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HOSPITAL MEDICAL WASTE MANAGEMENT MODEL BASED ON SOUTH SULAWESI PROVINCE

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ABSTRACT

Hospitals produce various types of waste and have certain sources of emissions and risks to patients and visitors. This study aims to determine the model of medical waste management by applying the Partial Least Squares (PLS) method. Quantitative research conducted observations and interviews with respondents using a questionnaire, aimed at making a static model of medical waste management to obtain data in the past or present, about opinions, characteristics, behavior, variable relationships and to test several hypotheses, sociological and psychological variables. The results showed that the HR variable had no effect (t = 1.333), the cost of influence (t = 2.206), the effect of equipment (t = 4.396), commitment had an effect (t = 5.781). Outer Model with data based on the Outer loading criteria > 5 with the highest correlation level on the HR extract indicator man power (0.906743), Extracting the cost of availability indicators (0.892116), extracting equipment availability indicator equipment (0.946571) and extracting commitment indicators for the implementation of waste management programs medical (0.918017). There is no need for human resources, there are influences of costs, equipment, and commitment to managing medical waste region based.

Keywords: Hospital, statistical model, partial least squares, management, medical waste.

INTRODUCTION

Hospitals are health care units for individuals, families and communities with the core medical services, both in terms of preventive, curative, rehabilitative, and promotive processes that are processed in an integrated manner to achieve optimal health services (Berkanis, 2010). Hospitals in Indonesia according to Indonesia's health profile from 2013 - 2016 are increasing every year. In 2014 there were 2,406 hospitals in Indonesia which increased to 2,776 in 2017 consisting of 2,198 General Hospitals (RSU) and 578 Special Hospitals (RSK) (Ministry of Health, 2018). As the number of hospitals increases, the amount of production of medical waste produced will also increase. Hospital waste has the potential to pollute the environment and can cause workplace accidents and disease transmission if hospital medical waste is not managed properly (Pertiwi et al., 2017).

Law Number 44 of 2009 concerning Hospitals classifies hospitals based on the type of services provided as general and special hospitals. The hospital as one of the health service sub-systems organizes two types of services for the community, namely health services and administrative services. Health services include medical services, medical support services, medical rehabilitation, and care services (Ministry of Health, 2017).

The quality of processed wastewater in hospital wastewater treatment plants (WWTPs) disposed of into the environment does not always meet the requirements in accordance with the quality standards permitted according to applicable regulations (Arif, 2018). The management of hospital medical waste in South Sulawesi has 4 hospitals or around 0.04% who have obtained permission from KLHK and the amount or production of waste reaches 10 tons per month to use the Incinerator. Basically all hospitals in the two provinces already have incinerators. However, due to the strict rules and requirements issued by the Ministry of Environment and Forestry, only a few obtained permission from the Ministry of Environment and Forestry (KLHK).

Control of waste control in hospitals is part of the government's efforts to prevent environmental damage and health problems. Waste control in hospitals is influenced by several factors (Shekdar, 2009).

Research Results at Regional Public Hospital (RSUD) dr. Moewardi conducted by Hapsari (2010), showed that the amount of medical waste generated was 240.6443 kg / day which was handled 219.5014 kg / day (91.214%) and unmanaged 21.1429 kg / day (8.786%) due to because there was no human resource planning for the waste management officer, while in the financial department of the hospital minimizing the use of the budget so that there was still an unmet need for waste management and procedures for implementing waste management in RSUD dr. Moewardi Surakarta is still not optimal (not in accordance with the standards set). In the results of the Yahar study (2011), in the Hospital Barru Regency showed that medical waste management was still not in accordance with Minister of Health Decree No.1204 of 2004. In the management of medical waste, sorting, landing, transportation, temporary shelter (TPS) and final disposal site (TPA) did not meet health requirements because sorting had not been done medical and non-medical waste.

