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Configuration of the Emergency Room at Toto Kabila Regional Hospital Based on Space Syntax Analysis

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Abstract—A hospital is a health service institution that functions for health services. In the composition of the units in the hospital there are several installations, one of which is the emergency department. Emergency Room (ER) services are very important because they are the main door to hospital services, so they require accessibility and visibility which makes it easier for medical personnel to treat patients. The importance of ease of access or accessibility in the ER is because it makes it easier for medical staff to review patients and ease of monitoring or visibility is needed to be able to control the patient's condition. The ease of accessibility and visibility in the emergency room unit is the basis for this research by assessing the configuration of the emergency room at Toto Kabila Regional Hospital. This research uses Depthmap X software from the Space Syntax technique which can measure the level of spatial configuration from the analysis carried out. The research method used is comparative research, where this research was carried out by comparing the results of the analysis of the speed performance relationship in the emergency room using the Space Syntax tool in the emergency room at Toto Kabila Regional Hospital. This research aims to explain the space configuration in the emergency room at Toto Kabila Regional Hospital by conducting an analysis so that it has criteria for ease of achievement and ease of supervision in order to produce a good emergency room through the use of depthmap software from space syntax. The research results show that accessibility and visibility are important so that patients receive fast service.

Keywords: emergency installation; room configuration; hospital; space syntax

1. Introduction

A hospital is a health-care institution that provides medical and health services to the community. Azwar (1996) cites the Association of Hospital Care (1947) to define a hospital as a center for public health services, education, and medical research.There are three types of hospitals in Indonesia: those based on ownership, those based on service, and those based on class, as follows:

(1) Based on ownership, there are government hospitals (RSUP, RSUD), BUMN/ABRI hospitals, and private hospitals.
(2) Based on the type of service: general hospital, mental hospital, or special hospital.
(3) Based on the type of class: hospitals are categorized into class A, B, C, and D.

There are several agencies in the hospital's units, one of which is the Emergency Room (ER), also known as an Accident and Emergency department (A&E), Emergency Department (ED), Emergency Ward (EW). One can refer to the ER as a showcase for hospital services. Hospitals consider the ER as their first priority for patients. In general, ER services include nursing services aimed at emergency patients, namely patients who are suddenly in a critical condition or will become critical and have their lives or limbs threatened if they do not receive help quickly and appropriately (Musliha, 2010).

As one of the main sources of health services in hospitals, services in the ER aim to provide services that are fast, responsive, and able to save patients' lives. Several factors in the speed of service in a hospital emergency room are waiting times. Waiting time is an important factor in ensuring good service quality. Overcrowding is a problem that frequently occurs in

emergency rooms and can cause long wait times. Good waiting times can improve the quality of service and provide more patient satisfaction (Romiko, 2018).

In the province of Gorontalo, there are several government and private hospitals that serve as health references. We conducted this research at the Toto Kabila Regional General Hospital (RSUD), located in Bone Bolango Regency and founded in 1942. This hospital is a type C facility. This hospital is a referral from the community health center in the Bone Bolango district area.

The Japanese government originally founded this hospital in 1942 under the name "Bokuka," which means warehouse for supplies. In 2020, Toto Kabila Regional Hospital constructed a new emergency room building to enhance its health services.

This study aims to investigate the performance of service speed in treating patients in terms of visibility and accessibility at the Toto Kabila Regional Hospital. Several factors, including the following, can determine service speed:

(1) The patient's journey from the triage room to the treatment room demonstrates patient convenience.
(2) Ease of moving medical equipment: the medical room is a mandatory room in the emergency room unit that functions to store medical equipment. The distance of the medical room from other rooms affects the speed of service.
(3) The convenience of medical staff and their supervision is a crucial factor, as it enables them to monitor and supervise patients, thereby understanding the patient's condition.
(4) Duration of action, speed in handling patients requires fast and precise action, so visibility monitoring is very necessary.

