Model statistic with program LISREL for medical solid infectious waste hazardous hospital Type B management in Medan City

To cite this article: Verawaty Simarmata et al 2018 IOP Conf. Ser. Earth Environ. Sci. 205 012002
Model statistic with program LISREL for medical solid infectious waste hazardous hospital Type B management in Medan City

Verawaty Simarmata¹, Setiaty Pandia² and Herman Mawengkang³

¹Doctor Program Graduate at Natural Resources Management and Environment of Universitas Sumatera Utara, Indonesia.
²Department of Natural Resources Management and Environment, Universitas Sumatera Utara, Indonesia.
³Department of Mathematics and Department of Natural Resources Management and Environment, Universitas Sumatera Utara, Indonesia.
e-mail: verawatysimarmata@yahoo.co.id and Phone (+62-812-6416-6188), setiatypandia@yahoo.com, hmawengkang@yahoo.com

Abstract. The occurrence of medical solid waste could be from the results of treatment activities, such as, in the treatment room for a hospital inpatient, general clinic, a dental clinic, a mother and child clinic, laboratories and pharmacies. Most of the medical solid waste contains infectious and hazardous materials. Therefore it should be managed properly, otherwise it could be a source of new infectious for the community around the hospital type B as well as for health workers themselves. This paper proposes a model for managing the medical solid waste in hospitals in Medan city, in order to create healthy environment around hospitals. Health development in Indonesian aims to achieve a future in which the Indonesian people live in a healthy environment, its people behave clean and healthy, able to reach quality health services, fair and equitable, so as to have optimal health status, health development paradigm anchored to the healthy. The healthy condition of the individual and society can be influenced by the environment. Poor environmental quality is a cause of various health problems. Efforts surveillance of various environmental factors need to be applied in accordance with the principles of sanitation focuses on environmental cleanliness.

Keywords: medical solid waste, quality health services, health problems and environmental cleanliness.

1. Introduction
Hospital activities will generate a number of by-products in the form of waste, both solids, liquids and gases that contain pathogens, chemicals and medical equipment which are generally dangerous and toxic [1,2]. In order to improve the quality of services, hospitals type B should be able to cope with such waste [3,4]. As for the waste treatment facilities in the hospitals type B one of them is to use incinerators [5].

The problem of waste is a serious concern of the people and government of Indonesia, especially since the last decade, mainly due to the business development activities of the hospitals type B which is the backbone of economic development for Indonesia [6]. Waste management is a necessity for the preservation of human health and the environment in general [7]. However, the procurement and
operation of medical solid waste processing facility hospitals type B was still considered burdensome for the hospital with generally [8].

2. **Problem Formulation**

If the amount of waste collected quite a lot, it is necessary to increase the number of containers. Containers are usually are made from metal or plastic [9]. Medical waste category of medical waste can be classified based on the potential dangers of hanging in it, as well as the volume and persistence properties which cause problems [6] for example:

1. Waste sharp objects such as needles, intravenous equipment, pasteur pipette, broken glass, and others;
2. Infectious waste, has a sense as waste associated with patients who require isolation of infectious diseases (intensive care) and laboratory waste [10];
3. Waste pathology (body tissue) is removed from the body tissue surgery or autopsy process;
4. Waste cytotoxic is material contaminated or possibly contaminated with bath cytotoxic during compounding, transport or treatment measures cytotoxic;
5. Waste pharmaceuticals derived from expired drugs that are not needed;
6. Chemical waste resulting from the use of chemicals in action, medical, veterinary, laboratory, sterilization processes and research;
7. Radioactive waste is material contaminated with radio-isotopes originating from medical or research used to radionuclous [11].

Until now, there are various laws and regulations governing the management of hazardous and toxic chemicals, but not sufficient, especially to prevent pollution or environmental damage [12]. For example, the Government Regulation on the Management of hazardous and toxic chemicals, the issue focused on the management of hazardous and toxic materials for solid waste hospital hospitals type B medical and other third parties who act as producers, users, transporters, storage, user and collection especially for solid waste home medical in accordance with certain diseased appendix in the regulation [13].

### Sets and indices

One quality that is fairly common in the LISREL model is that the models disregard the means and regard all variables to be centered about their group means. This, in turn, results in having the models with zero means. This is done in order to reduce the complexity associated in the analysis [14].

If a multi-group model is being worked on with the help of LISREL, then it will give the same output of that process as is obtained by running a regression with dummy variables in SPSS [15]. LISREL helps the researcher in providing a fairly influential and flexible means for the examination of various group differences. It provides indicative information called modification indices which help the researcher in identifying the equality constraints [16].

LISREL can help the user to identify the interaction effects that need to be included in the model and the ones that do not need to be included in the model. The indicative information can be used in diagnosing the model specification for medical solid infectious waste hospital hospitals type B management in Medan city [17].