Even though the container has been prepared according to the type of waste, the container is difficult to clean and emptied because it is not equipped with a plastic bag, the transportation process uses public lanes so that it disrupts hospital activities. The results of the research conducted by Sitepu et al., (2015), obtained data that the management of solid and liquid medical waste in Kabanjahe General Hospital did not meet the requirements in accordance with the Minister of Health Decree No. 1204 of 2004 concerning Hospital Environmental Health Requirements. The means for storing solid medical waste has no lid, not equipped with plastic bags and the color of the container does not match the type of waste. The transportation facilities used are not closed. Liquid medical waste is processed in WWTP with an Up Flow Filter system with the principle of work based on activated sludge, but effluent quality checks are not carried out before being discharged into the environment. In the research conducted by Utami (2017), that the management of solid medical waste at each clinic in the city of Makassar is still a small part still not in accordance with the management of medical waste according to the regulation of the environment minister.

In September 2018 in South Sulawesi Province cases were found, namely the disposal of B3 medical waste leading to the Garoppa River, Sawaru Village, Camba Subdistrict, which

borders the Bantimurung Bulusaraung National Park, including used syringes, used ampoules, used infusion plastic bottles, packaging medicine, used infusion hose, rubber gloves with blood spots, and blood sampling results.

Management of hospital wastewater is very important to secure the environment from disruption of pollutants caused by infectious wastes that are harmful to humans and the environment (Subekti, 2011). Liquid waste produced in the activities of Prof. RSJ Dr. Soerojo per day as much as 9.02 m3 added the dose of Poly Aluminum Chloride (PAC) in the coagulation bath before chlorination as much as 0.3 gr per day or depending on the volume of waste produced. Shows that it can reduce phosphate levels below the quality standard in Dr. RSJ wastewater. Soerojo Magelang with an efficiency of 43.69% (Andriani et al., 2017).

Based on the research conducted by Yulvizar (2009), it was found that the results of phenol measurements found a significant decrease between before and after processing and the results obtained after that were 0.020 mg / l fulfilling the specified quality standards, but the results of other parameter measurements were obtained. pH, BOD, COD and TSS do not meet the specified quality standards. Decreasing pH levels, BOD is thought to be due to the small amount of organic matter described, oxidized by microorganisms, in the COD parameter it is thought to result from lack of oxygen supply in aeration tanks and TSS levels thought to be due to the deposition process carried out during sampling.

The management of solid medical waste at the Kelet Regional General Hospital in Jepara Regency that there is still a lack of commitment of hospitals in the solid medical waste management system, all supporting facilities have not been fulfilled, the waste management and labeling stages have been carried out. Final disposal sites are not suitable and need change the sanitary landfill method. The supply of personal protective equipment is not in accordance with the Decree of the Minister of Health Number: 1204 / Menkes / SK / X / 2004 (Chandra, 2014).

Taking into account the condition of medical waste in hospitals, the number is increasing every year both throughout Indonesia and especially in South Sulawesi, while studies or research on hospital-based medical waste management are still very minimal, so based on these considerations researchers will conduct research on determining management models region-based hospital medical waste in South Sulawesi Province in 2019. The results of this analysis can be utilized by policy makers as an effort to manage medical waste completely in one province/regency/city so that it is the responsibility of the local government to manage medical waste. and can solve the problem of medical waste in the scope of each region. The purpose of this study is to determine the model of regional hospital-based medical waste management on South Sulawesi Province.

METHODOLOGY

Research design

The design of this study is a descriptive survey method with a qualitative approach. The research instruments were in the form of field observations, documentation and open and structured interviews. The location of the study in hospitals in the South Sulawesi Province in precisely the Regency / City of Makassar was 32 hospitals, Maros as many as 2 hospitals, Pangkep as many as 1 hospital, Barru as many as 1 hospital, Pare-pare as many as 3 hospitals, Pinrang as many as 3 hospitals, Bone as many as 4 hospitals, wajo as many as 2 hospitals, soppeng and Sinjai each with 1 hospital.

Population and Samples

The population in the study were all hospitals located in 9 regency / cities in the province of South Sulawesi. The research sample was conducted by purposive sampling (Lameshow et al., 1997). Sampling techniques based on the location of the city / district, type of hospital, hospital ownership. The number of hospital samples is 40 hospitals. Respondents from each hospital are Director / Head of Sanitation / B3 Waste Management Officer / Head of Occupational Health and Safety at the hospital.

