

# **Ergonomics in Healthcare: A Literature Review**

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## **Abstract**

The goal of this study is to analyze the ergonomics literature in healthcare organisations in terms of major characteristics of existing publications, limitations, and future research opportunities. In two ways, it adds to the body of knowledge. To offer an overview of completed research initiatives, it separates the literature into seven categories: "year," "area," "study technique," "findings," "setting," "constraints," and "future research orientation." Second, it identifies a research gap in the current literature and proposes future study opportunities. According to the findings, previous research on the topic has struggled to provide a robust theoretical framework. More research will be required to validate the proposed ideas, concepts, and frameworks. As a result, the effects of ergonomics on caregivers or healthcare professionals have been extensively researched with small samples, leaving plenty of room for future research to validate and expand prior findings.

## **Keywords**

Ergonomics; Healthcare workers; Healthcare operations; Working conditions; Covid-19; Physical and Mental health; Literature Review

## **1. Introduction**

Over the last decade, ergonomics approaches have become more widely applied to healthcare delivery in a number of settings (Hignett et al. 2013). To reduce the risk of employee accident, ergonomic factors are crucial during the design phase (Stichler and Feiler 2011). Ergonomics have been recognized as important in healthcare since the profession's inception, but development and growth have been gradual. The first workshop on healthcare (hospital) ergonomics was held in Paris in 1991. In 1997, Francois Daniellou formed the "Technical Committee on Healthcare Ergonomics and Patient Safety (HETC9)." Since 2005, there have been frequent seminars on "healthcare and patient safety ergonomics", as well as symposia and presentations at "clinical -patient safety conferences" (Hignett et al. 2013). Ergonomics is the study of adapting or harmonizing workplace conditions and work requirements to the capabilities of the working population. A good "fit" in the workplace minimizes the incidence of disease and accident, increases production efficiency, improves quality of products or services, and increases employee engagement. Ergonomics discipline uses a variety of critical worker attributes and skills to build safe work environments (Waters 2010). HC delivery is a very dynamic work system that is always changing on many fronts, making it more difficult and, to be honest, convoluted. Internally and internationally, HC sends mixed messages, partly because it is continuously trying to figure out who it is and what it does (Perry et al. 2021). Ergonomics has had a remarkable increase in publications in the healthcare field over the last 50 years (Keebler et al. 2022). Despite this, healthcare employees are more likely than the majority of the workforce to develop an occupational "musculoskeletal disorder (MSD)" (Hedge et al. 2011). Healthcare systems are defined by the World Health Organization (WHO) as "any organisations, individuals, or actions whose primary goal is to promote, restore, or sustain health." It thus includes both measures to change health factors and much more supervise the activities to improve health" (WHO 2007; page 2). Employees are a critical component of healthcare systems; they are the gasoline that keeps the entire system running and thus enhances the importance of ergonomics in healthcare organisations.

This literature review discusses the ergonomics in healthcare organisations. This review addresses the following questions:

RQ1: How has the ergonomics on healthcare organisations been studied in terms of "year," "region," "research technique," "context," and "outcomes"?

RQ2: What are the limitations of the existing literature?

RQ3: What are the research directions for the ergonomics in healthcare organisations in the future?

The paper's format comprises a review of the literature and its limitations, methods, future research directions, results and discussion, and a conclusion.

## 2. Literature Review

Ergonomics are the rules of work that can improve the current work system and make it to perform at its optimum by changing specific characteristics of everybody's work. Ergonomics is concerned with the relationships between humans, objects, and processes and organisations. The use of ergonomics in the service industry ensures that services are appropriate for individuals, increases productivity, and enhances staff well-being, among other benefits (Miruthu Bashini and Suresh 2018). Today, a lack of ergonomics causes not only business disruptions, but also physical impairment and associated hazards for everyone. Ergonomics must be taught in both basic and advanced education. These are the requirements for purchasing appropriate equipment and instruments that are easy to use and safe to handle for the patient's benefit (Matern and Koneczny 2007). Hospitals are said to be distinct from all other industrial enterprises. According to Hignett (2003) Hospitals are a particularly difficult place to practice ergonomics in. This is partly related to the organisation culture (which contains numerous managerial and executive divisions), but it's also due to the core business. The synthesis of the literature and their respective limitations are shown in Table 1. The dimensions of the past literature are mapped in Figure 1.

