



Article

# Ergonomic Design of Medical Record Document Storage Room at Puskesmas Yosowilangun

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**Abstract:** The size of the filing room at the Yosowilangun Health Center is not yet up to standard, the medical record document shelves, work tables and chairs are not ergonomic. The research aims to create an ergonomic design for the filing room at the Yosowilangun Health Center. This type of research is qualitative, using interview, documentation, observation, and brainstorming data collection techniques. The results of the research are that there is a need to design a new filing room that is adapted to standard regulations. The design of work desks, work chairs, and medical record document shelves is adjusted based on the anthropometry of the staff. The number of new filing shelves needed is calculated using the IFHIRO (International Federation Health Record Organization) formula. The area of the new filing room is 36m<sup>2</sup>, consisting of active and inactive filing rooms.

**Keywords:** Design, Ergonomic, Filing room, Medical record, Health Center

## 1. Introduction

Public Health Centers are health institutions that provide community and individual basic health services, prioritizing promotive and preventive efforts based on their working area [1]. Public Health Centers (Puskesmas) need to implement proper administrative management to improve community health services. One of the administrative management activities carried out by Puskesmas is maintaining medical records. Medical records are documents containing information about patient identity, examinations, treatments, and all actions taken on patients [2]. Medical records serve as crucial evidence and detailed documentation of services provided to patients [3].

The filing room is part of the medical records unit that functions for the storage and retrieval of medical records [4]. The storage of medical record documents must be properly managed because they hold legal value for both patients and healthcare providers. Medical records should be managed in an orderly manner to facilitate tracking and systematically organizing the data [5]. Medical record management involves handling patient medical record documents from the moment they are issued to the patient until they are stored on storage racks [6]. The implementation of medical record document storage requires adequate facilities and properly conditioned space. The management of medical record storage should consider ergonomics to facilitate work processes and achieve efficiency and work effectiveness.

The ergonomics of the medical record document storage room can improve the safety of medical records from damage. Ergonomics is the science of harmonizing work and the work zone to achieve maximum productivity and efficiency by optimizing human

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resources [7]. Medical record officers, in performing their tasks, need a workspace with good ergonomic aspects to ensure comfort, health, and occupational safety [8]. Facilities such as room layout, room size, and medical record storage racks that do not meet ergonomic criteria will cause difficulties in the process of handling patients' medical record documents. This can lead to a decline in the quality of medical record document services for patients [9].

A preliminary study conducted by researchers found that the storage system implemented is decentralized due to a lack of medical record storage space. Decentralized storage means medical records are stored separately according to the type of service [10]. Inpatient and inactive medical records at Yosowilangun Public Health Center do not yet have a dedicated room. The filing room area at Yosowilangun Public Health Center does not meet existing standards. The minimum area for a medical record storage room is 20 m<sup>2</sup> [11]. The infrastructure in the inpatient medical record filing room does not yet include desks and chairs for the medical records officers. Inadequate facilities will cause several obstacles [12].

Medical records stored in warehouses and arranged in cardboard boxes will result in document damage and delays in retrieving medical records. Medical records serve as crucial evidence and detailed documentation of services provided to patients [3]. The storage of medical record documents must be properly managed because they hold legal value for patients and healthcare providers. Medical records should be managed in an orderly manner to facilitate tracking and systematically organizing the data [5]. Based on these background problems, it is necessary to design an ergonomic filing room at Yosowilangun Public Health Center according to the anthropometric measurements of the staff.

Public Health Centers are health institutions that provide community and individual basic health services, prioritizing promotive and preventive efforts based on their working area [1]. Medical records are documents containing information about patient identity, examinations, treatments, and all actions taken on patients [2]. The filing room is part of the medical records unit that functions for the storage and retrieval of medical records [4]. Ergonomics is the science of harmonizing work and the work zone to achieve maximum productivity and efficiency by optimizing human resources [7].

A preliminary study conducted by researchers found that the storage system at Yosowilangun Public Health Center is decentralized due to insufficient medical record storage space. Decentralized storage means medical records are stored separately according to the type of service [10]. The shortcomings of the decentralized storage system include the possibility of duplicate medical records, higher costs for building rooms and racks, greater need for rack space, and more personnel required [4]. The filing room area at Yosowilangun Public Health Center does not meet existing standards. The minimum area for a medical record storage room is 20 m<sup>2</sup> [11]. The infrastructure in the inpatient medical record filing room does not yet include desks, chairs, and computers for the medical records officers. Inadequate facilities will cause several obstacles [12]. Inpatient and inactive medical records at Yosowilangun Public Health Center do not yet have a dedicated room.

