

# Syndromic Approach and Spatial Analysis of Chlamydia trachomatis among Mother with Vaginal Discharge in Medan

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## Abstract

Limitations of laboratory facilities in developing countries, makes difficult to diagnose the etiology of sexually transmitted diseases, while effectiveness of using WHO's syndromic approach can vary widely. The aim of this study is to develop a model of syndromic approach in diagnosing chlamydial infection and perform spatial analysis of primary health care coverage to the spread of chlamydial infection in Medan. Three hundred and twenty women who came to the gynecology clinic with complaints of vaginal discharge were recruited as participants and cervical swab specimens examined by using PCR. Signs and symptoms of vaginal discharge had been assessed by physical and gynecological examination. GIS data coordinate was obtained by visiting subject's residence and mapping using GPS Garmin's eTrex. The results showed the proportion of chlamydial infection in Medan was 35% and syndromic approach model based on odor, color, and consistency of discharge, and inflammation of the cervix has a sensitivity value of 67% (95% CI:58-76%) and specificity 57% (95% CI:50-64%) and PPV of 46% (95% CI:38-53%) and NPV of 76% (95% CI:70-83%). The spreading pattern of chlamydial infection were distributed evenly throughout the area of Medan with a tendency to cluster in the central region (NNA with a value of  $R=0.78$  and the value of  $Z=-4.4$ ). Primary health care range with radius of 3 km allows it to provide health services to women with vaginal discharge even though their perceptions of facilities availability and health workers capability remain low. The results of the study indicated that the spread of chlamydial infection in the low-risk group was relatively high and evenly spread throughout Medan. Therefore syndromic approach models obtained from this research can be used as a useful and simple approach in diagnosing chlamydial infection.

**Keywords:** Chlamydia trachomatis, vaginal discharge, syndromic approach, spatial analysis

## 1. Introduction

Reproductive tract infections, include sexually transmitted infections, was a public health problem that is occurring in developing countries (World Health Organization, 2007). Chlamydia trachomatis is a sexually transmitted infection that is the most common, but the majority of these infections have no symptoms at all (asymptomatic) so that this infection is not known or recognized by the patients (Schoeman, et al., 2012; Bebear, 2009).

However, the most common complaints of this infection was the presence of a discharge from the vagina, called vaginal discharge. Vaginal discharge was the most frequent cause of women coming for treatment or checks themselves (Kore et al., 2003). Approximately 20-30% of women who came to the clinic of gynecology, have complained of vaginal discharge and leucorrhoea (Sabir and Hassan, 2010).

Data on the prevalence and incidence of chlamydial infection in Indonesia and particularly in Medan was very limited. The prevalence of chlamydial infection in Indonesia focused on groups of high risk behavior (sex workers, female street children, refugees). From various studies, prevalence rate in Indonesia between the years 1990-2000 vary widely around 8%-73.7%. Health Department research in 2003 at seven cities in Indonesia got chlamydia prevalence among women sex workers as much as 12%-55%, where prevalence reached 44% in Medan (Jazan, 2004).

Various methods of examination can be performed to detect the chlamydial infection, including chlamydia DNA testing by nucleic amplification technique which is the gold standard for the detection of Chlamydia trachomatis (Schoeman et al., 2012). Nucleic amplification techniques may include Polymerase Chain Reaction (PCR) and Ligase Chain Reaction (LCR). This test has a high sensitivity and specificity, but the examination cost is relatively expensive and can only be done on health care facilities with a complete laboratory facilities. Limited laboratory facility makes complicated to diagnose the etiology of sexually transmitted diseases. On the other hand, the WHO has recommended syndromic approach as an important key to manage sexually transmitted infections that are practical and feasible for resource-limited settings. However, some studies show weakness of this approach, so that the other research tried to modify syndromic management approach in order to find a more

appropriate approach in diagnosis and treatment of sexually transmitted infections, especially against chlamydial infection. Several studies demonstrate the effectiveness of the syndromic approach was low in detecting chlamydial infection and gonorrhoea in women. This syndromic approach sensitivity may vary depending on gender, location, risk group, organism and other factors (Liu et al., 2003; Mukenge et al., 2002; Pettifor et al., 2000).

The aim of this study is to develop a model of syndromic approach based on multiple variables of the signs and symptoms associated with the likelihood of a chlamydial infection and conduct spatial analysis to assess the spread of chlamydial infection and primary health care coverage for managing cases of chlamydial infection in Medan.