Data collection

Data collection was carried out by observation, ie researchers conducted direct observations when the medical waste management officer at the hospital, interview, the researcher interviewed Director / Head of Sanitation / B3 Waste Management Officer / Head of Occupational Health and Safety at the Hospital. Interviews and observations using the question sheet of the hospital to answer questions related to HR, Cost, Equipment, Commitment and get an overview of the situation of Medical Waste Management in the Hospital and Documentation, namely by collecting data through the legacy of archives and including books about opinions, theories, laws and others related to research problems.

Data analysis

Data from interviews, observations, and data / reports from the parties involved in this study use Partial Least Suare (PLS) data analysis methods using SmartPLS software that is run on computer media. The reason for using Partial Least Squares (PLS) is because it does not assume the data must be of a certain scale measurement, which means the number of samples is small (below 100 samples) and the data is non parametric and more flexible. Partial Least Squares (PLS) is a variant-based structural equation (SEM) analysis which can simultaneously test measurement models while testing structural models. The measurement model is used to test validity and reliability, while the structural model is used to test causality (testing hypotheses with prediction models).

RESULTS

Sample Characteristics

With this analysis, it is intended to assess some general characteristics or general data of respondents and hospitals in the study location that are being observed, which are presented as follows:

Table 1. Distribution of Medical Waste Management Officers in South Sulawesi Provincial Hospitals

Characteristics	n	Percentage (%)
Gender		
a. Male	17	42,5
b. Female	23	57,5
Education		
a. High school equivalent	2	5,0
b. D1/D2/D3	6	15,0
c. D4 / Bachelor	28	70,0
d. Masters / Doctoral	4	10,0

Length of work		
a. <1 Year	4	10,0
b. 1-10 Years	30	75,0
c. 11-20 Years	5	12,5
d. 20-30 Years	1	2,5
Total	40	100

Source: Primary Data, 2019

From table 1. shows that the officers managing hospital medical waste in the Province of South Sulawesi are female sex higher than those of the male sex that is equal to 57.5%. Table 1. also shows that the officers managing medical waste in the hospital in this study were the most average level of education at the D4 / S1 level as many as 28 officers (70%) and the lowest at the high school / vocational education level as much as 2 officers (5%). For many years of work in the hospital, from 1-10 years there were 30 officers (75%) and the lowest 20-30 years as many as 1 officer (2.5%).

Table 2. Distribution of Volume of Solid Medical Waste in Hospitals South Sulawesi Province

No	Solid Medical Waste Volume (kg) per day	n	Percentage (%)
1	0 – 10	13	32,5
2	11 – 20	5	12,5
3	21 – 30	5	12,5
4	31 – 40	5	12,5
5	41 – 50	1	2,5
6	51 – 60	6	15,0
7	61 – 70	2	5,0
8	>71	3	7,5
Total		40	100

Source: Primary Data, 2019

Based on Table 2. shows that the volume of low solid medical waste produces solid hospital medical waste ranging from 0-10 kg per day, there are 13 hospitals (32.5%) and the highest produces a volume of solid medical waste above> 71 kg per day in 2 hospitals namely Lasinrang Hospital in Pinrang District produce solid medical waste of 155 kg per day and La Temmamala Hospital in Soppeng District produces 75 kg of solid medical waste per day from 40 hospitals studied.

Table 3. Distribution of Liquid Medical Waste Volume in Hospitals South Sulawesi Province

No	Liquid Medical Waste Volume (m3) per day	n	Percentage (%)
1	<1	11	27,5
2	1 – 20	13	32,5
3	21 – 40	4	10,0
4	41 – 60	5	12,5
5	61 – 80	2	5,0
6	>80	5	12,5
Total		40	100

Source: Primary Data, 2019

Based on Table 3. above, shows that the volume of liquid medical waste that produces the most liquid medical waste per day> 80 m3 per day there are 5 hospitals (12,5%) and the lowest produces a volume of waste <1 m3 per day there are 11 hospitals (27,5%) of the 40 hospitals studied.

Evaluation the Outer Model

To test convergent validity, use the value of outer loading or loading factor. An indicator is stated to meet convergent validity in a good category if the value of outer loading> 0.5. The following is the value of outer loading of each indicator in the research variable.

