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**Dynamic Model of Incident Control of Post-flood Leptospirosis in Wajo Regency: a Protocol Study**

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**ABSTRACT**

**Background:** Many Leptospirosis has been reported after flood from all over the world. Leptospirosis is frequently diagnosed to the community living in area impacted by flood. The flood can increase the risk of pathogen exposure through contact of contaminated water. This article is aimed to explain a research proposal about dynamic model of incident control of post-flood leptospirosis in Regency of Wajo, which completely assessed before publishing the research result. As the result, the reader can easily understand and interpret the research result correctly.

**Method:** This research type is analytical with cross sectional approach and builds dynamic system that is a model design describing and predicting actions which can be taken for incident control of post-flood Leptospirosis in areas flood-prone areas in Regency of Wajo which are Sub-district of Tempe and Sub-district of Sabbangparu. The sample of this research is all people aged >5 years old in flood-affected areas that occurred in Regency of Wajo, particularly in Sub-district of Tempe and Sub-district of Sabbangparu, with calculation of this sample carried out by Lameshow formula (1997) as many as 400 people. The data will be analyzed descriptively and analytically both bivariate and multivariate as well as build model with AMOS program.

**Discussion:** The research is going to be new library source and part of determining policy direction of health service and attempting to overcome Leptospirosis problems in the community dwelling in flood-affected areas in Regency of Wajo.

**Keywords:** Leptospirosis, Post-flood, Wajo, Dynamic Model.

## **INTRODUCTION**

Flood is defined as water flow which has large amount of water spilled over its surrounding so that it floods the land, devastates the vegetation, kills the animals, damages the infrastructure and gives impact to the society (Adomi Mbina and Ephraim, 2015, Gasim et al., 2014, Obeta, 2014). The cause of flood disaster in several cities in the world is immensely various that comprises disturbance of drainage system, weather factors particularly storms causing heavy rainfall, urbanization, environmental factors, dam, and many more. However, from some researches we can obtain data that most floods occurred due to deficient drainage system (Heintz et al., 2012, Khalid and Shafiai, 2015).

The harmful consequence from flood related to human health is completely complex and vast: including post-flood disease as well as the increase of general mental disorder (trauma) (Hajat et al., 2005, Alderman et al., 2012, Ahern et al., 2005, Dechet et al., 2012). To exemplify, Leptospirosis is commonly diagnosed to the community in flood-affected areas (Brown and Murray, 2013).

Leptospirosis is a zoonotic disease impacting vulnerable populations such as rural farmers and urban slum dwellers, endemic mainly in countries with subtropical or humid tropical climates and potentially epidemic. Humans are infected through direct contact with the urine of infected animals or with urine-contaminated environments.

Flood can increase the risk of pathogen exposure by contact with contaminated water. Many Leptospirosis plagues which have been reported took place after flooding from different parts of the world (Lau et al., 2015, Lau et al., 2010). The significant exposure also occurs from daily activities, and high rates of infection during heavy rainfall and flood (Yanagihara et al., 2007, Allan et al., 2015, Agampodi SB, 2010). Leptospirosis is detected in many areas of Mumbai India relatively to children with flood water contact (Karande, 2003).

Leptospirosis causes health problems in Indonesia. In 2001, 139 human serum samples tested were 18.7% positive. The results of these tests indicated an infection of the Bataviae serovar. In the event of floods in Indonesia, January 2002, the plague of leptospirosis occurred, especially in Jakarta. In this incident, 12.0% of 418 were seropositive samples of Serovar Bataviae or Hardjo. There has been a nationwide increase in the number of human cases reported since 2006. From the 667 human cases reported in 2007, 93% was cases with laboratory confirmation. The mortality rate was 8%. In the first quarter of 2008, 269 cases had been detected Leptospirosis (Victoriano A. F. B, 2009).

Wajo Regency as one of the areas in South Sulawesi Province annually becomes a flood subscribed area. In 2016, floods in Regency of Wajo soaked 24 villages in five Sub-districts in Tanasitolo, Belawa, Tempe, Pammana and Sabbangparu respectively (Ramling, 2016). Even in 2014 floods that inundated four urban villages, lasted up to one month. During that time, flood height continued to fluctuate. The height of water was caused by floods from Soppeng Regency and the overflow of Lake Tempe, and Walenae River (Sengkang, 2014). However, there were no reports of cases of Leptospirosis because no serological examination was conducted to Leptospirosis symptoms happening to flood-affected community (neglected diseases).

