Ergonomic Research Trends in the Health

N Panjaitan¹, A Y B Ali² and H A Samat³

¹Industrial Engineering Department, Universitas Sumatera Utara, Medan, Indonesia
²,³School of Mechanical Engineering, Universiti Sains Malaysia, Malaysia

E-mail: nismah.panjaitan@usu.ac.id

Abstract. The Ministry of Health (Kemenkes) in March 2019 released the number of hospitals in Indonesia, the number of hospitals released is 2813, the province with the highest number of hospitals in East Java and followed by West Java in the 2nd rank. The number of hospitals approaching the number 3000 indicates that there is an increasing number of patients each year, with the number of hospitals increasing each year, so hospital management is a very important factor for attention in improving hospital management especially in the area of ergonomics. Ergonomic research over the last 10 years has been in the health field of 62. The research includes macros ergonomics, meso ergonomics and micro ergonomics. Meso research ergonomics with the least amount of just 1 study in the last 10 years, 31 macro studies ergonomics and 30 micro-ergonomic studies. Ergonomic research in most health fields was conducted in 2015. The number of hospitals steadily increasing over the years should be followed by an increasing number of studies ergonomics in the field of health especially in hospitals.

1. Introduction
Hospitals have a complex management system, with almost every interaction, whether human-to-human or machine-to-human interaction. Hospital management has policies that employees must follow so that the administration process, procurement of hospital equipment, room layout, employee hours and all hospital activities can work well. In practice, there are still many obstacles as they are not in the right circumstances and are a bit hindering the performance of employees in achieving their goals.

Long-term use of the tool can result in muscle injuries, management policies that need to be evaluated, relationship with each department, the design of the tools used is not standard, the room conditions are too tight as many new equipment require redesign ergonomics and much more to improve over time, the advances in technology and technology require every hospital to adapt. It is important that there is research on ergonomics in hospitals so that everything can go well from direct hospital management to employees or employee activities to patients. Ergonomic macro studies and micro ergonomics can be done in hospitals with different discussions depending on the complaint.

This paper aims to look at ergonomic research trends in the health field over the last 10 years. Research on ergonomics in the health field is so small, the number of hospitals increasing each year should be offset by research on ergonomic management in hospitals, as interactions occurring in hospitals occur every time both human and human interact with the technology at the hospital. Good hospital
management will make it easier for patients to receive the services and facilities of the hospital to serve the patients.

This study also aims to classify the discipline of ergonomics in the health sector, macro ergonomics, meso ergonomics and micro ergonomics as having their respective roles in the health sector, because the health sector is the most important field in a country besides jada and manufacturing. If the comparison of the three is significantly different, then research after research in the health sector must be carried out. For this reason, it is necessary to develop research among ergonomics, meso ergonomics and micro ergonomics that are focused on meso ergonomics research to improve a good management system in the health sector, especially in hospitals.

2. Literature Studies

The Hospital is an Institution of Health Services that provides personalized or comprehensive personal health service providing hospital, outpatient, and emergency services. In Indonesia, Categorization of Hospitals is distinguished by the types of services maintained, namely General Hospital (RSU), and Special Hospital (RSK) [1].

General Hospital (RSU) is a hospital that provides health care for all types of diseases from basic, specialist, to sub specialty. In general, the General Hospital (RSU) is divided into two, the Private Hospital (RSU) by the private sector, and the Government General Hospital (RSU) [2]. Private General Hospital (RSU) is a Hospital that provides health services of all types of diseases, from basic, specialty, to sub specialty maintained and managed by the private, individual and group [3].

Ergonomics comes from the Greek word ergon (work) and nomos (norm / law) or meaning science that learns about the laws of work. Thus ergonomics is the science, technology and art to integrate tools, machines, systems, organizations and environments into human capabilities, abilities and boundaries so that working conditions and environments are healthy, safe, comfortable and efficient to achieve their highest productivity [4].

Ergonomics is a multidisciplinary science discipline, which integrates physiology, psychology, anatomy, hygiene, technology, social culture, ergonomics and other occupational-related sciences [5]. Its practice and development are aimed at improving physical and mental well-being, in particular preventing the emergence of work-related injuries and illnesses and promoting job satisfaction. It also promotes social well-being and organizes work well, to improve work efficiency [6].