## 2. Materials and Methods

This research was conducted in three main hospitals in Medan. Subjects were mothers who came to the hospital with complaints of vaginal discharge, a total of 320 eligible mothers were recruited as participants that taken by consecutive sampling technique. They were group of low-risk behavior. There was a tendency of increasing cases of sexually transmitted infections in this low-risk group in Medan. All subjects were selected in this study gave written informed consent. This study was approved by the Scientific and Ethics Committee for Health Research of Medical Faculty of University of Sumatra Utara.

Examination of the mothers who experience vaginal discharge based on signs and symptoms include characteristic odor, color, and consistency of discharge, itching complaints, lower abdominal pain, pain during intercourse, vaginal inflammation and inflammation of the cervix. Examination of *Chlamydia trachomatis* infection was performed by using PCR Applied Biosystems Veriti 96 Well on samples obtained from cervical swabs. The laboratory staffs who are examining these samples, were not informed about the clinical condition of the subject being examined. PCR examination is the gold standard for detection of *Chlamydia trachomatis* infection due to its high sensitivity and specificity. By using GPS Garmin's eTrex, GIS data coordinate was obtained by making a visit to subject's residence for spatial analysis and mapping. Similarly, for coordinates data of primary health centers (*Puskesmas*) in Medan.

### 2.1 Statistical Analysis

In this study, univariate analysis of the independent variables was done to find out the association independent variable with the presence of *Chlamydia trachomatis* infection. Multiple logistic regression analysis was used for all independent variables to find the best model. Variables are significant with p value < 0.05 will be determined its odds ratio value and basis for weighted scoring determination. ROC curve are used to determine cut-off point from scoring so that sensitivity value and specificity value can be determined from syndromic approach against chlamydial infection.

Dependent variable of *Chlamydia trachomatis* infection was based on a positive PCR result. Positive subject with chlamydial infection then performed spatial analysis and mapping the distribution of chlamydial infection and analysis of health services in Medan.

## 3. Results

### 3.1 Subject Characteristic

All subjects were mothers who came to the health service with complaints of discharge from the genitalia (vaginal discharge). Sociodemographic characteristics of the subjects were examined which comprise of data on maternal age, parity, educational background, income, and history of abortion as well as the proportion of chlamydial infection as in Table 1.

Table 1. Sociodemographic characteristics and chlamydial infection.

Characteristics of subjects	Number (n)	Percentage (%)
Age: ≤29 years	150	46.9%
≥30 years	170	53.1%
Parity: Parity ≤ 1	150	46.9%
Parity ≥ 2	170	53.1%
Education: ≤SMP(junior high school)	43	13.4%
≥SMA(senior high school)	277	86.6%
Income: < 1,2 million rupiah	35	10.9%
≥ 1,2 million rupiah	285	89.1%
History of abortion: Yes	79	24.6%
No	241	75.3%
Chlamydial infection		
Positive	112	35%
Negative	208	65%

The results showed that the proportion of chlamydial infection 35%, where the characteristics of the subjects showed a majority aged over 30 years old with 2 or more parity, senior high school and above of education background, income  $\geq$  1.2 million rupiah, and 24.6% subjects had a history of abortion.

### 3.2 Syndromic Approach

The World Health Organization has introduced a syndromic management approach or syndromic case management in diagnosis and treatment of sexually transmitted infections (WHO, 2007b). But this application still widely debated its usefulness (Clark et al., 2009). Several other researchers have modified the syndromic management approach in order to find a more appropriate approach in diagnosis and treatment of sexually transmitted infections in accordance resource settings. Syndromic approach in this study was identified and analyzed based on the symptoms and signs in mothers who experience vaginal discharge, variables that had a significant relationship were variable odor, color, consistency and inflammation of the cervix as Table 2 below.

Table 2. Syndromic approach model to Chlamydia trachomatis infection.

Variables	Examination of Chlamydia by PCR		P Value	OR	95% CI
	Positive	Negative			
Discharge odor					
- Yes	68	81	0,001	2,423	1,514-3,879
- No	44	127			
Discharge color					
- Yellow-greenish	86	120	0,001	2,426	1,445-4,071
- Clear-white	26	88			
Consistency of discharge					
- Mucupurulen	49	57	0,003	2,060	1,273-3,336
- Mucus-liquid	63	151			
Symptoms of itching					
- Yes	73	116	0,103	1,485	0,923-2,388
- No	39	92			
Lower abdominal pain					
- Yes	49	107	0,189	0,734	0,463-1,165
- No	63	101			
Pain during sexual intercourse					
- Yes	20	45	0,423	0,787	0,438-1,414
- No	92	163			
Inflammation of the cervix					
- Yes	28	29	0,014	2,057	1,152-3,676
- No	84	179			
Inflammation of the vagina					
- Yes	39	62	0,357	1,258	0,771-2,052
- No	73	146			