Medical records are stored in warehouses and arranged in cardboard boxes, which results in document damage and delays in retrieving medical records. Medical records serve as crucial evidence and detailed documentation of services provided to patients [3]. The storage of medical record documents must be properly managed because they hold legal value for patients and healthcare providers. Medical records should be managed in an orderly manner to facilitate tracking and systematic organization [5]. Based on these background problems, it is necessary to design an ergonomic filing room at Yosowilangun Public Health Center according to the staff's anthropometric measurements.

## 2. Materials and Methods

This study is a qualitative research project aimed at designing an ergonomic filing room at Puskesmas Yosowilangun. The unit of analysis was the medical records unit at Puskesmas Yosowilangun, with two medical records officers serving as research subjects. Data collection techniques included observation, in-depth interviews, and documentation. Observations were conducted by directly measuring the room area, the existing document storage racks, and the anthropometric dimensions of the staff. In-depth interviews were carried out through structured question-and-answer sessions with the medical records officers as informants, using an interview guide instrument and a voice recorder for data capture.

The selection of informants utilized purposive sampling, a technique that allows researchers to deliberately select data sources based on specific criteria. This approach ensures that the chosen participants possess relevant knowledge and expertise, thereby facilitating the exploration of the research object or social situation under study, resulting in high-quality data. Documentation was performed by capturing photographs of the condition of the medical record document storage area as well as research activities. The discussion stage employed a brainstorming method, beginning with the provision of information explaining the problem and objectives of the brainstorming session. Informants were then invited to identify and provide input and suggestions regarding the ergonomic filing room design developed by the researcher.

This was followed by the classification of ideas according to criteria agreed upon by the brainstorming group, verification of the agreements that had been reached, and, finally, the formulation of conclusions or solutions to address the ergonomic filing room design challenges. The collected data were then processed, analyzed, and described in accordance with relevant theoretical frameworks. Data validity was ensured through the application of technique triangulation and source triangulation. Technique triangulation was implemented by combining in-depth interviews, observation, and documentation, while source triangulation involved conducting in-depth interviews with multiple informants to ensure the validity and reliability of the information obtained.

The data analysis process began with in-depth interviews with the research subjects, followed by the transcription of interview results. After conducting interviews, the researcher performed direct observations to assess field conditions and to carry out measurements of the filing room at Puskesmas Yosowilangun as well as the anthropometric measurements of the staff. The resulting data served as the foundation for the calculation and ergonomic design of chairs, desks, and filing racks to optimize working conditions.

## 3. Results

### 3.1. Master Plan of the Medical Records Filing Room

The medical records filing room at Puskesmas Yosowilangun is located on the first floor, with dimensions of 3 meters by 2.5 meters. According to Ministry of Health regulations (Permenkes, 2014), the minimum area for a medical records document storage room is 20 m<sup>2</sup> [11]. The inpatient medical records filing room currently does not have a dedicated storage area. Medical records must be stored in rooms and storage areas designed ergonomically. Security measures include protecting service information from damage, loss, or unauthorized alteration of data by other parties. Privacy and confidentiality protections of patients' health records are part of these security aspects [13].

The inactive medical records filing room is still combined with the active records filing room. The storage space for active and inactive medical record documents should be separated because this will make it easier for officers to retrieve active medical records and will facilitate the destruction of inactive records [14]. Based on these conditions, the researcher redesigned the filing room since the current design does not align with

theoretical standards, and therefore a better design for the medical records document storage area was created.

### 3.2. Design of Work Chairs, Work Desks, and Medical Records Filing Racks

The anthropometric measurement results of medical records staff at Puskesmas Yosowilangun, involving two staff members, are presented in tabular form below.