### Variables

1. Variable performance of machines and tools (incinerator) in the treatment of hospital hospitals type B medical solid waste (X1).
2. Variable availability of medical solid waste from the activities of hospital hospitals type B activities (X2).
3. Variable of environment variable availability of human resources according to the rules in the Decree of the Minister of Health of the Republic of Indonesia Number 12 Year 2004 (X3).
4. Variable overcome the impact of the hospital's medical solid waste (X4).
Figure 1. Causal case diagram

Parameters

1. X1.1 = Source hospital medical solid waste.
2. X1.2 = Type hospital medical solid waste.
3. X1.3 = Number of hospital medical solid waste.
4. X1.4 = Production of hospital medical solid waste.
5. X2.1 = Number of rooms and patient.
6. X2.2 = Facilities or Facility Storage While medical solid waste.
7. X2.3 = Physical condition of availability of raw materials activities of hospital activities.
8. X2.4 = Medical solid waste collection process hospital.
9. X3.1 = Condition Availability HR environment.
10. X3.2 = Graduates HR environment.
11. X3.3 = Ability or expertise HR environment.
12. X3.4 = Training officers in the handling of hospital medical solid waste.
13. X4.1 = Condition of society in the hospital environment.
14. X4.2 = Attitude of people in a hospital environment.
15. X4.3 = The level of awareness of the hospital against medical solid waste treatment.
16. X4.4 = Level of medical solid waste pollution hospital.
3. Results and Discussion

Mathematical formulation with model statistic such as program LISREL used dependent and independent variables influence in the determination of the conceptual study, are \( R = Y \), and we explain, \( Y = a_1X_1 \{ (a_1X_{1.1}) + (a_1X_{1.2}) + (a_1X_{1.3}) + (a_1X_{1.4}) \} + a_2X_2 \{ (a_2X_{2.1}) + (a_2X_{2.2}) + (a_2X_{2.3}) + (a_2X_{2.4}) \} + a_3X_3 \{ (a_3X_{3.1}) + (a_3X_{3.2}) + (a_3X_{3.3}) + (a_3X_{3.4}) \} + a_4X_4 \{ (a_4X_{4.1}) + (a_4X_{4.2}) + (a_4X_{4.3}) + (a_4X_{4.4}) \}.

Model LISREL medical solid infectious waste hospital management in Medan city for Living protected Environmental Law paying. Applicable Legislation (Y). Whatever \( t \) formula = statistic test if will \( n_1 = \) the total number of samples and \( n_2 = \) number of sample groups. We can see the results of the program statistical methods using LISREL can be given results at the beginning (Table 1 combination with Figure 2) and end resistances (Table 2 combination with Figure 3).

**Table 1. SEM conformity index before modification model**

| Criteria                                      | Value 89; df=96; alpha=0.05 | Result LISREL | Solution |
|-----------------------------------------------|-----------------------------|---------------|----------|
| Free degree (db)                              | > 0                         | 96            | Qualify  |
| Chi – Square                                  | < 197.064                   | 107.99        | Qualify  |
| P-value                                       | P value □ 0.05               | 0.17091       | Qualify  |
| CMIN/DF                                       | □ 2.00                      | 3.712         | Not Qualify |
| Root Mean Square Error of Approximation (RMSEA) | □ 0.08                      | 0.37          | Qualify  |
| Goodness of Fit Index (GFI)                   | □ 0.90                      | 0.878         | Not Qualify |
| Adjusted Goodness of Fit Index (AGFI)         | □ 0.90                      | 0.846         | Not Qualify |
| Tucker Lewis Index (TLI)                      | □ 0.95                      | 0.872         | Not Qualify |
| Comparative Fit Index (CFI)                   | □ 0.94                      | 0.853         | Not Qualify |

**Explain:** \( n = \) number of samples; \( df = \) free degree

**Figure 2. Statistical T test table LISREL models**
The final results of data processing are summarized in the following in Table 2, for Model Statistic with Program LISREL for Medical Solid Infectious Waste Hazardous Hospital Type B Management in Medan City.

### Table 2. SEM conformity index after modification model

| Criteria                                      | Value 89; df=96; alpha=0.05 | Result LISREL | Solution |
|-----------------------------------------------|------------------------------|----------------|----------|
| Free degree (db)                              | > 0                          | 96             | Qualify  |
| Chi – Square                                  | < 155.405                    | 110.65         | Qualify  |
| P-value                                       | P value ≥ 0.05               | 0.14568        | Qualify  |
| CMIN/DF                                       | ≥ 2.00                       | 0.0800         | Qualify  |
| Root Mean Square Error of Approximation (RMSEA) | < 0.08                       | 0.0390         | Qualify  |
| Goodness of Fit Index (GFI)                   | ≥ 0.90                       | 0.9638         | Qualify  |
| Adjusted Goodness of Fit Index (AGFI)         | ≥ 0.09                       | 0.9406         | Qualify  |
| Tucker Lewis Index (TLI)                      | ≥ 0.95                       | 0.9894         | Qualify  |
| Comparative Fit Index (CFI)                   | ≥ 0.94                       | 0.9929         | Qualify  |

Explain: n = number of samples; df = free degree

**Figure 3.** LISREL models
4. Conclusions

The conclusions of the model LISREL medical solid infectious waste hospital management in Medan City, can be stated as follows. a. Internal hospital solid waste collection process internally. (X1 = 0.768). b. Sources of hospital medical solid waste. (X2 = 0.743). c. Number of hospital medical solids produced (X3 = 0.738). d. Type of hospital medical solid waste (X4 = 0.665). e. Model suitable measures and efforts to become a model statistic with program LISREL medical solid infectious waste hospital type B management in Medan City, is Y = 0.768X1 + 0.743X2 + 0.738X3 + 0.665X4.