The use of dynamic models is very helpful in monitoring flood-prone areas and post-flood areas in predicting and managing floods and their impacts in an area (Gober and Wheeler, 2015, Kia et al., 2012). In some studies, collaboration among architecture, environmental modeling and the use of satellite imagery and GIS can result in an excellent system of early prevention and flood risk control as it takes into account not only the geographic aspects, but also other social aspects (Gharagozlou et al., 2011, Komolafe Et al., 2015, Fernando, 2013, Kia et al., 2012). In addition, the summary of the various related studies in this research is presented in Table.

This research aims to analyse control dynamic model of post-flood Leptospirosis disease in Wajo Regency by analyzing various factors such as, Socio-demography, environmental sanitation and individual hygiene, local values, nutrition status, and geography. Therefore, it is expected to increase the source of reading for the next researchers, especially on the control of post-flood environment-based diseases with dynamic model approach.

**Table 1. Study of flood and leptospirosis**

No	Title and Author(s)	Source	Method	Result
1.	<i>Floods In Malaysia Historical Reviews, Causes, Effects and Mitigations Approach/</i> Gasim, M. B., Toriman, M. E., & Abdullahi, M. G (Gasim et al.,	International Journal of Interdisciplinary Research and Innovations, 2(4), 59-65.	Descriptive	1. Flooding is caused by damage to the drainage system 2. Floods cause damage to infrastructure

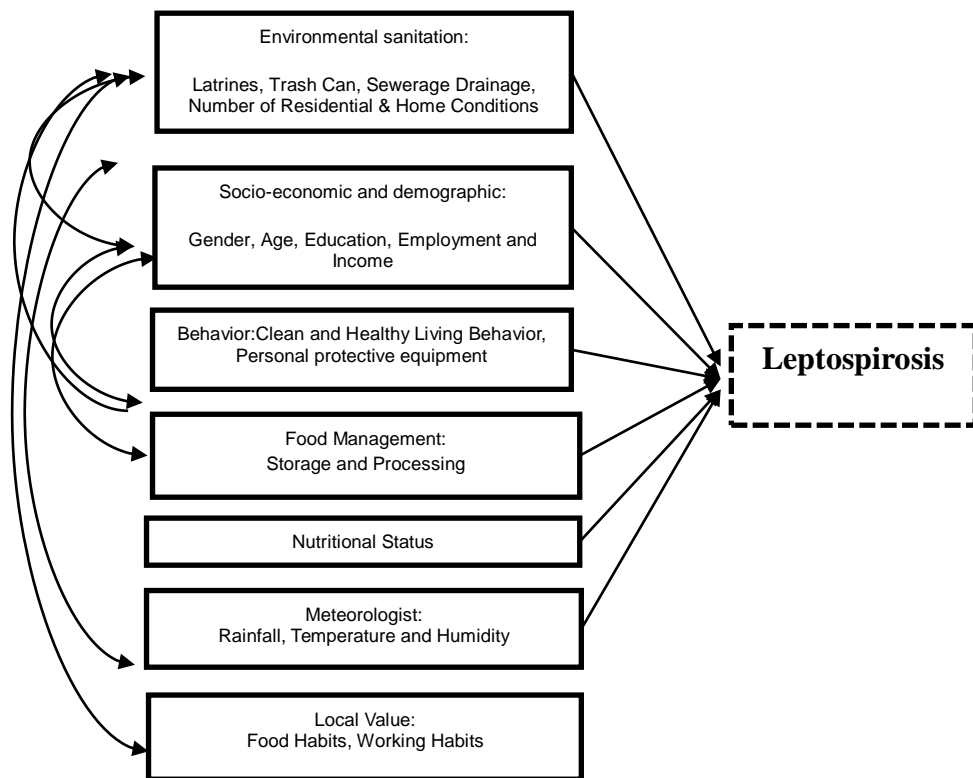
	2014).			
2.	<i>Spatial Analysis for Flood Control by Using Environmental Modeling.</i> Gharagozlou/ A, Nazari H, Seddighi M.(Gharagozlou et al., 2011)	Journal of Geographic Information System. 2011;03(04): 367-72.	Geo-Spatial Information, GIS, Environmental Modeling	1. Flood control based on environmental issues 2. The use of Geo-information technology is very beneficial in flood disaster management
3.	Leptospirosis following a major flood in Central Queensland, Australia/ Smith JK, Young M, Wilson K, Craig S(Smith et al., 2013).	Epidemiology and infection. 2013;141(03):585-90.	Surveillance	Serovar Arborea is suspected of being responsible for leptospirosis in seven of the nine confirmed cases. Serovar Hardjo and Australis were identified in samples from two remaining cases. All cases that have been exposed to flooding. No single source of exposure was identified.
4.	<i>Policy Learning for Flood Mitigation:A Longitudinal Assessment of the Community Rating System in Florida/</i> Brody SD, Zahran S, Highfield WE, Bernhardt SP, Vedlitz A(Brody et al., 2009).	Risk Analysis. 2009;29(6):9 12-29.	Federal Emergency Management Agency's (FEMA) Community Rating System (CRS)	The assessment of CSR scores indicates local authorities have learned from past floods, and this process is rapidly done in more specific conditions.
5.	<i>Factors Increasing Vulnerability to</i>	Int. J. Environ.	Literature	This study identifies the morbidity and mortality of risk