Table 4. Outer Loading, Data Processing Results

Variable	Indicator	Outer Loading
Cost (X1)	Availability of Funds	0.892116
	Budget Effectiveness	0.880885
HR (X2)	Education	0.495065
	Man Power / Power	0.906743
	Competence	0.855824
Equipment (X3)	Equipment Availability	0.946571
	Equipment Adequacy	0.734938
	Equipment Meets Requirements	0.251006
Commitment (X4)	Environmental Documents	0.827404
	Application of a Solid Medical Waste Management Program	0.918017
Medical Waste Management Hospital (Y1)	Arrangement	0.058348
	Collection and transportation	0.65937
	A temporary storage area	0.905378
	WWTP	0.741845

Source: Primary Data, 2019

Based on the data presented, it is known that each indicator of the research variable has an outer loading value of> 0.7. However, there are still some indicators that have an outer loading value of <0.7. According to Chin, as quoted by Ghozali (2008), the value of the outer loading between 0.4 - 0.6 is considered moderate to meet the convergent validity requirements. The data above shows almost all variable indicators whose outer loading value is above 0.4, so the indicator is declared feasible or valid for research use and can be used for further analysis. Unless there are two variable indicators whose outer loading value is below 0.4, that is, the Equipment Indicator Meets 0.25 Requirement and 0.05 Indikator.

Based on the results obtained, it can be stated that the indicators used in this study have good discriminant validity in preparing their respective variables. In addition to observing the value of cross loading, discriminant validity can also be known through other methods, namely by looking at the average variant extracted (AVE) value for each indicator, the value must be> 0.5 for a good model.

Table 5. Average Variant Extracted (AVE) Data Processing Results

Variable	AVE
Cost	0.785915
HR	0.599903
Equipment	0.499711
Commitment	0.763676
Medical Waste Management Hospital	0.452054

Source: Primary Data, 2019

Based on the data obtained, it is known that the AVE value of the cost variable, Human Resources, and Commitment> 0.5, this indicates that the cost variable, Human Resources, and Commitment in the model estimated to meet good discriminant validity criteria while equipment variable and hospital medical waste management AVE value <0.5 which is estimated to not meet good discriminant validity.

Composite Reliability

Composite Reliability is a part that is used to test the reliability value of indicators on a variable. A variable can be declared to meet composite reliability if it has a composite value of> 0.6 (Ghozali, 2014). The following are the composite reliability values of each variable used in this study:

Table 6. Composite Reliability, Data Processing Results

Variable	Composite Reliability
Cost	0.880121
HR	0.809393
Equipment	0.713328
Commitment	0.865692
Medical Waste Management Hospital	0.718451

Source: Primary Data, 2019

Based on the data in Table 6. above, it can be seen that the composite reliability value of all research variables> 0.6. These results indicate that each variable has met the composite reliability so that it can be concluded that the overall variable has a high level of reliability.

Cronbach Alpha

The reliability test with composite reability above can be strengthened by using the cronbach alpha value. A variable can be declared reliable or meets cronbach alpha if it has an alpha cronbach value> 0.7 (Andreas, 2010). The following is the cronbach alpha value of each variable:

Table 7. Cronbach Alpha, Data Processing Results

Variable	Cronbachs Alpha
Cost	0.727734
HR	0.696231
Equipment	0.522771
Commitment	0.698653
Medical Waste Management Hospital	0.468678

Source: Primary Data, 2019

Based on the data in Table 7, it can be seen that the cronbach alpha value of each research variable is only a cost variable with a value> 0.7 that meets the requirements of the Cronbach alpha value, while the other four variables are still <0.7 which do not meet the requirements. Thus it can be concluded that only the cost variable has high reliability while the other four variables do not.

Inner Model Evaluation

In this study, hypothesis testing used Partial Least Square (PLS) analysis techniques with the smartPLS 2.0 program. Testing the inner model or structural model is done to see the relationship between variables, significant values and R-Square from the research model. In this study will be explained about the results of the path coefficient test, and hypothesis testing. Based on the inner model scheme shown, it can be explained that the greatest path coefficient value is indicated by the effect of commitment to the management of hospital medical waste by 5,781. Then the second biggest influence is the influence of equipment on the management of hospital medical waste by 4,396, the third largest influence is the effect of costs on the management of hospital medical waste and Human Resources variable does not affect the management of hospital medical waste because the path coefficient value is 1,333 smaller than the value table 5% = 1.96.