Table 1. Synthesis of literature review and limitations

<i>Year</i>	<i>Reference</i>	<i>Database</i>	<i>Aim</i>	<i>Limitation</i>
2013	Hignett et al. (2013)	Taylor & Francis	This study gives a state-of-the-art commentary on HFE in healthcare, utilizing four case studies to examine and debate analytical and implementation obstacles, as well as identify future HFE issues.	NA
2010	Waters (2010)	Wiley Online Library	This article aims at providing a brief overview of ergonomics, emphasizing "what it is?", "How it can be used to help build safe work systems?", and "Why all health professionals and management should be aware of how high work demands might increase the risk of MSDs at work?".	NA
2007	Springer (2007)	HERO	Designed to introduce "ergonomic concepts and principles" to healthcare facility design and layout.	NA
2021	Perry et al. (2021)	Elsevier	This article examines some of the major roadblocks that have prevented HFE and its specialists from making substantial advances into the healthcare industry to the extent that they have in many other industries.	NA
2022	Keebler et al. (2022)	Sage Publication	This article looks at three "industry demands" that would have an impact on the Human Performance and Ergonomic Design in Healthcare's future.	NA
2011	Hedge et al. (2011)	Elsevier	The research aims at the current HIT usage patterns may raise the risk of work-related "musculoskeletal problems". It lists several of the most essential ergonomic design principles that are embedded in standards and solve concerns.	NA

2021	Kluwak et al. (2021)	Acta Polytech Hungarica	The study shows how a brief depiction can be difficult to use in analysing the patient transport scenario from the perspective of human transportation ergonomics.	The content has been drastically condensed due to the page constraint.
2021	Rodríguez and Hignett (2021)	Wiley Online Library	The aim was to offer a methodology for incorporating ergonomics and human factors into healthcare systems to improve their robustness and resilience.	The scope is restricted to the organisations level.
2012	Carayon (2012)	IOS Press content Library	This research aimed to focus on recent advances in “Human Factors and Ergonomics” investigation and implementation in the context of healthcare delivery.	NA
2015	Xie and Carayon (2015)	Taylor & Francis	This systematic review aimed to investigate at how “human factors and ergonomics (HFE)” utilized to contribute to the improvement of health-care job structures and procedures.	The systematic review was limited to "peer-reviewed journal papers", it would not have included all human factor and ergonomics -based interventional research. The systematic review was also limited to articles written in English, relevant foreign research on human factor and ergonomics -based healthcare system redesign may have been missed.
2015	Hignett et al. (2015)	BMJ	The goal of this study is to find out how "quality improvement science (QIS)" and "human factors and ergonomics (HFE)" can work together to make healthcare safer.	NA
2012	Dekker (2012)	Elsevier	This study intended to develop a "signal detection paradigm" to explain how "power hierarchies and gender gaps" affect the responsiveness to information and decision rules of many medical officials.	NA
2011	Lawler et al. (2011)	Elsevier	This research focuses on a number of "cognitive ergonomics" and socio-technical system problems that determine the effective implementation of health informatics.	NA
2011	Feiler and Stichler (2011)	JONA	This paper focused on nursing station and support area ergonomic solutions that can help prevent worker injury.	NA

