THE INTERNATIONAL JOURNAL OF BUSINESS & MANAGEMENT

The Implementation of Waste Assessment Model for the Sustainable Improvement of IGD Services in the Era Covid-19: A Case Study for IGD Services Rsia Cinta Kasih

NidaKhoiriah
Student, Department of Hospital Administration Management,
Esa Unggul University, Jakarta, Indonesia
Nofi Erni
Lecture, Department of Industry Engeenering,
EsaUnggul University, Jakarta, Indonesia
Anastina Tahjoo
Lecturer, Department of Hospital Administration Management,
EsaUnggul University, Jakarta, Indonesia

Abstract:
The COVID-19 pandemic has resulted in changes to the emergency service flow. Changes in the flow of emergency services can result in a long service time, causing a build-up of patients. Meanwhile, the accumulation of patients in the COVID-19 era facilitated the transmission of infection to other patients and workers. Waste identification using the Waste Assessment Model (WAM) Lean hospital could be a solution to reduce the accumulation of patients in the ER so as to prevent the transmission of infection transmission to either patients or workers. Descriptive analysis with qualitative methods carried out through observation to 45 maternal patients who will be hospitalized and in-depth interviews and giving an eight-waste relationship questionnaire to 14 experts, found that the critical waste of emergency services at RSIA CintaKasih is a waste of human skills by 15.5%. In the context of continuous improvement, the principles of administrative control for COVID-19 with the formation of the COVID-19 Team, Guidelines for Emergency Services in the Covid-19 Era and continuous outreach to hospital workers are recommendations for the continuous improvement of emergency services at RSIA CintaKasih in the era of COVID-19.

Keywords: *Era of COVID-19, Accumulation of Patients, Waste Assessment Model (WAM) Lean Hospital*

1. Introduction

The COVID-19 pandemic creates new life for all sectors, such as health, government and business. All health protocols must be made into new habits every day, such as using masks, washing hands, taking a shower after leaving the house, carrying a hand sanitizer, and bringing their respective worship equipment. For the health area, the hospital is required to re-design the service flow of all units in the hospital to maintain patient safety as well as health personnel serving patients. Hospitals need to prepare tighter safety procedures where massive sterilization must be carried out in every corner of the hospital. The admission procedure will also undergo changes including the universal use of masks, stricter screening procedures ranging from screening for COVID-19 symptoms to rapid examinations such as rapid tests, use of visit schedules, and restrictions on visitors / patient companions and even separation of facilities for COVID-19 and non-COVID-19 patients.

In the era of COVID-19, based on the latest regulations from WHO, the IGD is required to be more selective in accepting patients. Screening patients must be rapid but also very selective. The IGD must first separate ARI (Acute Respiratory Infection) and non-ARI patients before entering the hospital area which is called the primary triage area. If after screening in the primary triage, the patient is proven to have ARI then the patient must be screened for COVID-19 in the secondary triage according to existing guidelines, such as laboratory tests, chest X-rays, and rapid tests and even CT Scan Thorax and PCR Swab for hospitals that are available after it is proven not to be COVID-19, new patients can be transferred to non-ARI emergency rooms but if otherwise the patient must be immediately put into an isolation room or sent home to carry out independent isolation and monitored by the department local health (HIPGABI, 2020). With the new IGD service flow, it will have an impact on increasing patient waiting time and can lead to patient stagnation.

Patients who experience stagnation in the IGD are closely related to the incidence of patient accumulation in the IGD (*emergency department crowding*). According to the *Australian College for Emergency Medicine (2019)* defines *Emergency Department Crowding* as a condition in which the function of the emergency department is hampered mainly because the number of patients waiting to be seen, undergoing examination and treatment, or waiting to be transferred, exceeds the capacity of the bed and / or the capacity of emergency personnel. So, crowding is a condition in which the

demand for emergency care is greater than the ability of the resources owned by the service provider (IGD / RS) so that patients have to wait /stay longer than the set target time to get service or be transferred to the inpatient unit. This condition results in a '*bottle neck*' phenomenon for patients leaving the emergency room and causes congestion for new patients coming to the IGD.