We can simplify the four factors above into two main ones: 1) the patient's ease of access and the ease of moving medical equipment, and 2) the convenience of medical staff and the duration of observation.

According to Alkano (2016), at the observation stage, patients receive examinations by doctors and nurses using medical equipment. If the patient is in a critical condition, they will be taken to the critical zone or resuscitation room (red zone); if they are semi-critical, they will be taken to the action room. (yellow zone), with a response time of 15 minutes. We must confirm the patient's diagnosis within 2 hours and proceed to the treatment room. The green zone includes non-urgent and non-emergency patients, requiring a response time of 30 minutes. If the patient needs to receive observation, within a maximum of 6 hours a decision must be made to proceed to the inpatient ward or on outpatient status.

This study uses the space syntax method to analyze the spatial configuration of the emergency room at Totot Kabila Regional Hospital. Space syntax is a research method regarding space configuration and how to build generalizations of relationship patterns between spaces. We developed an accurate and valid method for measuring spatial interactions by combining graphical visualization and statistics.

We conducted this research based on observations and analyses of previous studies. Several research attachments using the space syntax method are listed below.

(1) Frieke "Space Syntax Analysis of Hospital Buildings After Strengthening Against Earthquakes," by Eugene Kawatu, was published in 2020. His research aims to determine the hospital's structure against architectural parameters viewed from space, using the space syntax method as a research tool.
(2) Intan Permata Sari, 2019, "Analysis of circulation's spatial performance using the space syntax method." The research's essence is to analyze the operational plan design at JIH Hospital using the space syntax method.
(3) Derya Arslam The essence of Burak Koken's 2016 research, "Evaluation of the space syntax analysis in post-strengthening hospital buildings," is the use of the space syntax method as an urban and architectural study tool to ascertain how hospital building systems can influence architectural parameters in rooms.
(4) Saif Haq and Yang Luo, 2012, "Space Syntax in Health Car Facilities Research: A Review." Their research focuses on the use of space syntax in the initial design of current and future health facilities.

We anticipate this research to offer a thorough comprehension of the emergency room's spatial arrangement at Toto Kabila Regional Hospital, focusing on factors such as accessibility, ease of monitoring, and visibility, while also comprehending the unique features of the emergency room's spatial arrangement.

2. Method

The research method used is comparative research, where this research was carried out by comparing the results of the analysis of the speed-performance relationship of emergency rooms using the Space Syntax tool in the emergency room at Toto Kabila Regional Hospital.This research stage consists of multiple stages, which are as follows:

(1) First stage

The study involved gathering floor plan data from the emergency room at Toto Kabila Regional Hospital and doing field observations to analyze the movement patterns of visitors/patients and identify any obstacles they encountered.

(2) Second stage

Generate a floor plan based on the previous stage, specifically depicting the movement of visitors/patients and the visual limitations

imposed by walls or other impediments. This floor plan will be utilized in the subsequent stage, which involves the utilization of the Depthmap X software.

(3) Third stage
Perform a connectivity and integration analysis of pre-existing designs using the Space Syntax technique with the Depthmap X tool.
   a. Connectivity (visibility) or Ease of control is a dimension that measures the local properties under study by counting the number of spaces directly connected to each other in the visual scope.
   b. Integrity (Movement) or ease of achievement is a dimension that can measure global properties in the form of the relative position of each space to other spaces in a spatial configuration.The following are the steps in the depthmap analysis stages:

   Visibility or ease of supervision
   - File - new
   - Map – import - open
   - Tools – visibility - set grid
   - Tools – visibility - make visibility graph
   - Tools – visibility - run VGA - visibility analysis – calculate - ok

   Movement (accessibility)
   - File - new
   - Map – import - open
   - Map – new - axial map - ok
   - Tools – axial - run graph analysis
   - Tools – axial - reduce to fewest line map
   - Tools – axial - run graph analysis - ok

(4) Fourth stage
This stage presents the findings of the study of two sets of data, including the level of visibility and movement/accessibility in the emergency room at Toto Kabila Regional Hospital.