The test results show that all variables in this model have a path coefficient with positive numbers. This shows that if the path coefficient value is greater on an independent variable on the dependent variable, the influence of the independent variables on the dependent variable will be stronger. And vice versa if the smaller the path coefficient value on one independent variable on the dependent variable, the weaker the influence between the independent variables on the dependent variable. Based on data processing that has been done using the smartPLS 2.0 program, the R-Square value is obtained as follows:

Table 8. R-Square Value, Data Processing Result

Variable	Value of R-Square
Medical Waste Management Hospital	0.565

Source: Primary Data, 2019

Based on the data in Table 4.7 above, it can be seen that the value of R-Square for the variable management of hospital medical waste is 0.565. This shows the magnitude of the diversity of the research data which can be explained by the research model of 56.5%.

Hypothesis Test

Processing data that has been done shows that, the results can be used to answer the hypothesis in this study. Hypothesis testing in the study was carried out by looking at the value of T-Statistics and the value of P-Values. The research hypothesis can be accepted if P-Values <0.05 (Sofyan & Heri, 2011). The following are the results of hypothesis testing obtained in this study through the inner model:

Table 9. Based on the results of T-Statistics and P-Values data processing

Hypothesis	Influence	*T-Statistics*	*P-Values*	Results
H1	Human Resources => Management of hospital medical waste	1,333	0,10	Rejected
H2	Cost => management of hospital medical waste	2,206	0,030	Accepted
H3	Equipment => management of hospital medical waste	4,396	0,000	Accepted
H4	Commitment => management of hospital medical waste	5,781	0,000	Accepted

Source: Primary Data, 2019

Based on the data in table 4.8 above, it can be seen that out of the four hypotheses proposed in this study, there are three acceptable hypotheses because each of the effects shown has a P-Values value <0.05. So that it can be stated that exogenous to endogenous variables have a significant effect. And there is one hypothesis rejected because the influence shown has a value of P-Values> 0.05. So it is stated that the HR variable does not have a significant effect on the management of regional hospital-based medical waste in South Sulawesi Province.

Based on the results of statistical tests using PLS that the effect of the human resource variable (HR) on the management of hospital medical waste is obtained by the Statistical T-value of 1.333 and P-Values using the T test with a value of 0.10. This value is smaller than t

table (1,960). This result means that the variable human resources (HR) does not affect the management of hospital medical waste. This means that the hypothesis (H1) is rejected. Based on the results of interviews and observations conducted in the field it is not appropriate from the results of Partial Least Square (PLS) data analysis, the level and quality of education of the officers responsible for managing medical waste in hospitals varies. Where the level of education of officers ranging from high school to master degree but educational qualifications there are several hospitals that manage their waste outside of environmental health workers and some even do not have environmental health workers.

Speaking of relationship analysis, the following are some of the results of previous research related to Human Resources (HR) variables, research conducted by Nursamsi et.al (2017), in research that states that factors (knowledge, attitudes, facilities and infrastructures) that affect the largest number of officers in the management of solid medical waste in the Community Health Center (Puskesmas) in Siak Regency was less knowledge of 59.1% and high knowledge of 40.9%. The same thing with the research conducted by Komang (2012), states that there is a significant relationship between the knowledge of nurses and the implementation of medical waste management $\alpha = 0.037$, knowledge of cleaning service with implementing medical waste management $\alpha = 0.010$. There is a significant relationship between the attitude of the nurse officer and the implementation of medical waste management $\alpha = 0.010$, and there is a significant relationship between the attitude of the cleaning service and the implementation of medical waste management $\alpha = 0.035$. The results of the research conducted by Sitepu et al., (2015) stated that the management of solid and liquid medical waste in Kabanjahe General Hospital was under the Head of the Facilities / Infrastructure Section.

The results of statistical tests using PLS show that the effect of the cost variable on the management of hospital medical waste is obtained by the statistical T-value of 2,206 and P-Values using the T test with a value of 0.030. This value is smaller than t table (1,960). This result means that the cost variable influences the management of hospital medical waste. This means that Hypothesis (H2) is accepted.

Based on the results of interviews and observations conducted in the field according to the results of Partial Least Square (PLS) data analysis, indicating that the availability of costs is a problem in the management of hospital medical waste. Starting from the cost of procuring equipment such as safety boxes, plastic bags, the cost of examining samples and the high cost of third-party transporters being a burden for hospitals, especially hospitals in the area because of the long distance.