Crowding conditions have a negative impact on all stakeholders, both patients, officers and hospitals. Patient safety is a major focus because it is associated with quality of care and an increase in medical errors in the IGD in crowding conditions. In a study by Claire Morley etal. (2018), which was summarized from several previous studies, the impact of the Emergency Crowding Department was divided into three impacts, namely the impact on patients, the impact on staff, and the impact on the hospital system. The accumulation of patients in the ER has become a global hospital problem, including hospitals in Indonesia. CintaKasih Hospital, Ciputat is one of the hospitals that also experiences these problems every day. *Lean Management*is one of the best solutions from operational management to improve hospital service flow to eliminate non-value-added waste and turn it into value added. According to Ivy Cheng (2016), the solution in preventing overcrowding in the must IGD be from 4 areas, namely input areas such as doing Telehealth, throughput areas such as forming a special triage team, output areas such as carrying out discharge planning properly, and also system areas such as running *Toyota Lean* or *Lean Management*. According to Graban (2016) in his book Lean Hospital, the third edition defines that Lean is a set of tools (tools set), management systems and methodologies that can change hospitals in managing and managing so as to reduce errors, reduce waiting times, remove all obstacles and support the activities of doctors and employees that aimed at improving the quality of service and patient care.

1.1. Emergency Service Standards in the Era of COVID-19

The Emergency Room, which is the first public area to be visited by patients, is the main focus in controlling safety. The Royal College of Emergency Medicine (2020) recommends emergency service standards with 5 main bases, namely:

- The Emergency Room (IGD) must be a sterile place from nosocomial infections so that it can protect patients;
- The Emergency Room (IGD) should not experience a congestion of patients or their families;
- The entire hospital area should not be too crowded;
- The emergency room must be designed according to standards to maintain patient safety;
- The Emergency Room (IGD) must also be a safe place for both medical and non-medical workers.

WHO (World Health Organization) on 25 May 2020 issued a PPI strategy to prevent and limit the risk of transmission of COVID-19 infection which consists of:

1.1.1. Carry out Standard Precautions for All Patients

Standard precautions, in this case is always washing hands, doing and teaching patients how to cough / sneeze ethics, using PPE according to the risk of contact and droplet transmission, practicing safe injections, managing sharp objects and preventing wounds safely, handling, cleaning, and disinfection of patient care equipment safely, cleaning the environment, carrying out safe handling and washing of used linen, and proper waste management.

1.1.2. Conducting Triage, Knowing Early on the Possibility of COVID-19 and Isolating COVID-19 Patients

Use of clinical triage in health care facilities for the purpose of early identification of patients with acute respiratory infections (ARI) to prevent the transmission of pathogens to health professionals and other patients.

1.1.3. Take Additional Empirical Precautions (Droplet, Contact, Airborne Precautions)

- *Contact precautions:* provide patient services with the principle of a single room so that the patient stays in the room, performs hand hygiene with 5 moments, uses the appropriate PPE (robes, masks and gloves), performs equipment cleaning (decontamination), and performs environmental cleaning.
- *Droplet prevention measures:* carry out 5 moment hand hygiene, provide single room service for patients or separate patients from other patients at least 1 meter away, health workers use appropriate PPE (surgical mask, eye / face mask), and patients must remain in the room (limited movement);
- *Air transmission prevention measures (in the context of COVID-19)*: all steps involved in preventing contact and droplets. It's just that, the mask used is the N95 mask.

1.1.4. Perform Administrative Control

This activity is the first priority and the PPI strategy includes the provision of infrastructure policies and procedures to prevent, detect and control infections during health care. Activities will be effective if carried out starting from anticipating the flow of patients from the first time they arrive to leaving health care facilities. Important steps in administrative control include early identification of the patient, implementing prompt and precise preventive measures, and controlling the source of infection.

1.1.5. Carry out Environmental and Engineering Controls

These activities are carried out, including in the infrastructure of basic health care facilities and in households that treat patients with mild symptoms and do not require hospital care. This activity is aimed at ensuring that adequate environmental ventilation in all areas within health care facilities as well as in households, as well as adequate environmental hygiene. Haru is maintained at a minimum distance of 1 meter between each patient and other patients, including health workers (if not wearing PPE).

1.2. Lean Hospital

Lean is defined as thin (lean). Lean is defined as a set of tools (tools set), management systems and methodologies that can change the organization in managing and managing so as to reduce errors, reduce waiting times, remove all obstacles and support the activities of doctors and employees aimed at improving the quality of service and patient care (Graban, 2016).