Macroergonomics is an ergonomic subdivision that complies with the organization / machine interface technology as well as researching, developing, and applying the principles of ergonomic and organizational design at the system level level [7]. The mesoergonomic framework based on the meso paradigm of House et al., the concept of organizational behavior in which two or more levels are examined simultaneously. Karsh et al. identified safety climate as a good example of mesoergonomic research, explaining that variables are specifically measured at the organizational, unit, and individual levels to determine cross-level relationships [8].

Micro ergonomics, is the science of ergonomics we know a lot about today [9]. If you have ever studied ergonomics and heard terms such as physiology of work, biomechanics of work, physical environment, anthropometry, percentile, standard time and more, these are the science of the scope of micro ergonomics. In general, micro ergonomics is the science of micro ergonomics in the scope of work stations [10].

3. Methodology

Literature surveys are conducted to look at the phenomena that have occurred in a problem in the last few years, so that in mapping out problems, the factors that influence the problem can be obtained through the
literature survey and thus become the focus of current research [11]. Additionally survey literature also saves time and expense in finding the core of the problem. Literature surveys can also be compared to current issues that make it easier to make decisions [12].

Literary studies often referred to as literature surveys are documentation of comprehensive reviews of the results of work published in published or unpublished literature [13]. The most widely used forms of literature include science books, scientific journals, scientific magazines, conference proceedings, doctoral dissertations, master's theses, government publications, financial reports, marketing and more. A literature survey can be conducted at the same time as the interview or before / after the interview [14].

There are several stages in carrying out a literature study [15]:

- **Looking for literature study sources**
  Determining sources in finding information is the first step in literature study, sources can be previous research, books or reports published on official websites either nationally or internationally.
- **Analyze the contents**
  Understand the purpose and meaning of research so that it makes it easier to determine the type of research to be carried out and the ease in classifying ergonomics.
- **Make a summary**
  Clarifying the content by making brief conclusions based on the research conducted to find the information needed based on the sources that have been collected.
- **Evaluating the summary**
  Taking the required information based on the summary that has been made so as to get the essence of the research needed in literature study research

### 4. Discussion

Ergonomics is divided into 3 macro ergonomics, meso ergonomics and micro ergonomics, but meso ergonomics is rarely discussed not only in the field of health but in all fields, the specific study boundaries between macro and meso have resulted in little studies on meso ergonomics and lack of steps. The steps identified in the meso-ergonomic improvement process are also one of the few factors in the discussion of meso ergonomics.

#### Table 1. Classification of ergonomic research in the field of health 2011-2020

| Year | Ergonomic Macro | Ergonomic Meso | Ergonomic Micro |
|------|-----------------|----------------|-----------------|
| 2011 | 2               | 0              | 3               |
| 2012 | 5               | 0              | 2               |
| 2013 | 2               | 0              | 3               |
| 2014 | 1               | 0              | 4               |
| 2015 | 6               | 0              | 5               |
| 2016 | 1               | 0              | 2               |
| 2017 | 2               | 0              | 1               |
| 2018 | 4               | 0              | 4               |
| 2019 | 5               | 0              | 3               |
| 2020 | 3               | 1              | 3               |

| Amount | 31 | 1 | 30 |

The table above shows the distribution of ergonomic research in the health field over the last 10 years,
a total of 62 journal research papers, 31 macroergonomic studies, 1 ergonomic research and 30 micro ergonomic studies. The most recent year of the ergonomic research in the field of health was 2015.

**Figure 1.** Graphs of ergonomic macro research in the 2011-2020 health areas

In Figure 1 above it can be seen that macroergonomic research began to increase in 2011 and decline in 2014. Most research was completed in 2015 and continued to increase until 2020, still likely to increase macroergonomic research by the end of 2020. The study of ergonomic macroergonomics in the field of health, 31 indicates that with the decline of macroergonomic studies in the field of health, the importance of hospital management and the increasing number of patients each year should be that macroergonomic macro research is likely to increase each year.

**Figure 2.** Graphs of ergonomic meso research in the field of health 2011-2020

Figure 2 shows very little meso ergonomic research in the health field, for the last 10 years there has been only 1 meso ergonomic research in the health field, not that there is no ergonomic research in the health field, but meso ergonomics is still not well known, other than the clear boundaries between meso and macro as well as macro and macro, meso ergonomics do not yet have concrete steps in improving meso ergonomic methods.
In Figure 3, the increase in research from 2012 to the highest in 2015, 2018 to 2020 continues to decline, with increasing levels of human-to-human and machine-to-human and machine disease, fatigue occurring in doctors and nurses, decrease performance and have a direct impact on patients in service. The importance of micro-ergonomic research in the field of health to improve performance in service.