Based on the facts in the field, there are several hospitals in the area that do not have a special budget plan for the management of hospital medical waste, both the maintenance and replacement of damaged equipment, especially in the WWTP. But most hospitals in both public and private areas mostly only use the budget from the Regional Public Service Agency. This result is in line with the research conducted by Islamey (2006), in Paru Jember Hospital consisting of procurement costs, maintenance costs, consumables, inspection fees, and transportation costs.

This result is in line with the research conducted by Aulia (2012), in his research stating that factors (sorting, collecting, storing, transporting and destroying) against medical waste affect the Public Service Agency of the Regional General Hospital Dr. Zainoel Abidin Banda. Each hospital should have an annual budget specifically for medical waste management so

that if there is equipment damage to the WWTP it can be replaced or repaired as soon as possible so that the WWTP can function according to its function, payment to third party transporters is not overdue for the transporter time according to the schedule of the agreement stated in the MOU between the Hospital and the Transporter Party. Hospitals should specify the costs incurred in managing waste, so that it can be easier to track these costs according to needs.

The results of statistical tests using PLS show that the effect of equipment variables on the management of hospital medical waste is obtained by the statistical T-value of 4,396 and P-Values using the T test with a value of 0,000. This value is smaller than t table (1,960). This result means that equipment variables have an effect on the management of hospital medical waste. This means that the hypothesis (H3) is accepted. Based on the results of interviews and observations in the field, the availability of equipment such as garbage containers, plastic bags, transportation equipment (trolleys, carts), safety boxes are available but the numbers are lacking and some are inadequate transportation equipment.

Speaking of relationship analysis, here are some of the results of previous research related to equipment variables, a study conducted by Nursamsi et.al (2017), states that incinerators that do not yet exist and are inadequate transport equipment also affect the process of managing health centers' solid medical waste. This question will affect the processing of solid medical waste and transport equipment is also a determining factor in the success of the management of solid medical waste at the Puskesmas. Commitment influences the management of hospital medical waste.

The results of statistical tests using PLS indicate that the effect of the commitment variable on the management of hospital medical waste is obtained by the Statistical T-score of 5.781 and P-Values using the T test with a value of 0,000. This value is smaller than t table (1,960). This result means that the commitment variable influences the management of hospital medical waste. This means that the H4 hypothesis is accepted.

Based on the results of interviews and observations in the field, the commitment of the hospital in terms of document reporting, monitoring of waste and the regularity in transporting solid medical waste to third parties in some hospitals is still lacking. The results of this study are in line with the research conducted by Chandra (2014), which states that there is still a lack of commitment of hospitals in a solid medical waste management system, all supporting facilities have not been fulfilled, the stages of waste management and labeling have been carried out. Training, immunization, health checks and records have not yet been carried out.

Outer model describes the relationship between specification (variable) and indicators. Correlation of all constructs with valid and reliable indicators because all variables have an outer loading> 0.5. HR extract with indicators (Education, man power, competence) the highest correlation is man power (outer loading 0.906743). Extracting costs with indicators (availability, effectiveness) with the highest correlation is Availability (outer loading 0.892116). The extraction of equipment with indicators (availability, adequacy, equipment meets the requirements) is the most correlated is the availability of equipment (outer loading 0.946571). As well as the correlation of commitment with indicators (environmental documents, application of medical waste management programs), the most correlated is the medical waste management program (outer loading 0.918017).

Inner hospital medical waste management model explains how much influence exogenous extracts/variables (HR, costs, equipment and commitment) have on endogenous variables (management of hospital medical waste). Three exogenous variables have a significant effect on endogenous variables because they have the path coefficient / T-statistic value> 2, except for the HR variable which does not significantly influence the Variable Management of home medical waste because it has a path coefficient value / T-Statistic <2.

CONCLUSION

Based on the analysis and discussion shows that there is no influence of Human Resources on the management of region-based hospital medical waste, there is an effect the Cost for the management of regional hospital-based medical waste, there is an influence on the management of regional hospital-based medical waste management, and there is an influence on commitment to management of region-based hospital medical waste.

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