Waste of defect	Providing inappropriate health care, the first time it takes time and materials to fix it. Serious mistakes in the hospital can cause disability and even death of the patient. This improper service can be caused by wrong processing, misinformation and errors that involve many people, such as errors when taking the patient's blood, or the nurse not checking the dose of medication given to the patient.
Waste of overproduction	Production or supply of products that do not match patient demands, for example returning drugs to pharmacies
Waste of transportation	Unnecessary transfers of patients or products in the system, for example registration counters and services are not side by side, so patients need a long time
Waste of waiting	The period of time that causes patients / products / employees to be unable to carry out activities in the next step
Waste of inventory	Related to the tools, equipment, and materials available in excess
Waste of motion	Movement of employees who are not required to do work, such as nurses who have to walk far to carry out examinations on patients
Waste of over processing	Perform activities that are more than the patient's needs, such as taking large blood specimens for centrifugation
Waste of human skills	In connection with the motivation and psychological conditions of employees in carrying out work, for example, employees who are forced to do work will not give optimal results

Table 1: Types of Waste Lean Hospital

The application of Lean principles according to Graban (2016) in the third edition of Lean Hospital, consists of two parts, namely:

1.2.1. Total Elimination of Waste

Waste, youth or waste are all activities that do not help the patient's healing process. All waste must be eliminated or minimized in order to reduce hospital costs, increase patient satisfaction and improve patient and employee safety. Examples of waste that often occurs in hospitals are as follows:

- Wait time for the patient to be examined by the doctor
- Wait time for the patient for the next stage
- There are errors that endanger the patient
- Unnecessary movements, for example, where pharmacies and cashiers are far away

1.2.2. Respect of People

Respect is to motivate employees to do their job better and more constructively. Respect of people has a broad meaning, how leaders are committed and trust their employees to participate in helping solve problems and reduce waste, motivating employees to care more about patients and the hospital environment without them feeling bored and forced, building cooperation between executive employees and management, so that there is no assumption that management manages the system, solves problems, makes decisions, while implementing employees only carry out instructions.

The Lean method has specific rules for determining activities that add value (value added), important activities but do not provide value (necessary non-value added), and those that cannot add value (non-value added). The rules or criteria for value added activity are as follows:

- Customers must be willing to pay for all these activities;
- These activities must be able to transform a product or service in a form; and
- These activities must be done correctly from the first time they are done.

If the activity does not meet the three criteria above, it is a non-value-added activity.

1.3. Waste Assessment Model (WAM)

Waste Assessment Model (WAM) which consists of a Waste Relationship Matrix (WRM) and a Waste Matrix Value (WMV). This model has the advantage of a simple matrix and a questionnaire that covers many things and is able to contribute for achieving accurate results in identifying the relationship between existing waste and also the causes of waste (Rawabdeh, 2005).The principle of using the Waste Assessment Model (WAM) is on the waste relationship in Lean Manufacturing which focuses on Seven Waste Relationship. All wastes depend on each other, influence and are influenced. The relationship between wastes is indeed very complex because the influence of each waste can appear directly or indirectly. The relationship between one waste and another can be symbolized by using the first letter in each waste (Rawabdeh, 2005). O for overproduction, I for inventory, D for defect, M for motion, P for process, T for transportation and

W for waiting. And at Lean Hospital plus one, namely S for skills. The following is the relationship between waste that has been described by Rawabdeh (2005) on Lean Manufacturing.

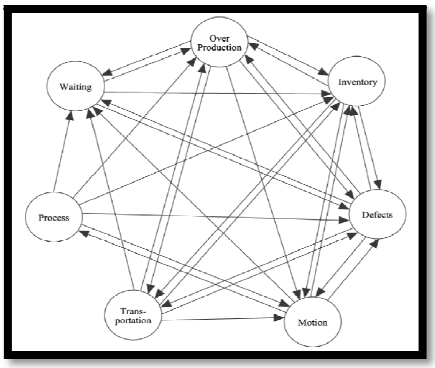

Figure 1: Seven Waste Relationships on Lean Manufacturing

In this study, researchers developed a theory of the relationship between the waste owned by Lean Hospital which consists of eight wastes, of which the eight are waste of skills / talent / potential. Researchers consider that the waste of skill / talent / potential also has a strong relationship between other wastes. This is because if a hospital cannot form job satisfaction for its employees or misplaces employees in units that do not match their potential, other waste will appear in every flow of the hospital service process. Thus, the Eight Waste Relationship was formed as follows:

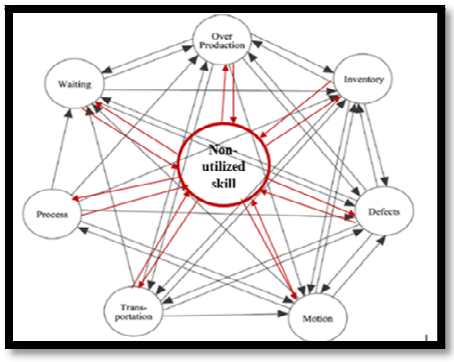

Figure 2: Eight Waste Relationships in Lean Hospital

The total relationship affecting this amounted to 44 relationships between types of waste *i* affect the types of waste *j* (*i_j*). Then asked six questions with a scoring guide with each answer having a weighting range of 0-4, where the relationship between waste is symbolized using the first letter for each waste (Rawabdeh, 2005).

No.	Waste	Answer Options	Score
1.	Did i produce j?	a. Always b. Sometimes c. Rarely	4 2 0
2.	What kind of relationship is i to j?	a. If increases then j increases b. If increases then j remains c. Not necessarily, depending on the circumstances	2 1 0
3.	Impact on i due to j?	a. Looks straightforward and clear b. It took time to show up c. Doesn't show up often	4 2 0
4.	Removing the impact i against j by means ...	a. Hospital Operational Methods b. Simple and direct c. Instructional solutions	2 1 0
5.	The impact of i on j mainly affects…	a. Service quality b. Resource Productivity *c. Lead Time* *d.* Quality and Productivity *e.* Quality and Lead Time *f.* Productivity and Lead Time *g.* Quality, Productivity and Lead Time	1 1 1 2 2 2 4
6.	How much impact i on j will increase the lead time	a. Very high b. Moderate	4 2

		c. Low	0

Table 2: Waste Relationship Matrix (WRM) Questions

The six questions above will be asked for each relationship or waste so that there is a total of 264 (44 relationships x 6 questions). The scores obtained from the six questions for each relationship between the waste are then totaled to obtain the total value for each relationship. The total value is then converted into a symbol of the strength of the relationship (A, I, U, E, O, and X) by following the conversion rules shown in table 2 below:

Range	**Type-Relationship**	**Symbol**
17-20	*Absolutely necessary*	A
13-16	*Especially important*	E
9-12	*Important*	I
5-8	*Ordinary closeness*	O
1-4	*Unimportant*	U
0	*No-relation*	X

Table 3: Score Conversion Score to WRM Letter Symbol

The conversion results are then used again to calculate the level of influence of each type of waste to other types of waste with values A = 10, E = 8, I = 6, O = 4, U = 2, and X = 0. This calculation will be summing up and the value of the effect level is known which is written in units (%) or known as the waste matrix value. After the results in (%) appear, the largest waste is chosen to be used as critical waste to find the root of the problem.

1.4. Fishbone Diagram

Fishbone diagram or also known as cause and effect diagram is a structured approach that is possible to carry out a more detailed analysis in finding the causes of a problem, discrepancies, and gaps that occur (Arini T, 2017). The functions of the *fishbone diagram* are:

- Summing up the causes of variation in process
- Identify categories and subcategories of causes that affect a particular quality characteristic.
- Provide instructions regarding the types of data that need to be collected.

The fishbone diagram structure consists of a head and bones. The head represents the problem to be solved and the bones contain the causes of the problem which are grouped into six parts, namely man, measurement, method, material, machine, and environment.

2. Methodology

This research type is case and field study with a qualitative descriptive analytic research design. The research data were collected through participatory observation of 45 emergency room (IGD) patients with inclusion criteria, namely maternal patients, patients who would be hospitalized, and experienced no severity when observed. After making observations, researchers confirmed through in-depth interviews and gave questionnaires to 14 expert respondents on emergency services (IGD). Researchers also obtained data by looking at the patient's medical records, and some existing policies in the research location.