2012	Holden (2012)	Taylor & Francis	The purpose of this research was to look into the structural and individual normative social influence on technological use and competence.	Considering personal and social conformity is highest whenever its participants are conscious of it.
2011	Stichler and Feiler (2011)	JONA	The study's goal is to enhance nurse - patient safety by focusing on "ergonomic designs" for patient care areas.	NA
2018	Vosper et al. (2018)	Taylor & Francis	The purpose is to improve the efficiency of frontline healthcare workers' safety and improvement efforts.	NA
2006	Janowitz et al. (2006)	Elsevier	The overarching purpose of this case study is to record the creation and validation of an integrated approach to occupational exposure assessment for a variety of healthcare staff.	NA
2003	Hignett (2003)	Taylor & Francis	The purpose was to discover the organisational and cultural features of the healthcare industry, as well as how these can affect ergonomics practice.	NA
2007	Matern and Koneczny (2007)	Springer	The purpose of this study was to address a knowledge gap about working conditions in operating rooms.	NA
2018	Miruthu Bashini and Suresh (2018)	Research Gate	The main purpose of this study is to see how different ergonomics aspects affect caregiver effectiveness in hospitals.	NA
2015	Hignett (2015)	Sage Publication	The purpose was to compare patient therapy to professional slides, excursions, and fall risk management utilising a quantitative framework for Human Performance & Ergonomics.	NA
2017	Valdez et al. (2017)	Elsevier	The purpose was to acquire a deeper knowledge of the current state of qualitative "Ergonomics/Human Factors (E/HF)" research in healthcare system and to draw recommendations for the future study.	The evaluation was limited within the selected articles, and the assessment of nine categories.
2004	Hignett and Wilson. (2004)	Taylor & Francis	The paper's main goal was to investigate the application of qualitative technique in ergonomics research and practise.	Despite the fact that all of the interviewees' perspectives were taken into account, the study may not have attained saturation in terms of the use of qualitative technique in ergonomics.

2014	Fross (2014, June)	Springer	The purpose of this study is to show a range of instances of ergonomic concepts in design.	NA
2014	Karsh (2014)	Elsevier	This presentation will build on and discuss the need for "mesoergonomics," as well as propose a framework for structuring a range of concerns for additional investigation and stimulating greater theoretically and empirically exploration.	NA
2001	Hignett (2001)	Research Gate	The goal of the study was to lay out a clear procedure for applying qualitative research methodology in ergonomics by adopting a "middle ground approach" to the background philosophy and using qualitative methodology to identify features of hospitals in terms of ergonomics practice.	NA
2007	Stucke and Menzel (2007)	Elsevier	The aimed to conduct an ergonomic assessment and evaluate the applicability of "Ergonomic Workplace Assessment Protocol" for "Patient Care Ergonomics Resource Guide", to critical care settings due to a lack of understanding regarding risks identified involved in providing intensive care.	Because the data came from a single CCU in a single hospital during a single shift in a single city, the findings had limited generalizability.
2004	Tarcan (2004)	Emerald	The goal of this research was to discuss about how to improve indoor environmental conditions and health standards.	NA
2014	Lee et al. (2014)	Research Gate	The goal of this research is to explain a holistic ergonomic strategy that was used to solve the multifaceted issues that healthcare personnel face on a daily basis.	NA
2020	Weir et al. (2020)	Elsevier	The purpose of this research is to find and review papers that have looked at the "pharmacy dispensing process" through the lens of HFE.	The results were reported using the three study that were established to guide the reporting of the data. There may be transferrable borders, and each study topic may not exist independently.
2016	Azadeh et al. (2016)	Elsevier	The goal of this study is to present a holistic strategy for exploring the effects of "macro-ergonomics" components in supply chain using data envelopment analysis in healthcare	NA

2015	Davcev and Jakimovski (2015)	Elsevier	The purpose of this project was to incorporate ergonomic problems into the planned "NFC-based" healthcare system's architecture.	NA
2011	Garrett and Khasawneh (2011)	Elsevier	With an emphasis on HIT and medication management procedures and safety, the goal of this study was to provide a scientific survey of recent research activities on the effects of "human factors and ergonomics" on healthcare provision.	NA
2014	Norris et al. (2014)	Elsevier	The project's purpose was to show how multidisciplinary and "formal human factors approaches to healthcare design" may help patients stay safe.	NA
2022	Macdonald and Oakman (2022)	Elsevier	The goal was to evaluate the validity of multiple MSD risk assessment approaches for a variety of reasons, with a particular focus on needs for routine occupational managing risks.	NA
2022	Wooldridge et al. (2022)	Elsevier	The goal of this paper is to describe three cases presented at the "International Ergonomics Association's 21st Triennial Congress" to show how HFE was used during the COVID-19 pandemic.	NA
2021	Smith et al. (2021)	CHEST	This study aims to enhance the "service reset programme" of services in healthcare at the "Northern Health and Social Care Trust" during the Covid-19 crisis in Northern Ireland.	NA
2015	Carayon et al. (2015)	Elsevier	The purpose is to provide knowledge on using mixed research methods in "human factors and ergonomics" study in health care.	Systematic literature reviews were likely limited for studies published in prestigious publications.
2019	Hulme et al. (2019)	Elsevier	The purpose of this systematic review was to discover and evaluate studies that applied a "systems ergonomics research technique".	The studies in this review were all affiliated with the same research institute.

