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Redesign Process with Failure Mode and Method Effect Analysis on Emergency Installation Patient Services Emergency (Study on Home Emergency Installations) Majalaya Regional Public Hospital

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Abstract
The achievement of Universal Health Coverage in Bandung Regency has made it easier for public to access health services, including Emergency Department (ED), which implicate high occupancy of inpatient beds at the end prolonged boarding time at ED. Data from Majalaya General Hospital show that 47% of patients spend more than six hours in ED before being transferred to inpatient wards. Longer boarding time correlates to high mortality rate, increase length of stay, dan high number of patients admitted to the ICU therefore it have to reduce clinical and non-clinical risks. This proactive risk reduction is carried aout by redesigning the process using Failure Mode and Effect Analysis (FMEA). Data is collected by observation, brainstorming and documented in a worksheet. These data help to determine risk priorities (based on Risk Priority Number or RPN) that will be prioritized using Pareto Analysis. There are 7 processes and 26 sub processes at boarding time. From 26 sub processes there are 37 potential failure modes and 12 failure modes are prioritized. Root cause analysis was conducted for these priority risks, followed by process redesign in healthcare services. Redesign are done by using electronic prescription, bell for pharmacist, reminding of safety patient for each hand over, and always look the medical record if any adding instruction. The RPN before intervention was compared to the RPN after intervention using Wilcoxon Test, which resulted in a Z-value -3.070 and a significance of 0.002 (<0.05). It can be concluded that there is significant difference in RPN results before and after FMEA.

Keywords: ED, Boarding Time, FMEA, RPN

1. Introduction

In the current era of National Health Insurance, the hospital business is becoming more competitive. The government is trying to create Universal Health Coverage in Indonesia to be achieved by 2023. The government wants all Indonesian people get their health insurance without exception. The public wants a quality hospital, has low or free costs for National Health Insurance participants, and has fast service. This creates an opportunity for hospitals to improve quality, reduce costs, and fast service. However, sometimes this makes hospitals excessive in providing services so that they incur high costs for the hospital.

The government through the Ministry of Health pays close attention to the issue of service and quality of Hospitals in Indonesia. In Government Regulation Number 47 of 2021 concerning the Implementation of the Hospital Sector Article 27 paragraph (1) Letters b and g, hospitals must maintain and improve the quality of service to patients. The Minimum Hospital Service Standards are stipulated through the Minister of Health of the Republic of Indonesia Number: 129/Menkes/SK/II/2008 concerning Minimum Hospital Service Standards. By complying with these Standards, Hospitals can find out the extent of their service quality and can implement strategies to improve quality or quality that is not yet appropriate.

A hospital is a health service institution that provides comprehensive individual health services that provide inpatient, outpatient, and emergency services. Hospitals can be static, mobile, or field. Hospitals are also divided into

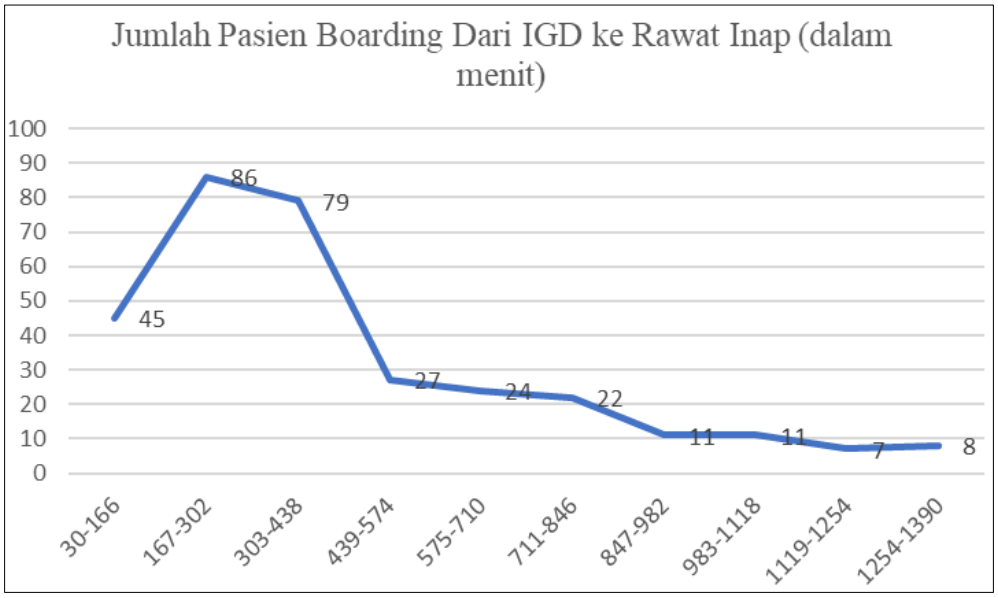
General Hospitals and Special Hospitals. Majalaya Regional General Hospital is a Regional General Hospital owned by the Bandung Regency Government by implementing the Full Financial Management Pattern of the Regional Public Service Agency. Majalaya Regional General Hospital is a Class B General Hospital.