The research location was the IGD RSIA CintaKasih and several related units related to the ER (IGD) such as laboratories, EDP (entering patient data), inpatient administration and cashiers. The study was conducted in July-August 2020 on emergency room patients who were advised to be hospitalized until the patient moved to the inpatient room on morning, afternoon, and night shifts. Data analysis was carried out by identifying critical waste with the Waste Assessment Model (WAM). The critical waste found is analyzed the causes of the problem with the Fishbone Diagram and then the recommendations are determined based on the results of in-depth interviews.

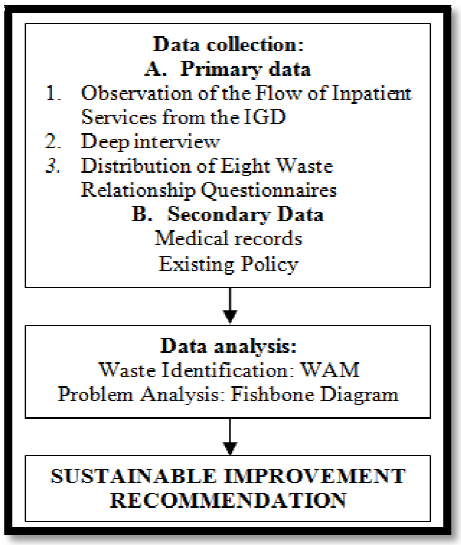

Figure 3: Research Flow

3. Analysis Data and Result

Since RSIA CintaKasih was designated as a PONEK Referral Hospital in the South Tangerang area in 2018 the number of IGD visits has always increased. From 2018 to 2019 the number of patient visits increased every year with the number of visits per day as many as 16 patients in 2017, 18 patients in 2018, and 23 patient visits in 2019. Meanwhile, based on 2020 monthly data from January to July, it can be concluded that after the COVID-19 pandemic that entered Indonesia in March 2020, the number of patient visits has decreased significantly. However, if we take a look at the distribution based on specialization, from the total number of patient visits that have decreased, the number of maternal patients who visited the IGD RSIA CintaKasih and were hospitalized was still the highest number compared to the other four specialties. This is evidenced by the distribution report of inpatients from the IGD 2020 from January to July, with the following details:

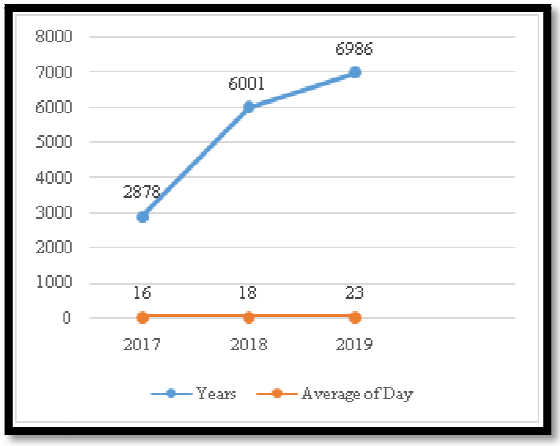

Figure 4: Data of Emergency Patient Visits at RSIA Cinta Kasih 2017-2019

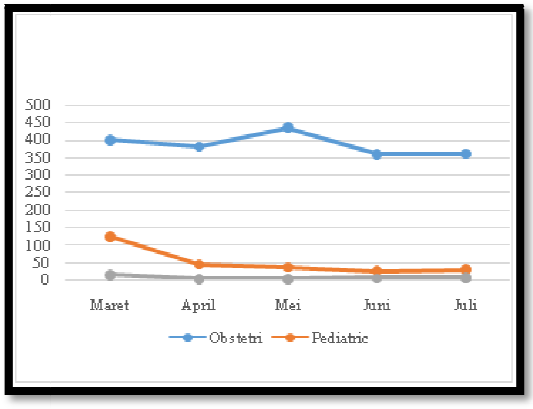

Figure 5: The Top Three Largest Numbers of Patients Inpatient from the ER After COVID-19

IGD RSIA CintaKasih not only serves true emergency patients but also serves other false error patients such as medical check-up patients for employees and general polyclinic which takes place from 08.00-21.00 WIB. The main cause of the congestion at that time is the result of the mixing of true emergency and false emergency patients. The mixing of false emergency and true emergency patients is basically not in accordance with the 2012 Ministry of Health's decision in the Emergency Services Guidelines which states that false emergency patients should enter the 24-hour polyclinic area. The WHO (World Health Organization) itself on May 25, 2020 issued a standard to prevent and limit the risk of transmission of COVID-19 infection which consists of conducting primary triage of patients to separate infectious and non-infectious patients, then isolation of infectious patients must be carried out immediately until proven the patient is non-infectious (non-COVID-19).