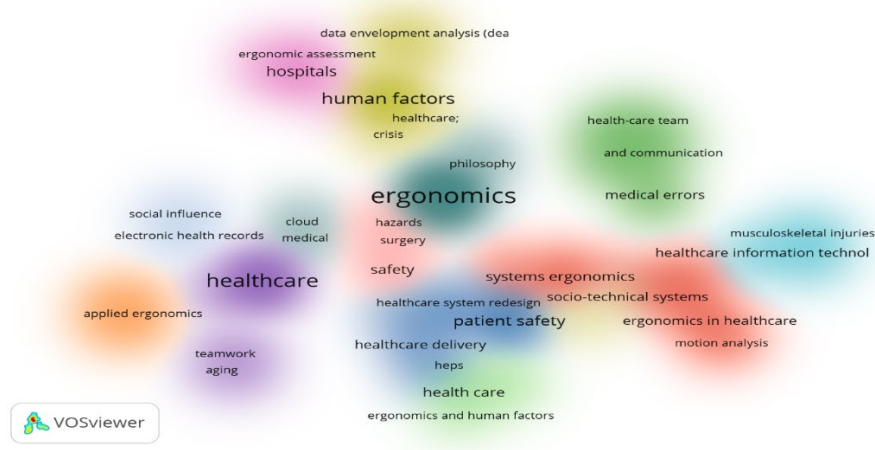


Figure 1. Mapping of dimensions of past literature

### 3. Research Methodology

The Scopus and Google Scholar databases were used to conduct the literature search. We collected 1,421 published papers for this review, and 40 relevant papers were extracted based on ergonomics in healthcare operations. The following search phrases were used to locate the articles: “ergonomics,” “physical health”, “healthcare”, as well as “Healthcare workers”, or “doctors”, “medical staff”, or “caregivers” or “health care professionals”. We Searched for “reviews”, “commentary”, “correspondence”, and “original research publications” that were published. Cross-references were used to extract reports where they were applicable. Out of all the articles that were relevant to the review's topic, only original research articles (namely those published as letter to the editors/commentaries) that examined "ergonomics" in healthcare organisations were used for the review. A flow chart of the methodology is shown in Figure 2.