During this pandemic, Majalaya Regional General Hospital was designated as a Referral Hospital for the Management of Certain New Emerging and Re-Emerging Infectious Diseases through the Decree of the Governor of West Java. The hospital provides inpatient, outpatient, and emergency services. The emergency unit is a part of the hospital that provides initial treatment for patients suffering from illnesses and injuries that can threaten life. The emergency unit is one of the entry points for patients who will be hospitalized.

Patients who enter the hospital's ER certainly need fast and precise help so that it is necessary to have standards for providing emergency services according to the competence and capabilities of its resources. For this reason, emergency services are carried out 24 hours a day, 7 days a week. However, in the era of National Health Insurance, where many people who used to be afraid to go to the hospital because of the current costs, all those who have National Health Insurance facilities visit the Emergency Installation, both in emergencies and emergencies or not.

Patients who enter the Emergency Room must go through a process that has been determined by the Hospital based on standard operating procedures. Patients must be stabilized first so that they can be continued to the inpatient room. In addition to being admitted to inpatient care, patients can also be referred to other hospitals for certain reasons or can be sent home because they do not require hospitalization. In general, the length of time that can be accepted in the Emergency Room is 6 hours. The 6-hour time in the Emergency Room is still acceptable before the patient is admitted to the inpatient room.

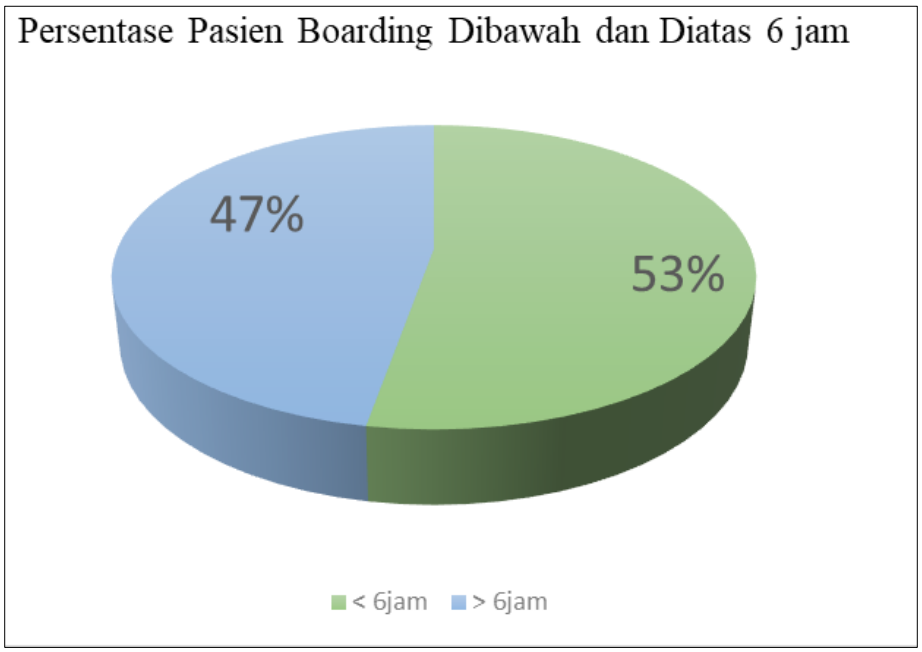
During the National Health Insurance period, many patients visited the Emergency Room, both in urgent and emergency situations or not. This caused crowding in the ER. The cause was the high number of visits, as well as the stagnation of patients who had indications for hospitalization. The main cause was obstruction at the exit of the ER, whether the patient who was going to go home or the patient who was going to enter the inpatient room. This had a negative impact on the patient themselves which could lead to increased patient morbidity and also patient mortality due to inadequate treatment in the ER. Majalaya Regional Hospital already has bed management, but it is considered not optimal due to the long process and the need to confirm the correctness of bed management directly to the inpatient room. The high boarding time for inpatients in the ER of Majalaya Regional Hospital can be seen from observations during the period of April 2022.