Space syntax aims to develop a descriptive strategy for configuring space by producing theoretical understandings about how to create and use space configurations, with the research criteria being ease of achievement (accessibility) and ease of monitoring (visibility) in the Emergency Room of Toto Kabila Regional Hospital.

This method uses software known as Depthmap X. Depthmap The assessment analysis process that will be carried out on space theory in space syntax using the depthmap device involves analyzing the layout based on the arrangement of spatial relationships. These results will be displayed in the form of VGA (Visual Graph Analysis).

The data obtained is based on observations made in the field, measured directly, and produced with the assistance of fellow medical officers. The primary data used in the research is the floor plan of the Toto Kabila Regional Hospital emergency room; secondary data is in the form of theoretical studies that are relevant to the problems studied. The instrument for this research is Depthmap X software version 0.3. Depthmap software is part of the space syntax technique for measuring space configuration.

According to Hillier & Hanson (1986), space syntax is a research method for understanding space configuration and how to build generalized patterns of relationships between these spaces. The concept of visibility has a close relationship with movement in a spatial configuration.

3. Results and Discussion

The analysis conducted consists of two categories: visibility analysis, which involves examining visual observations of things within the emergency room to determine the range of mobility for patients or medical staff.This stage presents the findings of the study of two sets of data, including the level of visibility and movement/accessibility in the emergency room at Toto Kabila Regional Hospital.

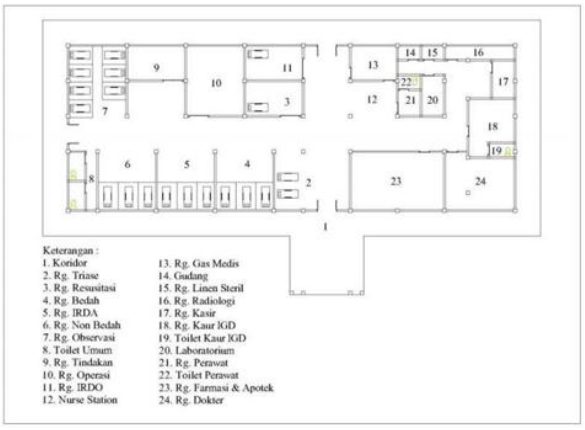


Figure 1. Floor Plan of RSUD Toto Kabila's Emergency Room
Source: Firdaus, 2024

Figure 2. RSUD Toto Kabila's Emergency Room - Nursing Area
Source: Firdaus, 2024

Figure 3. RSUD Toto Kabila's Emergency Room - Treatment Area
Source: Firdaus, 2024

Figure 4 depicts two distinct locations: point A represents the central corridor of the structure, while point B signifies the entrance to the emergency room section. The connection value at point A is significantly elevated. This implies that the nursing area has a centered visibility or range of supervision, whereas the visibility in the action room is comparatively lesser. Similarly, point B serves as the primary access point, facilitating convenient coverage from both external and internal sources.

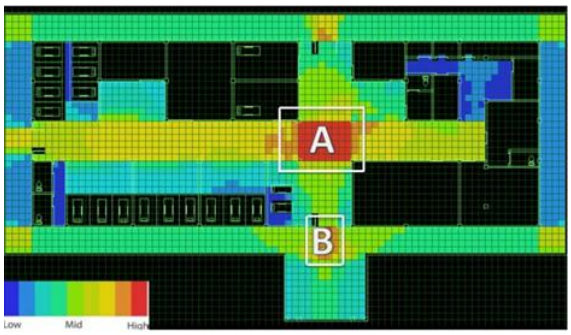
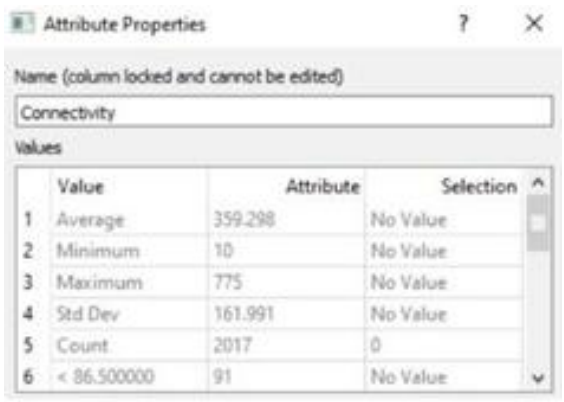