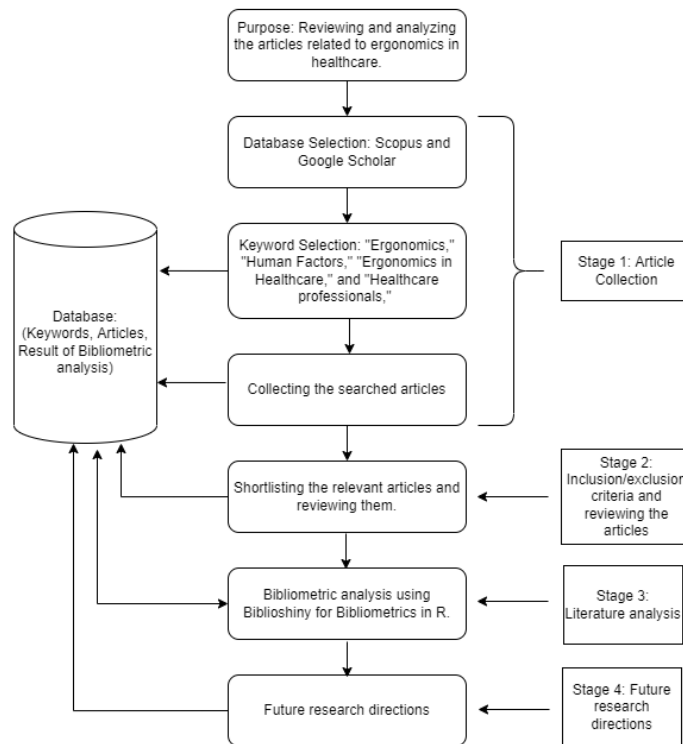


Figure 2. Flowchart of methodology

#### 4. Analysis

Figure 3 depicts a three-field plot that represents three elements: sources, authors, and title. These three components are displayed with grey connections that illustrate their interactions with one another, starting with the sources, then the writers, and finally each author is connected to the title. The size of each rectangle in each list indicates the number of articles linked to each component. Figure 4 shows a word cloud of the most regularly used words in Ergonomics and Healthcare operations publications. The most commonly used terms were "human factors and ergonomics," "healthcare organisation," and "safety." The word cloud displays words in various sizes dependent on how frequently they appear. The word placement is a little haphazard, but the most significant words are in the middle to draw attention to them owing to their massive size. A thematic map based on centrality and density, divided into four topographical zones, was also constructed (Figure 5). A conceptual structural map (Figure 6) was generated by mapping the relationship between one phrase and another using spatial mapping. The map depicts the contextual structure of each term that appeared frequently in research publications on ergonomics and healthcare. Figure 3 to Figure 6 is derived by using biblioshiny in R programming using the Scopus data.