Source: Majalaya Regional Hospital 2022

Fig 1: Number of patients based on boarding time. The X-axis is the length of time. boarding in minutes, Y-axis is the number of patients admitted to inpatient care.

From Figure 1.2 Number of patients based on boarding time above, it can be seen that there are still many patients who are detained in the Emergency Installation for more than 6 hours. Where 151 of 320 patients entered the inpatient room for more than 6 hours (47%) as shown in the figure below.



Source: Majalaya Regional Hospital 2022

Fig 2: Percentage of Patients Boarding for Inpatient Care Below and Above 6 Hours.

The average time it takes for a patient to enter the inpatient room is 7 hours and 22 minutes. This is a problem that must be addressed considering that the Emergency Room is a place where many patients come in and out, including emergencies and emergencies. This can cause further problems where there are limitations in conducting further patient observations and the possibility of extraordinary events that can occur at any time and the Emergency Room must be ready to receive these patients.

Information obtained from the Head of Medical Services Division of Majalaya Regional General Hospital, interventions have been carried out to prevent the accumulation of patients in the Emergency Room, including (1) the addition of inpatient rooms on the 4th Floor of the Alamanda Building with 58 beds, the Dahlia room with 28 beds, the intensive room with 6 beds to 22 beds; (2) there are no special hours for inpatients to return home so that patients can go home at any time; (3) Flexibility in inpatient rooms, for example, internal medicine patients can be treated in the surgical room except for child patients who are not together with adults, infectious patients who are not together with non-infectious patients. After several interventions above were carried out, the Emergency Room patients still piled up due to the high number of visits.

Regulation of the Minister of Health of the Republic of Indonesia Number 80 of 2020 Concerning the Hospital Quality Committee Article 2 states that Every Hospital is required to implement quality governance. Quality governance to improve the quality of the Hospital can be done by implementing risk management. One of the risk management that can be done is using Failure Mode and Effect Analysis (FMEA).

Failure Mode and Effect Analysis method is one of the proactive risk analysis where the organization anticipates failure during the process. FMEA method is very appropriate as a problem solving approach in this study because the study shows that there is a relationship between long patient boarding time and patient mortality rate. This is because the FMEA method aims to reduce the risk in each process or subprocess in the service provided. As we know that long boarding time has implications for longer and more services, so that each process and subprocess of service has more risks. So this FMEA method is very appropriate to be able to reduce the risk of service received by patients.

Based on the background description above, the author is interested in conducting a study entitled Process Redesign Using the Failure Mode and Effect Analysis Method on Boarding Time for Emergency Room Patients: A Study at the Emergency Room of Majalaya Regional General Hospital.

2. Methods

This research approach uses a quantitative research method with a case study method at the Emergency Installation of the Majalaya Regional General Hospital which was conducted on 1065 populations and a sample was taken using the Slovin Formula of 320 patients. Data collection techniques used in this study were observation, brainstorming, and documentation. This type of research uses quantitative descriptive research because researchers want to see the effect of FMEA on reducing risk and reducing IGD boarding time. This study uses the operational research method.

3. Results

Data Normality Test Results Normality test is a statistical test used to test whether the observed quantitative data has a normal distribution or not. Normality test is important to ensure that the observed data meets the assumptions required by several statistical analysis methods. The criteria for normal data are if the sig value is ≥ 0.05, while if sig is ≤ 0.05 then it is not normal.

Table 1: Results of RPN Data Normality Test Before and After FMEA

	Kolmogorov-Smirnov[a]			Shapiro - Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
RPN Lama	,326	12	,001	,813	12	,013
RPN Baru	,230	12	,081	,859	12	,048

Source: Processed Data (2024)

From the table above, it is found that sig ≤ 0.05, namely 0.013 and 0.048 and the variable is less than 30, so the data is not normally distributed. Test ResultsWilcoxon The Wilcoxon test is used to see the effectiveness of the Failure Mode and Effect Analysis method in reducing the risk of boarding time for IGD patients. In this study, the Wilcoxon test is used to compare and see the differences between the Old RPN and New RPN data. The criteria for changes are if the sig value is ≤ 0.05, while if sig ≥ 0.05, there is no change after the process redesign using FMEA.