#### A. Work Chair Design

**Table 1.** Anthropometric Data for Work Chair Design

No	Dimension Measured	R1	R2	Average	SD	P5	P95
1.	Sitting shoulder height	58 cm	54 cm	56 cm	2,83	51,34	60,66
2.	Sitting elbow height	24 cm	26 cm	25 cm	1,41	22,68	27,32
3.	Lower arm length	39 cm	35 cm	37 cm	2,83	32,34	41,66
4.	Buttock-popliteal length	42 cm	40 cm	41 cm	1,41	38,68	43,32
5.	Shoulder width	40 cm	39 cm	39,5 cm	0,7	38,35	40,65
6.	Hip width	36 cm	38 cm	37 cm	1,41	34,68	39,32
7.	Popliteal height	38 cm	36 cm	37 cm	1,41	34,68	39,32

The ergonomic design of work chairs is developed by adjusting to the staff's anthropometry. The sitting shoulder height uses the 95th percentile, sitting elbow height uses the 5th percentile, lower arm length uses the 95th percentile, buttock-popliteal length uses the 5th percentile, shoulder width uses the 95th percentile, hip width uses the 95th percentile, and popliteal height uses the 95th percentile.

The purpose of conducting anthropometric measurements is to ensure that the products developed have dimensions appropriate to their users. Accurate sizing will provide comfort for the users. Anthropometric measurements can result in optimally designed furniture products, as there are established standards for measuring specific body positions [15]. The anthropometric aspects of staff that should be considered in designing ergonomic chairs include several factors: the chair height should not exceed the user's popliteal height; the seat depth (from front to backrest) should not be greater than the buttock-popliteal length of the shortest user; the seat width between armrests should allow for sufficient space for users with larger hip widths (at the 95th percentile); if armrests are not provided, the seat width can be slightly narrower than the hip width; the backrest should be designed to support the user's body weight adequately and take into account the backrest angle [16].

In a sitting position, the skeletal muscles and spinal column, particularly in the lumbar area, should be supported by the backrest to prevent pain and fatigue. The chair should include armrests, and the height of the seat should be adjusted in relation to the workstation and the height of the work desk [17]. It is important to ensure that there is minimal or no pressure from the seat on the back of the knees to maintain proper blood circulation, and that the armrests are aligned with the elbow height to provide support for the upper arms, thereby reducing stress on the shoulders and spine [18]. Adapting the ergonomic aspects of the work chair to the anthropometric characteristics of the staff is crucial to support the effectiveness of their performance and to create a comfortable and conducive working atmosphere [19].

#### B. Work Desk Design

**Table 2.** Anthropometric Data for Work Desk Design

No	Body Dimension Measured	R1	R2	Average	SD	P5	P95
1.	Sitting elbow height	24 cm	26 cm	25 cm	1,41	22,68	27,32
2.	Sitting knee height	48 cm	43 cm	45,5 cm	3,54	39,68	51,32
3.	Arm span	168 cm	157 cm	162,5 cm	7,78	149,7	175,3
4.	Forward arm reach	75 cm	73 cm	74 cm	1,41	71,68	76,32

The ergonomic design of work desks should be adjusted to the anthropometric data of staff. The elbow height while sitting uses the 5th percentile, the sitting knee height uses the 95th percentile, the arm span uses the 5th percentile, and the forward arm reach also uses the 5th percentile. If the desk surface is too low, it may cause the spine to bend forward and the back to hunch, while an excessively high desk surface may cause the shoulders to lift from a relaxed position, leading to discomfort in the shoulders and neck. To reduce staff fatigue while working, the height of the desk should be adjusted to match the staff's anthropometric dimensions [17]. Ideally, a work desk should have adjustable height. A non-ergonomic desk can be identified if its height does not match the body measurements of the user when seated [20].

#### C. Medical Records Filing Rack Design

**Table 3.** Anthropometric Data for Filing Rack Design of Medical Records

No	Anthropometric Measurement	R1	R2	Average	SD	P5	P95
1.	Shoulder width	40 cm	39 cm	39,5 cm	0,7	38,35	40,65
2.	Vertical arm reach	200 cm	194 cm	197 cm	4,24	190,03	203,97
3.	Arm span	168 cm	157 cm	162,5 cm	7,78	149,7	175,3

The ergonomic design of medical records filing racks should be adjusted according to staff anthropometry. Shoulder width uses the 95th percentile, vertical arm reach uses the 5th percentile, and arm span uses the 5th percentile. Filing racks with appropriate dimensions can minimize the risk of accidents and staff fatigue. Ergonomic filing racks adapted to staff anthropometric measurements can facilitate easier retrieval and storage of medical records, thereby reducing occupational hazards. Therefore, it is important to redesign filing racks in accordance with the staff's anthropometric dimensions. The aim is to create comfort, health, safety, and aesthetic appeal within the workspace, which in turn can enhance staff productivity and improve the quality of health services at Puskesmas [21].