In accordance with the Covid-19 Patient Service Guidelines in the IGD by HIPGABI 2020 which stated. The primary triage study focuses on the patient's initial complaints coming to the ER and a history of contact with a COVID-19 patient or a history of going to a place where COVID-19 is indicated before the patient enters the hospital service unit. However, in the research observations it was found that emergency patients with ATS 1-4 levels (pregnant women who had heartburn, rupture of membranes, pregnant women with severe pre-eclampsia, and discharge) were not subjected to primary triage for screening. The new triage was carried out in the IGD unit. This happened because the emergency room for pregnant women was not separated from the general emergency room. This was confirmed by the results of in-depth interviews with the head of the IGD. Based on the results of in-depth interviews with the head of the ER, said that this happened because there was no primary triage room to screen patients and their families of patients who entered the ER, the absence of a clear Guidelines for Emergency Services RSIA CintaKasih in the era of COVID-19, no special team to screen patients and families of emergency room patients, and no routine socialization of service standards in the era of COVID-19. In the absence of primary triage before entering the emergency room and screening for COVID-19 in the emergency room, the lengthy duration of emergency service at RSIA CintaKasih has resulted in stagnation of patients, which eventually leads to overcrowding in the emergency room.

In addition to the causes explained by the head of the IGD above, the cause of errors in the emergency service standards of the CintaKasih Hospital in the COVID-19 era also occurred because of waste. The dominant waste in the calculation of the Waste Assessment Model (WAM) is waste of human skills. In the analysis of the eight-waste relationship matrix (table 5), it was found that the waste of human skills is the critical waste that causes errors in ER patient service standards in the COVID-19 era with a value of 15.5%. Followed by a waste of overproduction of 14.4%, and a waste of over processing of 13.9% (table 5).

Waste of human skills / talent / potential, namely related to the motivation and psychological conditions of employees in carrying out work, not utilizing employee creativity, inappropriate employee placement, not supporting staff to develop their careers, and ignoring staff skills and talents (Graban 2016, Firman, 2019). Based on the modification of the waste relationship matrix, the waste of human skills / potential / talent is closely related to generate another seven wastes in service. So, waste of human skills must be eliminated and recommendations for continuous improvement are found to improve emergency services in the era of COVID-19.

Based on the results of problem analysis using the fishbone method, it is known that the root cause of the problem of the emergence of waste of human skills in the inpatient service flow of the ER in the COVID-19 era is as follows (Figure 6):

- The number of human resources in emergency services in the COVID-19 era is lacking;
- The emergency service policy for emergency patients in the COVID-19 era does not comply with the protocol set by the Ministry of Health and WHO;
- Unclear patient care policies in the COVID-19 era
- The flow of patient care in the COVID-19 era is not well socialized to patients and workers; and
- Work safety culture towards employees and patients is still lacking.

So, based on the causes of the problems above, recommendations for continuous improvement for Emergency Hospital CintaKasih in the Era of COVID-19 are the making of guidelines for Emergency Services at RSIA CintaKasih in the era of COVID-19, guidelines for PONEK services in the era of COVID-19, running COVID-19 screening for patient's ER before the patient enters, and forms a COVID-19 Team.

4. Conclusion

Based on the research results, it is concluded that in the era of COVID-19, waste elimination in handling is not the main thing in service quality. Emergency services must prioritize the safety of workers and patients. So that lean hospital in hospital development can be used in reducing unnecessary services in order to prevent accumulation of patients in the hospital.