References

[1] Zarook M S 2012 Medical Waste Management and Control Scientifict Research Journal of Environmental Protection 3 1625-1628

[2] Singh A, Kumari R, Wakhlu A, Srivastava K, Wakhlu A and Kumar S 2014 Assessment of Bio-Medical Waste Management in a Government Healthcare Setting of North India International Journal of Health Sciences and Research ISSN: 2249-9571 4(11), 203-208

[3] Silva C E, Hoppe A E, Ravanello M M and Mello N 2005 Medical Waste Management in the South of Brazil Waste Management 25 600-605

[4] Tabasi R and Marthandan G 2013 Clinical Waste Management: A Review on Important Factors in Clinical Waste Generation Rate International Journal of Science and Technology ISSN: 2224-3577 3(3) 194-200

[5] Conrardy J, Hillanbrand M, Sandra M and Nussbaum G F 2010 Reducing Medical Waste AORN Journal 10.1016/j.aorn.2009.12.029 91(6) 711-721

[6] Anurag V, Tiwari and Prashant A K 2014 Assessment of Biomedical waste management in Amravati International Journal of Engineering Sciences & Research Technology ISSN: 2277-9655 3(5) 399-402

[7] Dhruv P, Hirani K R, Villaitramani and Snehjit J K 2014 Biomedical Waste: An Introduction to its Management International Journal of Innovative Research in Advanced Engineering (IJIRAE) ISSN: 2349-2163 I (8), 82-87

[8] Diaz L F, Savage GM and Eggert L L 2005 Alternatives for the Treatment and Disposal of Healthcare Wastes in Developing Countries Waste Management 25: 626-37

[9] Chudasama R K, Rangoonwala M, Sheth A, Misra S K C, Kadri and Umed V P 2013 Biomedical Waste Management: A Study of Knowledge Attitude and Practice Among Health Care Personnel At Tertiary Care Hospital in Rajkot Journal of Research in Medical and Dental Science 1(1) 17-22

[10] Asante O B, Yanful E and Yaokumah E B 2014 Healthcare Waste Management; Its Impact: A Case Study Of The Greater Accra Region Ghana International Journal Of Scientific & Technology Research www.ijstr.org ISSN: 2277-8616 3 106-102

[11] Thirumala S 2013 Study Of Bio-Medical Waste Generation and Management in Various Hospitals in Davangere City of Karnataka India Nitte University Journal of Health Science ISSN: 2249-7110 3(3) 22-24

[12] Kumar G V, Duvvuri K and Kaumudini B V 2007 A Critical Analysis of Healthcare Waste Management in Developed and Developing Countries: Case Studies from India and England Proceedings of the International Conference on Sustainable Solid Waste Management Chennai India 134-141

[13] Larwin K and Harvey M 2012 A Demonstration of a Systematic Item-Reduction Approach Using Structural Equation Modeling Practical Assessment Research & Evaluation Item Reduction using SEM ISSN: 1531-7714 17(8) 1-19

[14] Muluken A, Haimanot G and Mesafint M 2013 Healthcare Waste Management Practices Among Healthcare Workers In Healthcare Facilities of Gondar Town Northwest Ethiopia Health Science Journal E-ISSN: 1791-809 7(3) 315-326

[15] Stephan L K B 2001 Statistics for Managers Using Mocrosoft Excel New York Prentice-Hall International Inc
[16]  David L S 2006 Building a Better Model: An Introduction to Structural Equation Modelling

Research Methods in Psychiatry Vol. 51 No. 5 pp: 317-324

[17]  Joseph H F 2001 Multivariate Data Analysis Seven Edition New York Prentice-Hall International Inc

Acknowledgements

The acknowledgements my present to:

1. For my Lecture in Doctor Program Natural Resources Management and Environment in University of North Sumatra Prof. Setiaty Pandia, Prof. Herman Mawengkang, Prof. Erman Munir, (RIP) Prof. Retno Widhiastuti, Dr. Delvian and Dr. dr. Wirsal Hasan.
2. For Dinas Lingkungan Hidup Provinsi Sumatera Utara and Dinas Lingkungan Hidup Kota Medan.
3. For 73rd, all hospitals in Medan City and Dinas Kesehatan Kota Medan.