Figure 4. Visibility of RSUD Toto Kabila
Source: Firdaus, 2024



	Value	Attribute	Selection
1	Average	359.298	No Value
2	Minimum	10	No Value
3	Maximum	775	No Value
4	Std Dev	161.991	No Value
5	Count	2017	0
6	< 86.500000	91	No Value

Figure 5. The Value of Connectivity Visibility in Emergency Room RSUD Toto Kabila
Source: Firdaus, 2024

The use of depthmap x software allows for the calculation of connection and visibility values. Specifically, it provides the maximum, minimum, and average values of the measured plan. According to **Figure 5**, the numbers mentioned result in an average connectivity value of 359,298, with a minimum of 10 and a maximum of 775. An investigation of the simplicity of monitoring the depthmap software employing nurse station points, which include medical workers such as nurses, midwives, and doctors, was conducted.

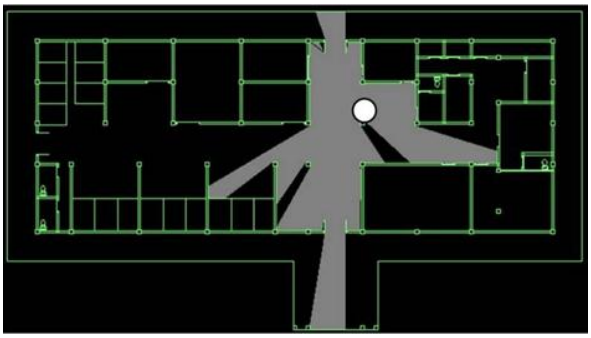


Figure 6. Central Visibility in The Nurse Area at RSUD Toto Kabila
Source: Firdaus, 2024

The emergency room at Toto Kabila Regional Hospital provides adequate visibility, enabling nurses to closely monitor and manage patients' conditions upon their arrival at the emergency room. Movement analysis, also known as integration measurement, is a technique used in depthmap analysis to assess the level of movement integration in objects. This analysis produces two-dimensional models and provides parameter values as output.

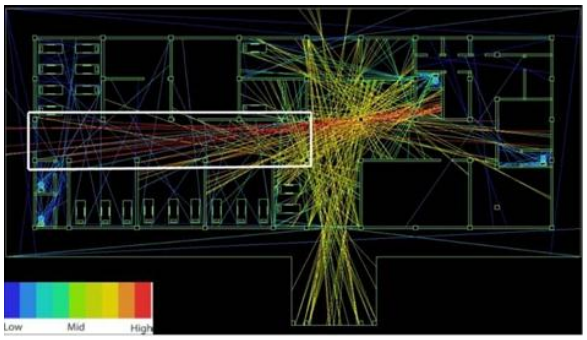


Figure 7. The Movement at RSUD Toto Kabila
Source: Firdaus, 2024

During the movement stage, depicted in the picture above, a line is generated in the corridor that possesses a significant level of integration. This phenomenon arises due to the deliberate displacement of several areas, including the operation, monitoring, pediatric, surgical, and non-surgical rooms.

Figure 8. The Value of Movement Integration at RSUD Toto Kabila
Source: Firdaus, 2024

The utilization of depthmap x software for movement measurement yields integration data, specifically the maximum, minimum, and average values of the measured plane. The calculated values indicate that the average movement value is 2.29738, the minimum value is 1.454217, and the maximum value is 4.43867.