	<i>Health Effects before, during and after Floods/</i> Lowe D, Kristie L. Ebi, and Bertil Forsberg(Lowe et al., 2013)	Res. Public Health 2013, 10, 7015-7067; doi:10.3390/ijerph10127015	review	factors associated with flooding, especially demographic characteristics such as age and sex, for example, women have a greater risk of psychological effects. Other risk factors that include previous flood experiences, the depth of flood water or trauma, existing illnesses, drugs, and low education or socio-economic status.
6.	<i>Local wisdom-based disaster recovery model in Indonesia.</i> Bevaola Kusumasari and Quamrul Alam(Kusumasari and Alam, 2012)	Disaster Prevention and Management Vol. 21 No. 3, 2012 pp. 351-369	Case study in Bantul Regency.	The people themselves must decide how to rebuild their homes. The local government only provides assistance in making disaster-resistant houses such as earthquake resistant and has supported basic needs such as access to drinking water. Furthermore, learning from developing countries in handling post-disaster recovery process based on local wisdom.
7.	<i>Modelling the Spread of Infectious Diseases after Flood in the Rainy Season in South Bandung, Indonesia,</i> Nuraeni, Shimaditya	Conference Proceedings The 29th International Conference of the System Dynamics Society, July	Environmental Modelling	The dynamic modelling system between the two diseases illustrates that many incidences of diarrheal disease and ARI occur in the wet season and provide reasonable insight and policy to reduce and control the potential outbreaks of potential

	Arai, Takeshi (Nuraeni and Arai, 2011)	25 – 29, 2011, Washington, DC  ISBN 978-1- 935056-08-9		infectious diseases.
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**METHOD**

The type of research is analytical with cross sectional approach and build dynamic system model that is model design describing and predicting the actions that can be taken for incidence control of post-flood Leptospirosis in Wajo Regency. The concept framework built in this research is:



**Figure. Research concept framework**

### Study Setting

The research is conducted in the affected area, namely Tempe and Sabbangparu in Wajo Regency which are always flooded every year.

### Study Population

The population of this research is the whole community and environment as many as 6. 484 neighbourhoods (RT) affected by floods in Sabbangparu and Tempe sub-districts, Wajo Regency. Moreover, the sample of this research is all people who are aged > 5 and < 65 years old in the area affected by flood in the sub-districts of Tempe and Sabbangparu, Wajo regency.

### Sample Size

The calculation of this sample is calculated by the formula Lemeshow (1997) (lemeshow and Lwanga, 1991) as follows:

The total of minimum sample in this research is:

$$n = \frac{NZ^2pq}{d^2(N-1) + Z^2pq}$$

Information:

$n$  : Minimum sample size

$N$  : Number of population

$Z$  : Confidence interval (1,96)

$p$  : Proportion based on previous study (0,5)

$q$  :  $(1 - p)$

$d$  : precision (0,05)

So, the minimum sample calculated for this study is:

$$n = \frac{6.484 \times 1,96^2 \times 0,5 \times 0,5}{0,05^2(6.484 - 1) + 1,96^2 \times 0,5 \times 0,5}$$

$$n = \frac{6626}{17}$$

$$n = 363$$

The total of samples in this study is 363 people, but to reduce the bias, it is added 10% so the total is 400 people. According to the proportion of the village / urban village, the distribution of sample size is:

- a. Salotengnga village:  $(140/6.484) \times 400 = 74$  people
- b. Pallimae village:  $(420/6.484) \times 400 = 26$  people
- c. Tadangpalie village:  $(382/6.484) \times 400 = 24$  people
- d. Mallusesalo village:  $(325/6.484) \times 400 = 20$  people
- e. Worongnge village:  $(333/6.484) \times 400 = 21$  people
- f. Liu village:  $(411/6.484) \times 400 = 25$  people
- g. Ugi village:  $(700/6.484) \times 400 = 43$  people
- h. Walennae urban village:  $(343/6.484) \times 400 = 21$  people
- i. Salomenraleng urban village:  $(286/6.484) \times 286 = 18$  people
- j. Laelo urban village:  $(424/6.484) \times 400 = 26$  people
- k. Watalippue urban village:  $(647/6.484) \times 400 = 40$  people
- l. Mattirotappareng urban village:  $(780/6.484) \times 400 = 48$  people
- m. Wiringpalannae urban village:  $(1292/6.484) \times 400 = 80$  people