5. References

i. Andrianto, W, et al. Analysis of Lean Production Process Application to Reduce Engine Maintenance Process Lead Time (Case Study of PT. GMF Aeroasia). Jakarta: Journal of Industrial System Optimization, Vol. 14 No. 2, October 2015: 299-309

ii. American College of Emergency Physicians. 2018. Advancing Emergency Care: Policy Statement; Definition of Boarded Patient. National Voluntary Consensus Standard for Emergency Care

iii. Cheng, Ivy, s. 2016. Emergency Department Crowding And Hospital Patient Flow: Influential Factors And Evidence Informed Solutions. From the Department of Clinical Science and Education, SödersjukhusetKarolinskaInstitutet, Stockholm, Sweden

iv. Gasperz, V, 2010. Integrated Performance Management System Balanced Scorecard With Malcolm Baldridge and Lean Six Sigma Supply Chain Management Examples of Implementation in Business and Government Organizations. Jakarta: PT GramediaPustakaUtama.

v. Graban, M., (2016). Lean Hospitals: Improving Quality, Patient Safety and Employee Engagement, 3rd Edition., New York: CRC Press

vi. RI Minister of Health Decree No. 856 / Menkes / SK / IX / 2009. INSTALLATION STANDARD EMERGENCY (IGD) HOSPITAL

vii. Ministry of Health. 2012. Technical Guidelines *Emergency Room Hospital Building*. Jakarta: Directorate of Medical Support Services and Health Facilities, Directorate of Health Efforts, Ministry of Health RI

viii. Kurniati, Amelia., Et al. 2020. Guidelines for Emergency Nursing Services during the Covid-19 Period. Jakarta: HIPGABI (Indonesian Association of Emergency and Disaster Nurses

ix. Rawabdeh, IA 2005. A model for the assessment of waste in job shop environments. International Journal of Operations & Production Management. 800-822.

x. Sugiyono. 2011. Quantitative Research Methods, Qualitative and R & D. Bandung: Alfabeta.

xi. Theryoto, et al. 2017. Implementation of Lean Thinking to Reduce Boarding Time of Emergency Room Patients to Hospitalization at Koja Hospital in 2017. Jakarta: ARSI Journal

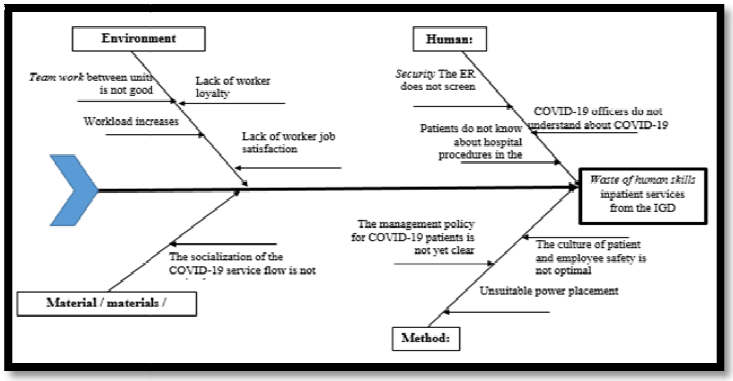

Figure 6: Analysis of the Causes of Problems in Critical Waste of Human Skill Based on In-Depth Interviews with the Head of the IGD