Table 2: Wilcoxon Test Results

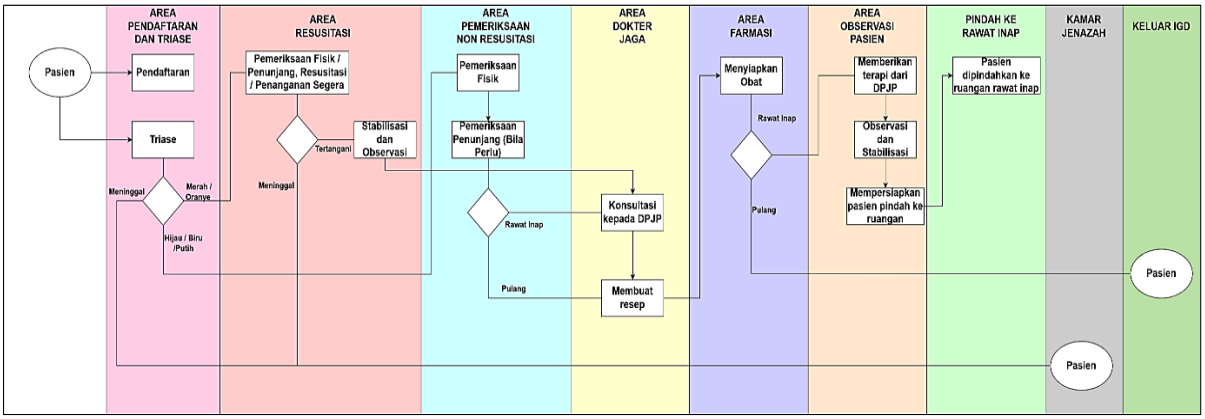
	RPN Lama – RPN Baru
Z	-3,070[b]
Asymp. Sig. (2-tailed)	0,002

Source: Processed Data (2024)
a. Wilcoxon Signed Ranks Test
b. Based on positive ranks.

Based on the test results tableWilcoxonRPN shows that the calculated Z is -3.070 and the Asymp. Sig. (2-tailed) value is 0.002. A negative Z-count value means that the direction of the difference is smaller than the previous value and moves away from the number 0. A sig. value of 0.002 or less than 0.05 can be concluded that there is a significant difference in RPN results between before and after FMEA is carried out.

4. Discussion

The research was conducted from February 2024 to July 2024. This research was conducted based on the research algorithm and worksheets provided. The results of the research are as follows: The flow of patient service processes from entering the Emergency Installation to placement in the inpatient room at Majalaya Regional General Hospital is as follows:



Source: Processed Data (2024)

Fig 3: Patient Service Process Flow at Majalaya Hospital Emergency Room

From the picture above, it can be seen that patients who come to the ER must first go through a triage process. The triage used in the ER of Majalaya Hospital uses the Australasian Triage Scale system. After the triage category is determined, the patient is placed in a predetermined place. For patients in the red and orange categories, patients are immediately given treatment carried out in the resuscitation room or directly in the observation room. These patients are immediately examined and treated in an emergency room. If the patient is treated, the patient is continued for stabilization and observation. Then patients in the Green, Blue, or White categories are placed in a place in the room according to the category and then a physical examination and supporting examinations are carried out if necessary. In this category, patients who are hospitalized are consulted with a specialist doctor and then the doctor on duty makes a prescription as with patients who are declared not to need hospitalization. Furthermore, officers at the pharmacy depot prepare the medicine. Medicine for patients who go home is given to the patient's family and medicine for inpatients is prepared and placed in the place provided. Patients who are hospitalized are then given further or additional therapy from the Doctor in Charge of the Patient for further observation and stabilization. After the patient is stable and the room is ready to receive Preparations are made for transferring the patient to the inpatient room, after which the patient is transferred to the inpatient room.

