancing patient safety, and managing co-morbidities. The system is complex and involves a team of doctors, nurses, and supporting staff who work together to provide effective patient-centred care. Regular evaluation of the system is necessary to identify violations, predict errors, and train individuals to follow safety rules and be goal-oriented.

Incorporating human factor and ergonomic engineering, new technologies, medical interventions, and therapies can help in designing a flawless and error-free system. The implementation and acceptance of HFE in the healthcare system can be challenging. However, integrating HFE principles and methods can lead to better understanding, capacity building, investment, and research in the field of patient and employer safety. Incorporating HFE courses, degree programs, and workshops can help build capacity among administrators and healthcare providers to understand HFE. Including HFE as a core competency in the graduate medical education regulation can also accelerate the growth in productivity and cost-effectiveness. Overall, the adoption of HFE in the healthcare system can lead to a safer and more efficient system, enhancing patient safety and satisfaction while also improving staff convenience, ease, and productivity.

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