MAPPING AND SPATIAL ANALYSIS OF AN EPIDEMIC DIFFUSION PROCESS IN THE RURAL AREA OF INDONESIA

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ABSTRACT

This study was the application of spatial concepts and methodology to the problem of understanding the dynamics of a Cholera epidemic diffusion process in the rural area of Indonesia. Maps of disease were contracted for each week of the study period to show the presence of disease. Variable of health services, socio economic, environment sanitation, river flows and road was made thematic map and than it was correlated with map of the rapid speared of cholera epidemic. The analysis of the pattern of cholera diffusion in the rural of west Java Province has clearly revealed that during two month, cholera diffused predominantly from a common source outward in a southeast.

The cholera epidemic spread outward in a centrifugal manner to contiguous area. The epidemic spread more rapidly along river flows. Where there were little or no medical facilities, the rate of spread as well as the attack rate was very high compared to areas where such facilities were available. The analysis reveals that variation in the spatial pattern of cholera epidemic in the rural area of Ciamis regency are response to interrelated factors such as environmental sanitation, health services, road, river flows that brought feces. The findings under score the need for long and sort term planning aimed at providing adequate and efficient preventive health services for population as a whole.

INTRODUCTION

In geographic writing diffusion has two distinct meaning; (a) expansion diffusion is the process by which material being diffused remain and often intensify, in the originating region, that is new areas are added between two period; (b) Relocation diffusion is similar process of spatial spread, but the things being diffused leave the areas where they originated as they move to new areas. The El Tor out break is an example of diffusion by both processes.

The El Tor strain of cholera was first identified in the bodies of six Muslim pilgrims at a quarantine station out-side Mecca in 1905. EL Tor was name of the quarantine station. In the 1930s the same strain was recognized as endemic in the Celebes (Sulawesi) of Indonesia, which has a largely Muslim population. For another 30 years there was little news of El Tor until in 1961. It began to spread with devastating speed outward from the Celebes (Sulawesi). By 1964 it had reached India (replacing the normal cholera strain endemic in the Ganges delta for centuries), and by early 1970s it was pushing south into central Africa and west Russia and Europe. The seventh of the world's great cholera outbreaks was getting into its stride. (Hagget, 1976, Bintarto, 1985)

At about the same time an epidemic of a totally different kind was spreading from city to city. Hot pants were introduced as a style of western female dress in the spring fashion shows in

Paris in 1970. In the autumn of that year boutiques from Sydney to San Francisco had Caught on to the style and by the spring of 1971 the first secretary in a conservative British university had been sent home for wearing the shorts to work. Now the style is just part of fashion history (Hagget, 1983).

Waves similar to waves of cholera and hot pants have swept around the world in record time. Among the inconsequential waves was the brief Western passion for all things Japanese in the 1880s, and the late 1970s craze for skateboards among children on both sides of the Atlantic. Things as different as influenza epidemics and oral contraceptives, bank rate charges and computer data banks. Dutch elm disease and fire ants, have one thing in common. They originate in a few places and later speared over a much wider part of the world.

The cholera outbreak in the Middle East is continuing unabated. More than 60 new cases were reported in Jordan and Syria and the Teheran authorities said for the first time that the outbreak had spread to Persia. But there is a comparatively low death gate. Jordan has reported no death so far and in Syria. Where have been more than 2.000 CASES, the toll is 68 dead (Kwofie, 1976).

Cholera is an acute intestinal disease, the causative organism being vibrio cholera, biotype El Tor. Mild cases often exhibit self-limiting diarrhea. But in the severest form, it is manifested by the sudden outset of profuse and effortless rice water stools, vomiting, rapid dehydration, shock and death, if not attended to within 24 hours.

This study was in the rural area of Indonesia, the case of cholera diffusion in Ciamis Regency. Two hypotheses are proposed about relationships of distance and time and assumed effects of environmental and socioeconomic factors in the spread of cholera epidemic; 1) give a know sources of origin, cholera epidemic in the initial stage will spread outward in a centrifugal manner to contiguous areas. As the epidemic advances, however variation in the general diffusion pattern will occur. 2) Such variations will be a direct response to the interrelationships of socioeconomic, sanitation, health services, road and river flows.

The testing of these hypotheses will hope fully shed light on spatial patterns as well as the process factors in the cholera diffusion. The fist hypothesis is tested with trend surface analysis. The variable for the trend surface analysis in cholera rates, time and distance. All distances are linear and measured in kilometers from the first center of the cholera epidemic.

This study used to topography map, thematic maps and field survey as main sources of data. Sources of others data are population registration, the census data, cholera disease data and health services data.