The high-risk process in the ER service from the time the patient enters until he/she is discharged to the inpatient room is when the patient is determined to be hospitalized until the patient is discharged to the inpatient room. This is because there are many processes and subprocesses that are risky for the patient. In addition, this process is also a service that takes the longest time compared to other services. According to data, 43% of patients in the ER experience a boarding time of more than 6 hours. From these high-risk services, there are processes and sub-processes that are carried out, namely:

a. Conduct patient consultation with the Doctor in Charge of the Patient.
b. The doctor prescribes therapy from the patient's responsible physician.
c. Pharmacists prepare medication.
d. Providing therapy from the Doctor in Charge of the Patient.
e. Observing and stabilizing the patient's condition.
f. Preparing the patient to move to the inpatient room.
g. Transferring patients to the room

Risk analysis of failure modes is carried out, prioritizing failure modes, conducting root cause analysis, so that a process redesign is obtained which will be implemented with the following results:

a. Conduct risk analysis

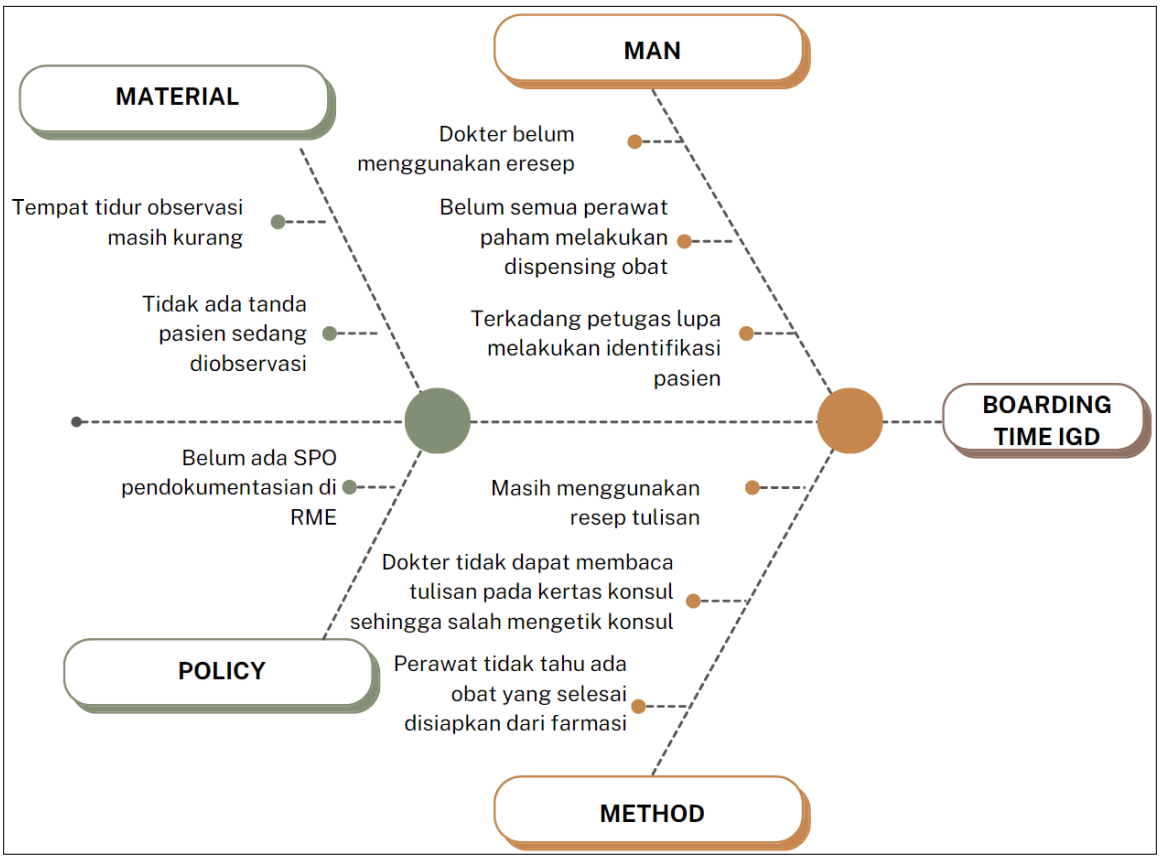
At this stage, the team brainstorms potential failure modes and the impacts these failures could have.

b. Prioritize failure modes

At this stage, sorting is carried out from the highest RPN value to the lowest RPN value. After that, analysis was carried out using Pareto analysis. The author and the FMEA team have carried out a priority assessment and Pareto analysis with the following results (Pareto diagram can be seen in appendix 5 of this research).