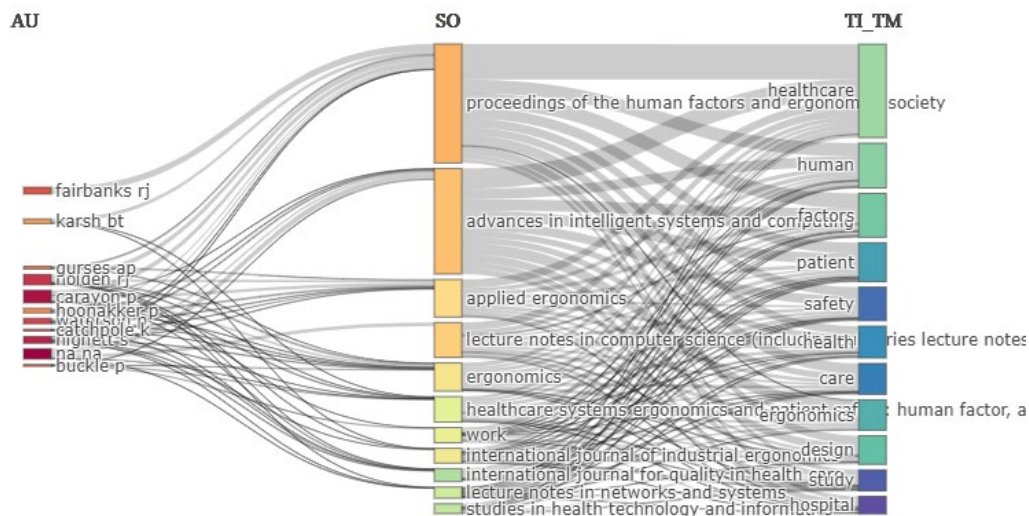


Figure 3. Three Field Plot from Scopus database



Figure 4. Word Cloud from Scopus database



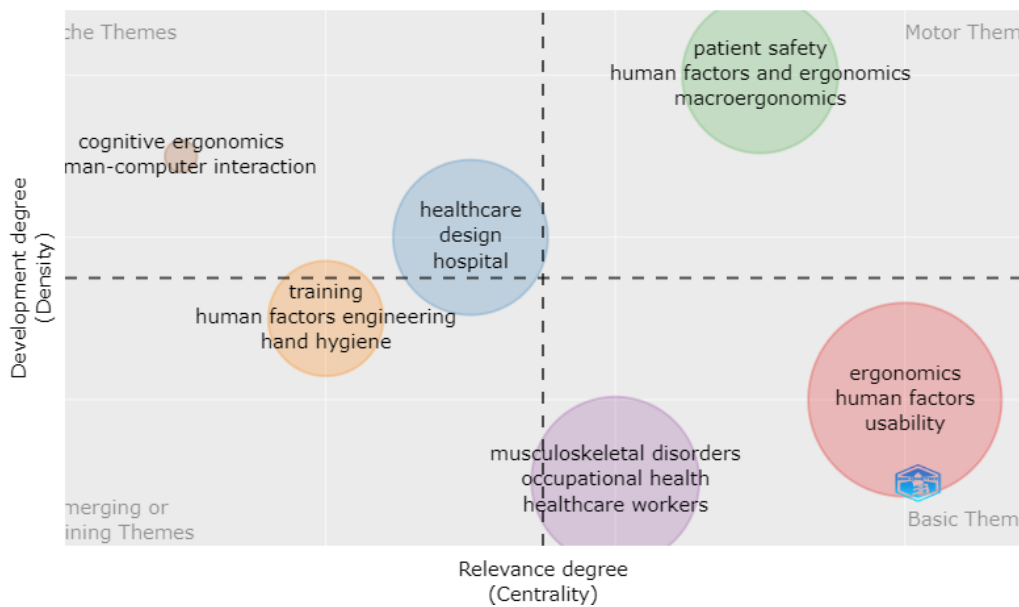


Figure 5. Thematic Map from Scopus database

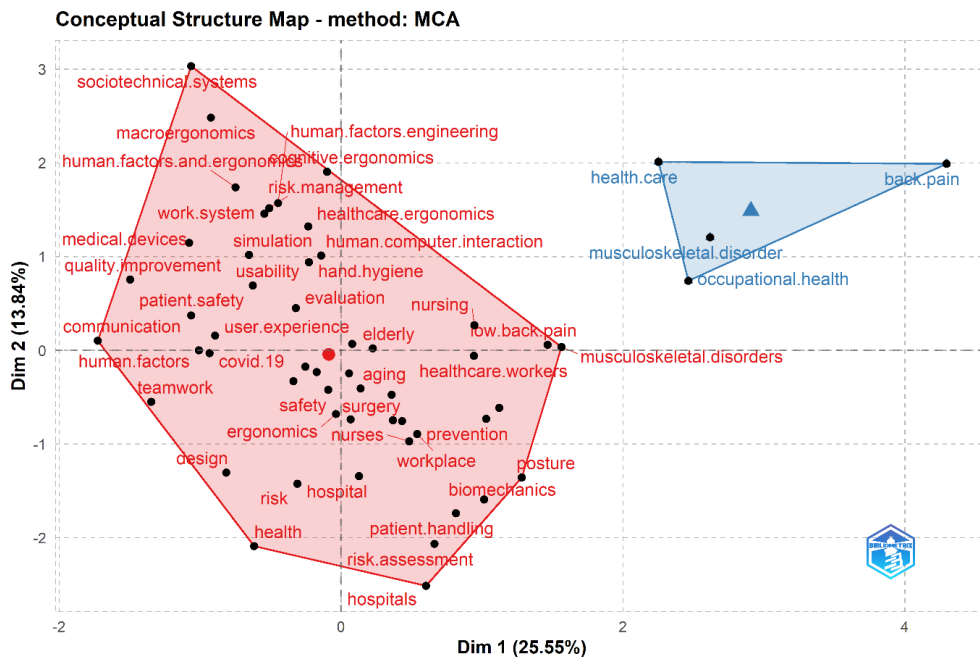


Figure 6. Conceptual Structure Map from Scopus database

### 5. Future research directions

Hedge et al. (2011) indicated that ergonomics program will expand beyond the regular workplace and into the domains of telecommuting in the future. Kluwak et al. (2021) consider performing ergonomics comprehensive tests in the future with various methodologies and models that have proven to be successful in modelling systems in various domains. Future research should focus on the impact of human factors and ergonomics on quality and safety of care, as well as the ergonomics-based system redesign to enhance the safety and quality of care service (Xie and Carayon 2015). Other important social phenomena, such as how technology converts social structures and processes, how