FINDINGS

The Spread of the cholera epidemic

The map shows the spread of the El Tor strain of cholera from the origin during two month. This strain of cholera appears to be epidemic in the population of the village in Ciamis Regency, West Java Province, Indonesia. From this origin village, it erupts from week to week spread temporary Epidemics in surrounding areas.

The incidence of cholera is higher in the lowest socioeconomic groups and this is primarily due to unsanitary living condition. Once cholera is introduced into a give region, its propagation is decisively influenced by a number of complex factors such as the availability of safe water supply, cooking practices, level of personal hygiene or the standard of environmental sanitation.

The host specific to cholera is person or environment, transmits the infection; (a) person to person contact and; (b) person to environment to persons contact. The farmer is accessioned by the agglomeration of people in villages and towns, marketplaces and funerals. The infection is transmitted principally by direct contact with the sick and the dead.

In the person to environment to person made of transmission, sanitation practices with regard to water, disposal of human excreta, food hygiene and housing conditions all play a vital role. Water, especially alkali and contaminated water, serves as an ideal medium for the spreading of the vibrio. Cholera spread appears to have been operating predominantly in village's communities. The progression of cholera epidemic in village of Indonesia, however follow lines of communication such as land transport and river.

The extension of cholera epidemic in, Ciamis the epidemic spread to south and southeast. The rivers were the means of transporting the careers of the cholera vibrios, they were the means by which the cholera vibrios were spread. Other movement networks included such means of transportation as traveling by road along commercial routes, all of which played an important neighboring village

The rapid spread of the cholera in Ciamis also was influenced by distance and times and also by use rivers for drinking, washing, take a bath. The poor sanitary conditions existing in rural areas coupled with the severity of the drought.

During the fist week of the epidemic two village reported cholera outbreaks and than second week become eight villages. The spread of the cholera epidemic during two months can be seeing table 1 and figure 1.

Table 1: The spread of the cholera epidemic during eight week

Week	Infector El Tor (person)	Amount of the village
1	11	2
2	26	8
3	92	27
4	128	63
5	829	129
6	1111	134
7	1000	149
8	983	151
Total	4180	-

Sources: Department of Health and Herpribadi, 1993

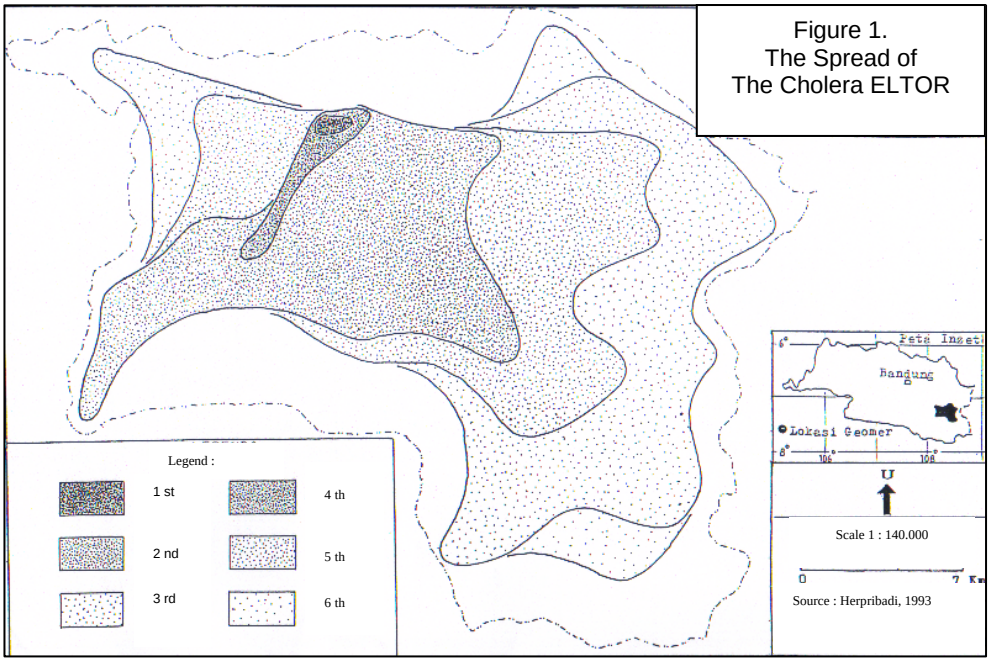

Figure 1.
The Spread of
The Cholera ELTOR

Spatial Patterns of the Cholera Diffusion

The general pattern of the epidemic, there are four distinct directions of diffusion can be readily discerned: south west, south, south east, east The direction of diffusion of the epidemic during the two month was predominantly southeast. This fact is clearly indicated by the trough. However, as the advanced into second week, multiple fore were developed in the south and southeast. From these centers the epidemic diffused to ward the neighbor.