c. Conduct root cause analysis

Root cause analysis according to the framework of thought is carried out using fishbone analysis. In this fishbone analysis, the FMEA team conducted brainstorming and found that the elements of Man, Method, Material and Policy are the root cause of the failure mode that has the potential to occur in the service process during boarding time at the Emergency Installation of Majalaya Hospital. By determining this root cause, it will be determined what process redesign will be carried out to reduce the risk that may occur during the boarding time of patients at the Emergency Installation. The results of the root cause analysis can be seen in the image below:



Source: Processed Data (2024)

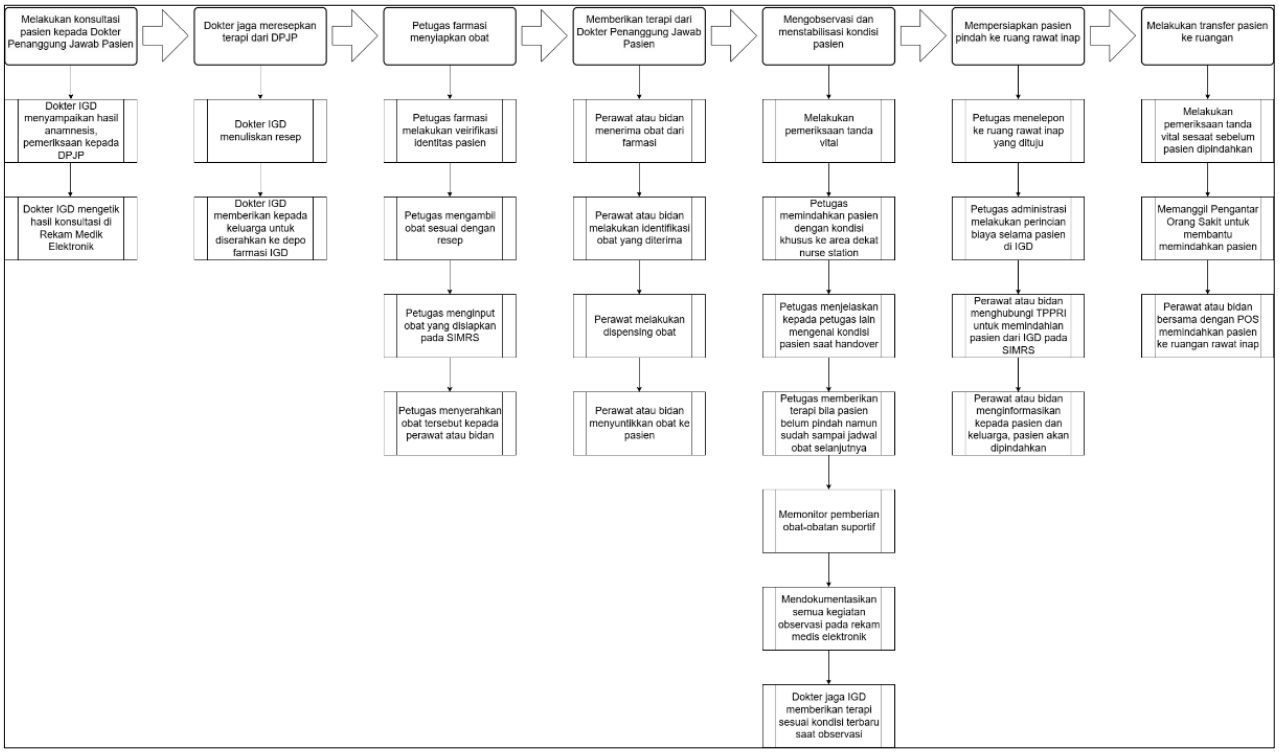
Fig 4: Fishbone diagram of root cause of IGD boarding time

d. Conduct process redesign

The next step in the research framework is to redesign the process from the results of the root cause analysis above. From each failure mode, a redesign or management recommendation is given to reduce the risk during the boarding time of IGD patients. The process redesign that can be applied to IGD services to reduce the risk of IGD services is