### **Data Collection**

The research data collection involves principal investigator, research assistant, supervisor, and enumerators as well as data manager. All of them are recruited through the process of screening and interviewing and training for 3 days. The aim of the research is to understand the purpose and the method of research as well as data collection technique. In addition, there is also a similar perception session before collecting data in order to avoid bias data.

By this research, all people involved in this activity will also discuss the problems that may be faced in the field. Furthermore, enumerators are served with comprehensive knowledge about maternal and child health issues to help them in the field.

### **Data collection and instruments**

The type of data collected in this research is primary and secondary data. Primary data is gained by doing direct observation and interview respondents in the field. Biomedical data is a serum sample of blood which is taken from member of household having symptoms of the disease or suspected Leptospirosis. It then will be examined by ELISA method at entomology laboratory of FK-UNHAS. Secondary data is a report or health profile obtained from Health Centre (Puskesmas) and Health Department, data from Regional Disaster Management Agency (BPBD), and Rainfall data from BMKG Makassar City and Wajo Regency.

Instruments used in collecting data on population and field conditions include: Modified Questioner from SIRKESNAS, a set of computers, digital scale, stationery and software (AMOS Software, SPSS, and Microsoft Office).

Instruments of biomedical samples include syringes, Tourniquet, Plasterin, Cotton Alcohol, Reaction Tube, Tip pipette, Micron pipette, tube rack, cooler box, centrifuge, and label.

### **Data processing and analysis**

Processing and data analysis will be conducted by the principal investigator assisted by the research assistant and the data management team. Data will be inputted using Epidata software v.3.1 and analysed using SPSS v.18 (SPSS Inc.). Re-checking of inputted data includes re-checking of data and encoding. If incorrect codes are found, they will be cleaned or replaced in accordance with a fixed questionnaire. Furthermore, modelling is arranged on the AMOS program. This model shows a concept that is arranged in connecting one variable to others.

### **Quality Assurance Measures**

The quality assurance measures will be directed at controlling bias, the interview technique, the preparation of the fieldwork, the conduct of the research, and finally at the plausibility of the database. This relates to the validity and reliability of the data. To obtain high validity and reliability data, there will be quality control as follows:

1. Standardization of field officers.

All officers who will collect data are alumni of Environmental Health Department, Public Health Study Program of Hasanuddin University that have been trained first. The training includes explanation and practice of test questionnaire in which data will be collected in the field.

2. The validity and the reliability of the questionnaire are examined before implementing it in the research area by conducting a questionnaire test on society living in the flood-prone areas in Wajo Regency.

3 Blood sampling will be performed by trained health personnel.

4. Field control is carried out, primarily for research which is supervision of data collection activities by researcher who will be in the field to observe and maintain the quality of data collection conducted by enumerator.

5. Data management control through data input training, making log book input data and supervision is controlled by the researcher so, an error will soon be known in data entry.

### **Ethical considerations**

Each potential respondent will be first provided with an explanation of the purpose, nature time commitment and potential benefits involved in participating in the study, and will be given an assurance of confidentiality.

Ethics of this research is the permission of the Ethics Committee of Medical Faculty of Unhas. All respondents are given a detailed explanation of the actions taken before the interview is implemented. If the respondents agree to participate in the research, they will sign the informed consent before the interview and blood collection.

### **Results**

The result of this research will be published by the end of 2017.

### **Discussion**

Leptospirosis in Indonesia is one of the neglected diseases. This research is expected to pay attention to health problem in flood-affected area. During floods and after floods, collecting data on environment-based health and disease is needed to understand the epidemiology of the disease. This article explains in a cross-sectional way the occurrence of leptospirosis in flood-affected communities if the determinants of leptospirosis could be clearly identified through this research, it will greatly contribute to control and prevention program of leptospirosis specifically in Wajo regency and globally in Indonesia.

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**Authors' contributions**

Principal responsibility for the study design, conduct, analysis, interpretation and manuscript preparation (Doctorate candidate). AD, ILM, MH participated in design, supervised the conduct, analysis and interpretation, commented on draft and approved the final protocol.

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