#### D. Work Chair Design Based on Anthropometry

Work chairs should ideally be designed using the "floor up" method, starting from the floor surface to minimize pressure on the lower legs. A good work chair should not use a footrest, as it can interfere with leg movement space and flexibility [22]. The ideal criteria for a work chair are as follows [20].

- 1) Product stability: it should have five legs to stabilize the chair position, equipped with special wheels for carpeted floors since they can move easily on vinyl floors.
- 2) Product strength: the chair should be designed solidly, with vulnerable parts reinforced with bolts or dowels on the armrests and backrest.
- 3) Seat width: it should be at least as wide as the hip width of female users.
- 4) The backrest: it should be designed to support the weight of the back and constructed to move forward and backward according to the posture and shape of the user's back.
- 5) Backrest width: it should match the width of the female user's back.
- 6) Chair materials: the seat and backrest materials should ideally be covered with soft material for comfort.
- 7) Ease of height adjustment: the height should be easily adjustable while seated, using the minimum 5th percentile and maximum 95th percentile of anthropometric measurements.
- 8) Seat depth: the seat should be designed to accommodate the buttock-to-popliteal fold length.



**Figure 1.** Ergonomic Chair

The work chair design that has been developed features a seat base length of 39 cm, armrest length of 42 cm, backrest height of 61 cm, seat height ranging from 35 cm at the lower limit to 39 cm at the upper limit, backrest width of 41 cm, seat base width of 39 cm, and armrest height of 23 cm. A chair is one of the most important components in the workplace. A good chair is one that is able to maintain posture, provide good circulation, and help users avoid discomfort. The design of a work chair should be based on properly selected anthropometric data, so that the resulting design can provide comfort to the user and avoid creating doubt or hesitation. Staff who sit for long periods in chairs that do not match their body dimensions may experience injuries, starting with pain, aches, or fatigue in various parts of the body. Muscles that most frequently experience musculoskeletal complaints include the muscles of the neck, shoulders, arms, hands, lower back, fingers, back, and other lower body muscles [23].

#### E. Work Desk Design

The criteria for an ergonomic work desk [11] include the following. First, desk length should be appropriate to the staff's working posture while seated, using the arm span dimension based on the 5th percentile. Second, desk width should not exceed the forward arm reach (5th percentile). Third, desk height should match the staff's working posture while seated, based on the sitting elbow height dimension. Fourth, desk thickness should be adequate while still allowing for comfortable leg movement underneath. Fifth, the desk surface is recommended to be flat and free from obstructions.



**Figure 1.** Ergonomic Chair

The work desk that has been designed has a length of 150 cm, a height of 74 cm, and a width of 72 cm. A desk that can accommodate a variety of sitting positions will provide comfort for users while working. An ergonomic work desk, designed according to the anthropometric measurements of its users, can help maintain good working posture. Good working posture also increases work productivity. Working in a posture where the joints remain in a neutral and naturally aligned position minimizes stress and tension on

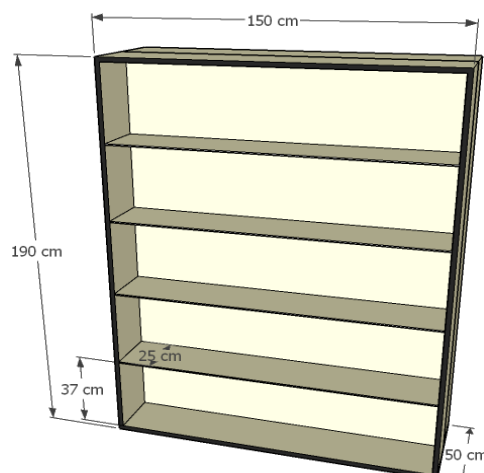
muscles, tendons, and the skeletal system, thereby reducing the risk of developing musculoskeletal disorders (MSDs) [24].

#### F. Medical Records Filing Rack Design

The design of medical records filing racks should be adjusted according to the staff's anthropometry as well as the size of the medical record documents being stored.