The aforementioned results are the product of axial graph analysis, a method that entails examining the boundaries of objects' movement using depthmap software. Based on the analysis results, the red line represents a high value, while the blue line indicates a low value in enclosed places like doctor's rooms, pharmacies, and similar locations.

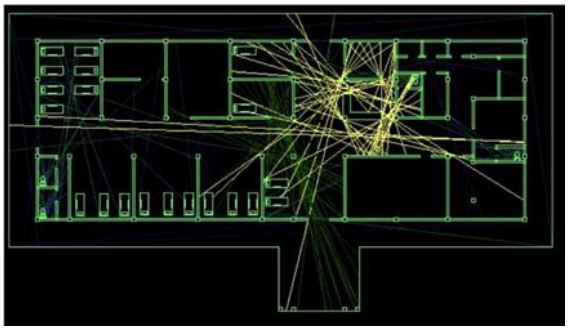


Figure 9. Centre Accessibility in The Nurse Area at RSUD Toto Kabila
Source: Firdaus, 2024

The image illustrates that this hospital features an easily accessible nursing space for newly admitted patients. However, the patient control phase is hindered by a wall, impeding the nurses' freedom of movement to effectively monitor and manage the patients. Accessibility, namely the ease of movement between rooms inside a building, is crucial for efficient services in the emergency department. It is essential for quick and efficient access from one area to another. Visibility, which refers to the ease of observing different areas within a structure, is crucial for effective monitoring of services in the emergency department.

4. Conclusion

In terms of the conducted research, the spatial arrangement effectively offers a comprehensive understanding of the areas within the research subject. This enables the collection of data on the accessibility and visibility in the emergency room at Toto Kabila Regional Hospital. This research seeks to elucidate how the spatial arrangement of the object being examined aligns with the criteria for facilitating accessibility and observation or supervision, with the ultimate goal of generating a high-quality IGD. An effective emergency room is one that is capable of delivering prompt and accurate assistance. The emergency room at Toto Kabila Regional Hospital is easily accessible, but, patient visibility or supervision is hindered by obstructive barriers.

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References

Alkano, R. Y. P. (2016). Inovasi Kualitas Pelayanan Kesehatan Instalasi Gawat Darurat di IGD RSUD Dr Iskak Kabupaten Tulungagung.

Azwar, A. (1996). *Menjaga Mutu Pelayanan Kesehatan*. Jakarta: Pustaka Sinar Harapan.

Derya, Aslan, J. &, Koken, B. (2016). Evaluation of the Space Syntax Analysis in Post-Strengthening Hospital Building. *Architectural Research* 6 (4), 88-97.

Frieke, Eugene Kawatu. (2020). Analisis Space Syntax dari Bangunan Rumah Sakit Setelah Perkuatan Terhadap Gempa. *Engineering Education Journal*, 8 (10), 1-5.

Hati, I. P. (2019). Analisa Peforma Tata Ruang dan Sirkulasi Menggunakan Metode Space Syntax. Thesis, Yogyakarta: Universitas Islam Indonesia,

Hiller, B., & Hanson, J. (1986). The Social Logic of Space. *Journal Lanscape and Urban Planning*. Vol 13

Musliha. (2010). *Keperawatan Gawat Darurat*. Yogyakarta: Nuha Medika

Nazir, M. (2014). *Metode Penelitian*. Bogor: Ghalia Indonesia

Romiko. (2012) Faktor-Faktir yang Berhubungan dengan Lama Waktu Tunggu Pasien di IGD RS Muhammadiyah Palembang. Jurnal Aisyiyah Medika. Vol 2

Haq, Saif, & Yang, Luo. (2012). Space Syntax in Healthcar Facilities. Herd Health Environments Research & Design Journal. Vol 5 (4), 98-11