Actually, the epidemic occurred as several minor epidemics in several villages after the principal source of diffusion had developed. Such minor epidemic outbreaks have occurred after a long distance transmission of the disease by infected persons. In the other wards, the transmission of the disease from the source of origin to the south and southwest was characterized by space.

The form and direction of the spread of the cholera epidemic during two month was described by thematic map. The pattern of spread in Ciamis Regency, during two month, epidemic spread rapid along flow river. It is also followed the movements of know infected persons along lines of communication. In the other hand, it is influenced by low socioeconomic conditions.

The extension of cholera epidemic at first week to direction south with short distance or neighbor village. The first case was report in Ciamis, the epidemic spread to south and southeast (figure 1 and 2).

Played an important role in the spread of epidemic to neighbor village. In addition to the complex movement networks, occasions such as marketing days, festivals of all kinds, funeral celebrations, all of which provided opportunities for carriers as well as unidentified carriers to congregate, made possible the dissemination of the vibrios with in short period.

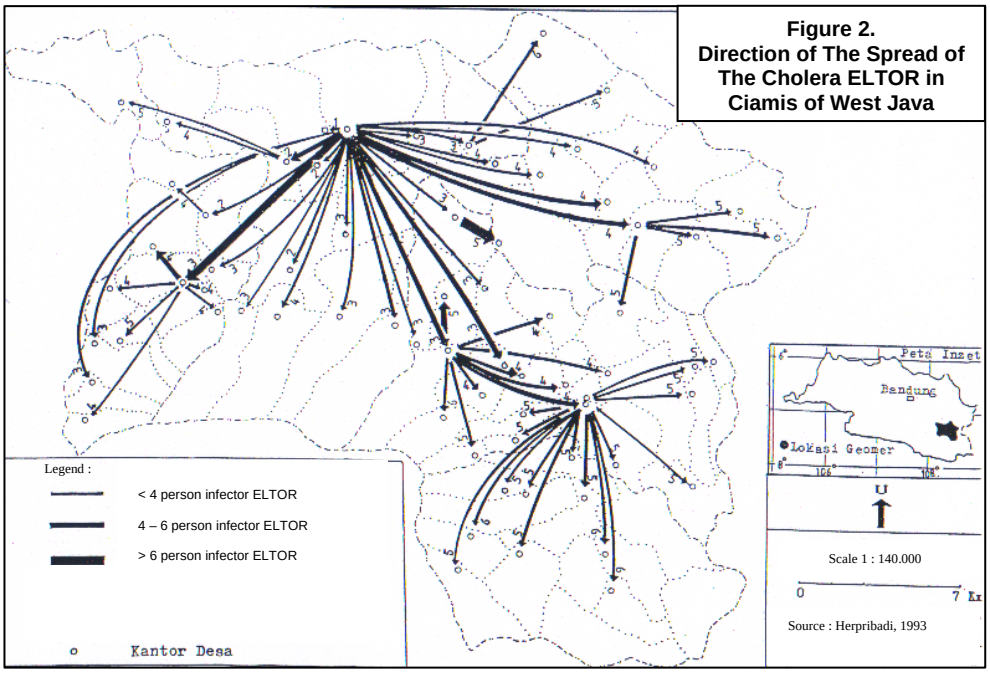

Figure 2.
Direction of The Spread of The Cholera ELTOR in Ciamis of West Java

The rapid spread of cholera in the village of Indonesia was influenced to a large extent by the drought, which has affected other village. The drought caused rivers to dry up and water level to drop. What little water was available in the form of potholes or some muddy water of dry rivers or was used for drinking and washing, it become an ideal medium of spread of the cholera infection.

Historically, such mass movement of people have been linked with spread of cholera. In fact, the spread of cholera within village of Indonesia is known to have occurred from village to village carried by panic-stricken population.

Rural areas, often widely scattered, seemed to have been more effected than towns. The outbreaks in village tended to be more explosives but lasted for brief periods. Since men are principally responsible for the care of farmer or businessmen and since this occupation entails movement of both men and farmer or businessmen from place to place, men more than women and children seemed to have contract the cholera in newly invaded area.

CONCLUSION

Cholera epidemic in the rural of west Java province spread out ward in a centrifugal manner to contiguous area.

Variations in the spatial pattern of epidemic were responses to such process factors as health services, poor sanitation, socioeconomic, road and river flows.

The need for long and short term planning aimed at providing adequate and efficient preventive health services for population as whole.

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