**Table 4.** Anthropometric Data for the Design of Medical Records Filing Racks

No	Anthropometry/DR M	Percentile Size (cm)	Rack Dimension	Final Dimension Used
1.	Shoulder width	40,65	Shelf distance	81
2.	Vertical arm reach	190,03	Rack height	190
3.	Arm span	149,7	Rack length	150
4.	Document width	22,5	Rack width Rack width (double-sided)	25 50
5.	Document length	34,8	Section height	37



**Figure 3.** Ergonomic Rack

The storage of medical record documents will be more effective if supported by adequate facilities, namely filing racks adapted to the staff's anthropometry. Besides providing the racks, the arrangement and layout of medical records data that comply with ergonomic aspects are also important in supporting filing activities and staff performance [25]. The presence of anthropometric data of staff can help produce a work tool design that is appropriate for use by staff, with the hope of creating comfort, health, safety, and aesthetic value in the workplace [26].

#### 3.3. Analysis of New Medical Records Filing Rack Requirements

The availability of medical records document storage racks in health service facilities is a crucial factor in maintaining security and preventing damage to patient data [27]. Medical records storage should be located in a secure filing area. The need for medical records filing racks must be adjusted to the number of documents stored. If the storage exceeds the available capacity, a planning process for new storage procurement is needed. Planning for the procurement of medical records storage racks should be based on the volume of medical records to be stored. The current medical records filing racks are insufficient to accommodate all medical records. Therefore, the number of racks needed in the new medical records filing room must be calculated to determine how many racks

are required, using the IFHRO (International Federation of Health Record Organization) formula [28].

- 1) Number of new patient visits at the *Puskesmas*

**Table 5.** Data for Designing Medical Records Document Filing Racks

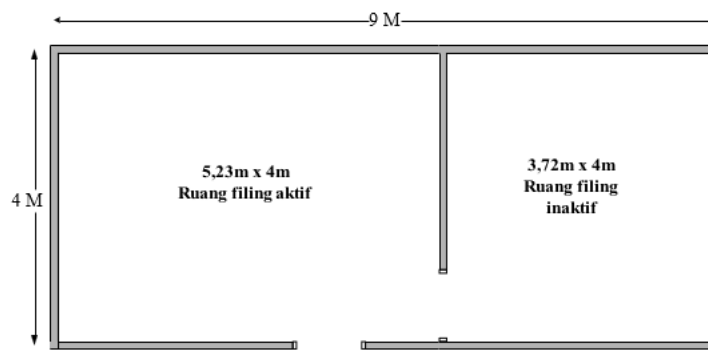
No	Type of Service	Number of New Patient Visits
1	Outpatient	24.917
2	Inpatient	4.759
Total		29.676

- 2) Medical record thickness  
Determination of medical record thickness was done by measuring the thickness for every 100 medical records. The average thickness was calculated as:  
Average thickness =  $4.7 \text{ cm} / 100 = 0.47 \text{ cm}$
- 3) Number of documents per linear meter  
Number of documents per metre =  $1 \text{ meter} / \text{average thickness} = 100 \text{ cm} / 0.47 = 212.76 = 213$  documents medical records
- 4) The length of the row of documents adjusts to the length of storage  
Length of row = number of medical record documents  $\times 3$  / number of documents per metre =  $29,676 \times 3 / 213 = 417.97 = 418$  metres
- 5) Calculation of 1 filing shelf with respect to the size and number of shelves  
Length of filing shelf = length of shelf  $\times$  shaf  $\times$  face of shelf  
Length of storage shelf =  $(150 \times 2) \times (5 \times 2) \times 2 = 6000 \text{ cm} = 60 \text{ m}$
- 6) Determination of the number of patient medical record filing shelves needed in the next 3 years  
Number of shelves required = length of shelf array / length of storage shelves  
Number of shelves required =  $418 / 60 = 6.96 = 7$  shelves
- 7) Determination of the number of inactive medical record filing shelves with 2-year shelf life
  - a. Length of inactive medical record rows  
Length of rows = number of medical records  $\times 2$  /  $100 = 29,676 \times 2 / 213 = 278.65 = 279$  metres
  - b. Calculation of 1 filing shelf by considering the size and number of shelf shaf  
Length of storage shelf = shelf length  $\times$  shaf  $\times$  shelf face =  $(150 \times 2) \times (5 \times 2) \times 2 = 6000 \text{ cm} = 60 \text{ m}$
  - c. Number of shelf requirements = length of shelf array / length of storage shelf  
Number of shelf requirements =  $279 / 60 = 4.65 = 5$  shelves