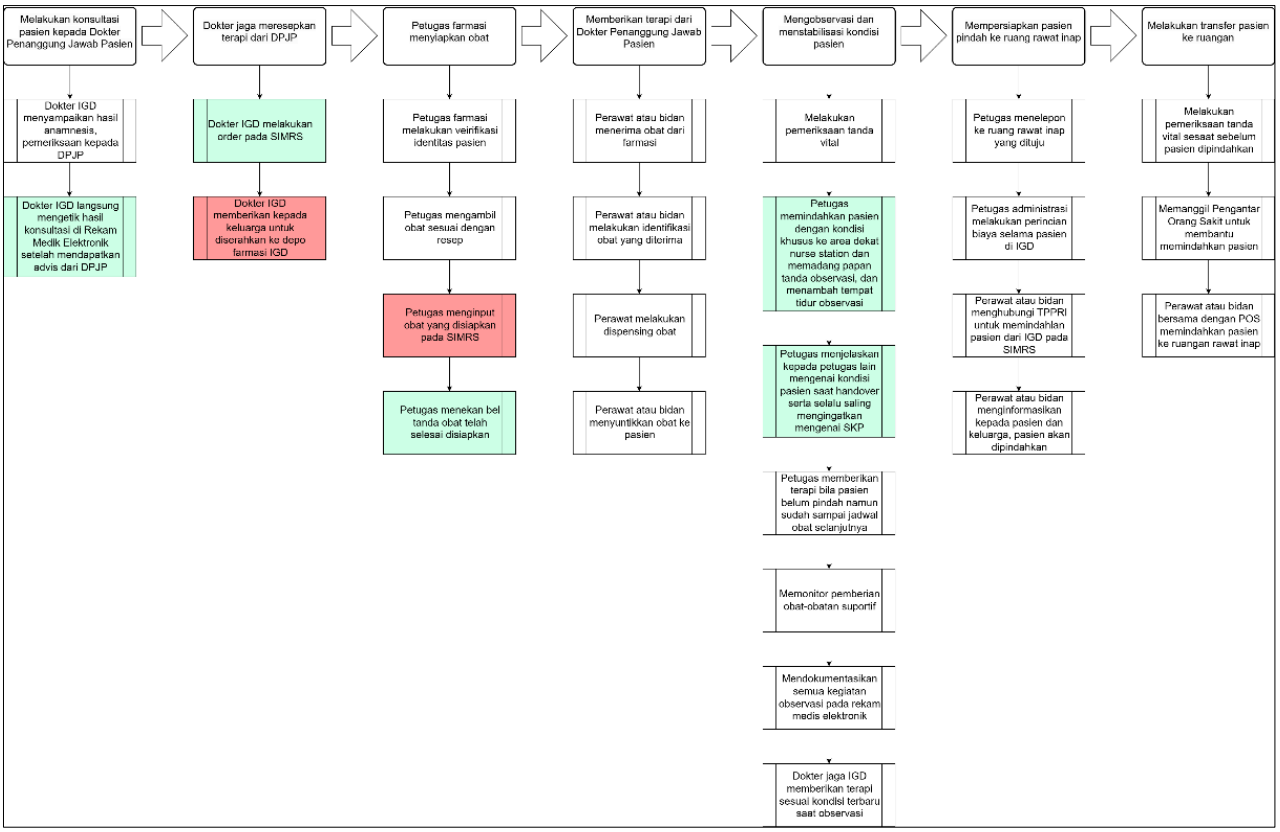
- Use of Electronic Prescriptions, this is because by using electronic prescriptions there are three failure modes that can be handled significantly to prevent the risks that may arise.
- Addition of pharmacist bell process. This is done so that nurses know that the prescribed medication has been prepared and can be given to the patient.
- Providing a sign "Observation Patient" on the patient's bed that is being observed. This aims to ensure that officers know and do not miss observing patients who need it.
- Remind the patient of specific patient identification and the six general patient safety goals each time they perform a handover.
- Whenever there is additional therapy, the doctor on duty must provide information to the nurse and ask the nurse to be able to read it directly from the Electronic Medical Record.

The process before and after the redesign that has been achieved in this research can be seen in the image below:



Source: Processed Data (2024)

Fig 5: Process and subprocess before redesign



Source: Processed data (2024)

Fig 6: Processes and subprocesses after redesign

5. Conclusion

The research conducted from February to July 2024 at Majalaya Regional General Hospital analyzed the patient service flow in the Emergency Room using the Australasian Triage Scale. The study identified high-risk processes during patient boarding, especially from hospitalization decision to transfer to inpatient rooms, with 43% of patients experiencing boarding times over six hours. Through Failure Mode and Effect Analysis (FMEA), root causes related to Man, Method, Material, and Policy were identified. Process redesign recommendations, including electronic prescriptions, pharmacist bell alerts, and improved communication, were

proposed to reduce risks and enhance service efficiency, aiming to improve patient safety and reduce boarding times.

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