Figure 4 shows the total number of ergonomic studies over the last 10 years, the highest number of studies in 2015 and continues to be stagnant until 2020, with 62 health studies conducted during the years 2011 - 2020.
Table 2. Ergonomic studies in the field of health

| Research          | Discussion                                                                 |
|-------------------|-----------------------------------------------------------------------------|
| Macro Ergonomic   | The study of macroergonomic ergonomics in the field of health studied several issues namely; on policy implementation, performance improvement, target achievement, departmental impact on other departments, long-term strategy determination and technology selection to support hospital-wide departmental activities. The research done is expected to have a positive impact and can be applied as a measure of improvement in the management system, with good management the goals and objectives of the hospital will be achieved... |
| Meso Ergonomic    | The journal dealing with meso ergonomics in the field of health is very limited, steps and concepts of ergonomic meso are still undergoing ongoing research, so the setting of concepts and concepts can be quickly applied to improve a system both in terms of macro ergonomics and micro ergonomics. This ergonomic meso study develops previous research on the concept of ergonomic meso and its application to human factors and to designing ergonomic meso concepts and steps. |
| Micro Ergonomic   | Micro-ergonomic research in the field of health includes the individual's relationship to the tools used, device and room design, measuring and evaluating body postures to reduce musculoskeletal incidence in workers; it is important to conduct micro-ergonomic research in hospitals to ensure patient and staff support for doctors, nurses and support staff the other. |

From the table above, it can be seen that there are differences in the scope of studies in the hospital sector, macro ergonomics includes a study of the entire structure so that all departments are included in it, in contrast to micro which only discusses a small part, namely focusing on humans and activities. Both have different roles in responding to problems that occur in the health sector.

Meso ergonomics research has been carried out only 1 out of 10 in the last 10 years, it is very far compared to macro and micro, therefore there must be an increase in research in the field of meso ergonomics in hospitals. The development of an understanding of meso ergonomics must also be continuously developed so that all knowledge can be applied.

5. Conclusion
The classification of research journals in the field of health from the field of study and in the last 10 years shows that little research has been done in the field of health, we know that health care is an important part of a State other than defense and security of the State. Bad management of a hospital not only affects the achievement of the hospital, but also affects the patients who should receive the maximum service, studies done in terms of hospital management, technology acquisition, tool design and more. Ergonomic macro and micro ergonomic research have the same amount of 31 for macro ergonomics and 30 macro ergonomics.

According to a recent journal of macro ergonomic research examining the part of hospital management systems, from looking at the impact of hospital policy on employees to improving the hospital management system itself. While micro ergonomics studies the assessment of fatigue while using tools for a long time to design tools that facilitate the work of both patients and doctors and nurses, so doctors, nurses and patients can feel good service from administration to service and safety.

The study of meso ergonomics is extremely rare because experts do not yet have the knowledge of meso ergonomics, because the position of meso ergonomics is between macro ergonomics and micro
ergonomics, besides the field of health in other areas meso ergonomics has not been widely studied such as manufacturing, services and other fields. The uncertainty of the tools and the concrete steps of meso ergonomics are the reason why so much of meso ergonomic research in the field is not just health. It does not cover the possibility of increasing meso-ergonomic research over time in all areas.

2015 has been the year with the most research in the field of health and is beginning to show an increasing trend towards the end of 2020, increasing the research in the field of health is expected to improve the quality of hospital management system in serving patients until they leave the hospital. We cannot reduce the number of patients every year that we have to do is improve the hospital management system so that all patients can be treated properly.

Ergonomics has a very broad scope, equipment design to the system can be studied by ergonomics, so there is a need for increased ergonomic research conducted in the field of health to improve the quality of public health as the aim of the State in ensuring the health and well-being of the people.

Based on the classification of macro, meso and micro all have a relationship and relationship with each other, macro becomes important when the existing problems approach from the managerial side of the company, while the micro prioritizes the ability and human burden that should be and for meso becomes a link between the two who have different levels in the company. If all collaborated, it will be a system improvement that is good for the company and workers' welfare.

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