### 3.4. Design of a New Ergonomic Medical Record Filing Room Using SketchUp

#### A. Requirements for the new medical record filing room area

The area of the current filing room that does not meet standards has an impact on delays in file retrieval and data processing [29]. The design of the new filing room area is adjusted to comply with Indonesian Ministry of Health Regulation Number 75 of 2014. The required room measures 9 m  $\times$  4 m with a total area of 36 m<sup>2</sup>, with the following layout for the new medical record document storage room:



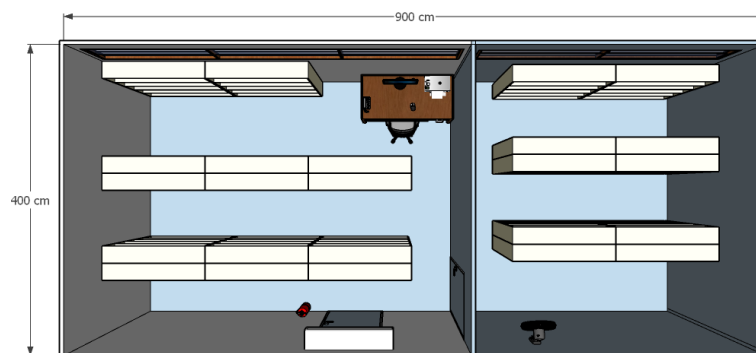
**Figure 4.** Layout Plan for the New Medical Record *Filing* Room

The design of the new medical record filing room has been adapted to meet the standards set by the Indonesian Ministry of Health Regulation Number 75 of 2014 and is based on the calculated needs for medical record document racks. The availability of the new filing room ensures that medical record document storage is well-organized. Existing medical records will also be stored properly, making it easier for staff to locate patient medical record documents.

The requirements for the medical record storage room include that the room's layout must be strategic so that file retrieval, storage, and distribution can be performed quickly and efficiently. There should also be a separation between active and inactive medical record files, so that only active records are kept in the storage room. The required area for the new filing room is sufficient to allow staff to move comfortably and work effectively, with a layout that supports good mobility and efficient work activities. This will also help improve staff work quality. A comfortable work environment greatly helps improve staff productivity in providing services, ensuring that patients receive optimal service [30].

#### B. Design of the Medical Record Filing Room Based on Ergonomic Aspects

The requirements for storing medical record documents should ideally be separated from other workspaces due to the high importance and confidential nature of medical records [31]. Below is the design for a new medical record document storage room created using the SketchUp application in a 3D model.



**Figure 5.** Design of the New Medical Record Document Storage Room

The new filing room design includes both active and inactive document storage areas. The active document storage room measures  $5.23 \text{ m} \times 4 \text{ m} = 20.92 \text{ m}^2$ . The active medical record storage room requires 8 racks to store inpatient and outpatient medical records. The filing racks used consist of 2 single-sided racks and 6 double-sided racks. The active filing room is also equipped with desks and chairs for staff. The inactive filing room measures  $3.72 \text{ m} \times 4 \text{ m}$ , with an area of  $14.88 \text{ m}^2$ . The inactive filing room requires 6 racks

to store inpatient and outpatient inactive medical records. The document storage racks used consist of 2 single-sided racks and 4 double-sided racks.

The researcher recommends relocating the medical record document storage area to a larger room. Based on the current conditions at Puskesmas Yosowilangun, where storage is still located in a warehouse that can disrupt file retrieval, it is proposed to move it to the second floor, which will later be designed as a new medical record document storage area with sufficient space for both active and inactive records, as well as staff work areas for storage activities.

#### 4. Conclusions

The current medical records filing room area is insufficient to accommodate medical records and does not comply with regulations. Anthropometric measurements of staff were carried out to design the work chairs, work desks, and medical records filing racks. The required number of medical records filing racks was determined using calculations from the International Federation of Health Record Organization (IFHRO). The new medical records filing room area complies with the Indonesian Ministry of Health Regulation Number 75 of 2014. The redesigned medical records filing room consists of separate active and inactive filing areas, equipped with a staff work area. Puskesmas Yosowilangun can proceed with the procurement of the proposed ergonomic work chairs, desks, and document storage racks designed according to staff anthropometric data. Future researchers are encouraged to conduct a more detailed analysis of the physical environment of the medical records unit room.

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