EIGHT WASTE RELATIONSHIP

No.	EWR	KODE RESPONDEN														Total Keseluruhan	Rata-Rata	Konversi
		R.001	R.002	R.003	R.004	R.005	R.006	R.007	R.008	R.009	R.010	R.011	R.012	R.013	R.014			
1	O_I	16	15	15	10	15	4	14	15	12	1	9	11	9	9	153	11	I
2	O_D	16	20	13	11	12	10	9	16	15	5	12	7	9	12	162	12	I
3	O_M	17	14	11	4	5	5	5	15	9	10	14	10	10	11	145	11	I
4	O_T	16	14	7	15	15	16	9	14	13	13	13	11	9	15	192	13	E
5	O_W	14	16	5	16	15	14	12	16	14	13	15	13	13	16	193	14	E
6	O_S	12	15	14	11	11	12	9	12	16	14	17	11	9	11	174	12	I
7	I_O	11	15	15	20	7	12	16	15	5	9	9	16	13	15	177	13	E
8	I_D	9	12	15	10	9	9	9	13	11	5	7	9	4	17	134	10	I
9	I_M	15	12	11	15	4	11	7	10	11	5	4	10	4	9	127	9	I
10	I_T	16	14	14	9	9	9	13	10	13	9	2	9	10	9	127	9	I
11	I_S	11	12	12	9	7	10	14	17	11	13	12	9	7	7	147	10	I
12	D_O	16	14	16	2	9	9	16	16	16	16	16	9	13	7	162	12	I
13	D_I	9	14	17	14	9	9	13	9	4	9	9	7	9	9	126	9	I
14	D_M	16	14	15	9	9	7	15	9	15	9	9	13	12	12	169	12	I
15	D_T	16	14	14	9	7	12	13	13	15	13	13	12	10	15	182	13	E
16	D_W	17	16	16	16	9	14	12	15	13	9	9	15	14	16	192	13	E
17	D_S	12	15	15	9	9	9	15	16	13	15	14	11	14	15	195	13	E
18	M_I	12	12	13	14	7	9	6	17	7	15	15	14	10	9	156	11	I
19	M_D	15	14	11	15	9	12	10	12	13	10	10	15	12	12	185	13	E
20	M_W	16	12	11	17	9	14	12	14	16	11	12	16	10	16	192	14	E
21	M_S	15	12	20	15	12	14	9	16	17	15	17	15	9	15	204	15	E
22	T_O	15	16	11	12	9	13	7	15	12	9	9	9	9	9	142	10	I
23	T_I	16	16	15	14	9	9	10	15	14	7	9	10	7	9	157	10	I
24	T_D	11	16	11	9	9	9	15	14	17	9	7	13	9	15	167	12	I
25	T_M	17	16	12	9	12	15	11	17	14	11	11	9	9	15	174	12	I
26	T_W	12	16	14	15	14	17	13	14	16	9	9	17	7	16	188	13	E
27	T_S	14	14	9	9	9	10	9	15	15	12	12	9	12	12	145	11	I
28	P_O	15	16	13	9	9	15	10	9	13	9	9	9	13	9	149	10	I
29	P_I	7	14	15	10	4	9	9	14	7	2	9	14	7	9	117	8	O
30	P_D	11	14	17	13	12	9	9	11	17	7	7	13	10	15	161	11	I
31	P_M	17	16	17	12	12	10	14	15	17	9	9	12	10	11	182	13	E
32	P_S	12	16	17	9	10	9	12	16	16	14	14	11	15	13	192	13	E
33	P_W	15	16	10	17	12	9	17	13	15	10	12	15	10	12	184	13	E
34	W_O	9	14	11	13	12	9	9	17	13	12	12	13	10	9	148	10	I
35	W_I	9	10	10	4	9	9	4	10	10	9	9	9	7	2	95	9	O
36	W_D	11	12	15	9	9	12	15	17	17	9	9	14	7	13	177	13	E
37	W_S	12	12	15	9	12	13	13	14	17	14	14	15	7	12	179	12	I
38	S_O	12	12	11	15	9	9	9	9	15	9	9	10	7	11	148	10	I
39	S_I	12	12	13	9	7	9	9	9	9	11	11	12	12	4	138	10	I
40	S_W	14	14	13	13	14	13	9	17	17	15	15	13	14	17	204	15	E
41	S_M	15	15	15	14	15	11	9	15	15	13	13	15	15	15	201	14	E
42	S_T	17	14	12	9	9	9	11	14	15	10	10	7	9	13	164	12	I
43	S_D	15	16	15	16	14	12	9	11	13	15	15	12	13	17	195	13	E
44	S_P	15	14	15	7	11	9	7	17	17	15	15	10	9	12	179	13	E

Table 4: Results of Analysis and Conversion of Eight Waste Relationship Matrix from 14 Respondents

From / To	O	I	D	M	T	P	W	S
O	A	I	I	I	E	X	E	I
I	I	A	I	I	I	X	X	I
D	I	I	A	I	E	X	E	E
M	X	I	E	A	X	X	E	E
T	I	I	I	I	A	X	E	I
P	I	O	I	E	X	A	E	E
W	I	O	E	X	X	X	A	I
S	I	I	E	E	I	E	E	A

Table 5: Result of Waste Matrix Value

From / To	O	I	D	M	T	P	W	S	∑	%
O	10	6	6	6	8	0	8	6	56	14.40%
I	6	10	6	6	6	0	0	6	40	10.30%
D	6	6	10	6	8	0	8	8	52	13.40%
M	0	6	8	10	0	0	8	8	40	10.30%
T	6	6	6	6	10	0	8	6	48	12.40%
P	6	8	6	8	0	10	8	8	54	13.90%
W	6	8	8	0	0	0	10	6	38	9.80%
S	6	6	8	8	6	8	8	10	60	15.50%
Total	46	56	58	50	38	18	58	58	388	100%

Table 6: Result of Conversion of Waste Matrix Value