specialists utilize social strategies to engage with technical and non-technological challenges in workplace, and how creators' preconceived stereotypes impact the planning process and content, require more research (Holden 2012). Large-scale observations are required to record ergonomic risk variables and occupational tasks in complicated situations (Janowitz et al. 2006). Future improvements and relevant procedures can be put to the test, especially in terms of safety and efficiency (Matern and Koneczny 2007). Future research should look into how widely these tactics can be used in the E/HF community. Prospective investigations should be undertaken to evaluate the present state of qualitative research conducted by E/HF researchers in the health care domain (Valdez et al. 2017). Further experimentation with more HFE work that aims to span "micro and macro system levels" is an obvious topic for advancement (Karsh 2014). To ensure that future ergonomists have the choice of adopting qualitative methodologies in research and practice, this must be provided in a robust and methodical manner (Hignett, 2001). Given the uncertainties surrounding the safety of technology in the dispensing scenario, future research on the incorporation of technological improvements in pharmacy practice may be beneficial (Weir et al. 2020). Azadeh et al. (2016) strongly advised to create and utilize fresh methodologies and approaches in this area. For future research, it is vital to increase the integrity of mixed research methods in healthcare ergonomics; thus, well-defined criteria for evaluating mixed methods research are required (Carayon et al. 2015). A quality assessment checklist for the broader subject of systems ergonomics should be developed in the future, covering all parts of research from the underpinning theory to data analysis and concluding creation (Hulme et al. 2019).

## **6. Results and Discussion**

In this investigation, 40 published journal and conference papers were evaluated. They investigated on the ergonomics in healthcare organisation and the importance of the ergonomics in healthcare sector. Past research shows that ergonomics enhances the productivity and efficiency of the healthcare workers as well as the overall performance. The findings of the literature review are as follows:

- Ergonomics experts should work closely with healthcare professionals to obtain a deeper understanding of the complex healthcare world, as well as to develop and grow clinical ergonomics and human factors application and understanding with an environment that can sustain meaningful long-term relationships (Hignett et al. 2013).
- HF/E is poorly understood in medicine, and when ergonomics experts are involved, it is present in very small groups spanning various disciplines, and it is perceived as expensive and consuming time (Keebler et al. 2022). There is a significant need to ergonomics awareness in the healthcare sector.
- Telecommuting will undoubtedly grow more popular in the future, and ergonomic awareness, coaching, and training in the application of basic ergonomics ideas can help healthcare employees to ensure safe and healthy work environments regardless of where they commute (Hedge et al. 2011).
- A holistic perspective which emphasizes upon enhancing interaction of people such as medical practitioners, health care workers, and patients as well as the other components that make up healthcare systems are essential; this connects vision of "human factors and ergonomics". This would lead to improved outcomes in regarding safety, wellness, well-being, and overall performance. (Rodríguez and Hignett 2021).
- Healthcare systems must be reformed to deliver safe, effective, and efficient care that fulfils patients' diverse requirements (Xie and Carayon 2015).
- Ergonomists can contribute to greater "workplace risk management" by promoting the need for change awareness; study on "MSD-related workplace management" concerns; and ergonomist training program (Macdonald and Oakman 2022).
- The ergonomics internal environment must support the ongoing paradigm shift in terms of methodology breadth. To ensure that future ergonomists have the choice of adopting qualitative methodologies in research and practice, this must be provided in a robust and methodical manner (Hignett 2001)
- Ergonomics is more akin to a technical training program, with an emphasis on real models and external industry tasks.

## **7. Conclusion**

Ergonomics is the study of how to design healthy and secure environments wherein work requirements "fit" the abilities of the people who must complete the task. It is vital to understand this from this perspective (Waters 2010). Healthcare is a highly contested, complicated, and adaptive labor system, sector, and institution. Its natural beginnings, including individuals as being the only consistent and stimulant for work, produce a wide range of variability that restrict healthcare work dependability (Perry et al. 2021). Ergonomics aids in increasing productivity and reducing internal customer health issues (Tarcan 2004). Most of the papers are studied with a limited sample where the

generalizability of the results is lost. The most common concern in the current literature is that most study publications fail to specify any potential research goals or limitations. This places a significant research gap in future research by requiring researchers to remove the barriers that impede healthcare practitioners from exploring techniques. The limitation of this study: considered and selected only English language papers where other language papers were missed.

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