Syndromic approach model to Chlamydia trachomatis infection based on analyzing of discharge odor, discharge color, consistency of vaginal discharge, itchy symptoms, symptoms of lower abdominal pain, pain during sexual intercourse, vaginal inflammation and inflammation of the cervix. Out of eight these variables, we found four variables that were significant, they were discharge odor with OR = 2.423; discharge color with OR = 2.426; discharge consistency with OR = 2.060 and inflammation of the cervix with OR = 2.057. The significant variable with p value  $< 0,05$ , odds ratio value has been determined and this value became the basis for weighted scoring determination. ROC curve are used to determine cut-off point from scoring, so that sensitivity value and specificity value can be determined for syndromic approach against chlamydial infection. This can be seen at Table 3.

Table 3. Sensitivity and specificity syndromic approach of Chlamydia trachomatic.

Syndromic Approach	Chlamydia Infection with PCR		Sensitivity (95% CI)	Specificity (95%CI)	Positive Predictive Value (95%CI)	Negative Predictive Value (95%CI)
	Positive	Negative				
Positive	75	89	67%	57%	46%	76%
Negative	37	119	(58-76%)	(50-64%)	(38-53%)	(70-83%)

The table above compares the syndromic approach model in diagnosing the possibility of chlamydial infection with PCR as gold standard examination. The results of the diagnostic test syndromic approach showed that this

syndromic approach model has a sensitivity value of 67% (95% CI: 58-76%) and specificity 57% (95% CI: 50-64%) and positive predictive value (PPV) of 46% (95% CI: 38-53%) and negative predictive value (NPV) of 76% (95% CI: 70-83%).

### 3.3 Spatial Analysis of Chlamydial Infection in Medan

Medan has 21 subdistricts and 39 primary health centers (*Puskesmas*) scattered throughout the region. The results of the mapping of the 112 cases of chlamydial infection that were PCR positive in this study can be seen in Figure 1.

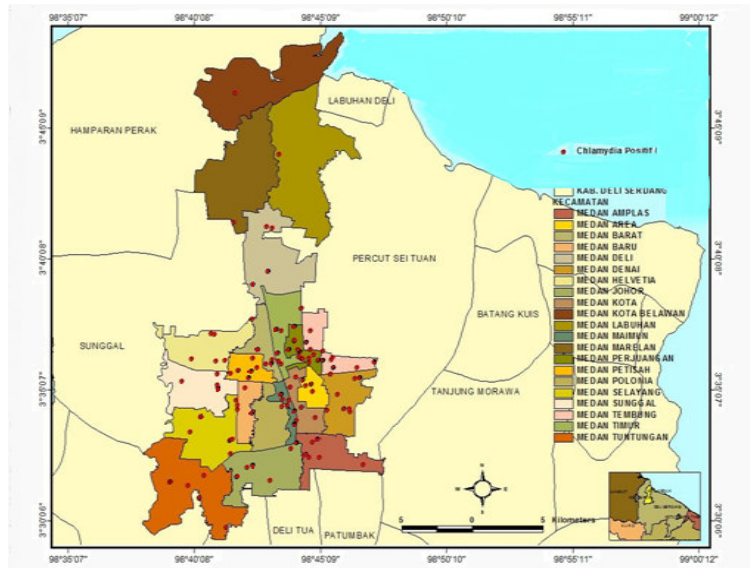


Figure 1. The spread pattern of Chlamydial infection in Medan

Based on a value of NNA (*nearest neighborhood analysis*) obtained values of  $R = 0.78$  with a  $Z$  value =  $-4.4$ , which means the pattern of the spread uniformly distributed in the direction of the shape or tendency toward clustering. On the map also seen that almost all regions of Medan found cases of chlamydia, with a tendency to cluster in the center of the region. Thus the spread pattern of chlamydial infections in Medan was distributed evenly throughout the area of Medan, but there was pattern that clustered in the center of Medan i.e., Medan Perjuangan subdistrict.

The health centers (*Puskesmas*) working area depend on the extent of sub district. In general, the health center will reach all areas of his district. Coverage of health services by health centers in this study mapped based on the radius range 1-3 km, as shown in Figure 2 below.

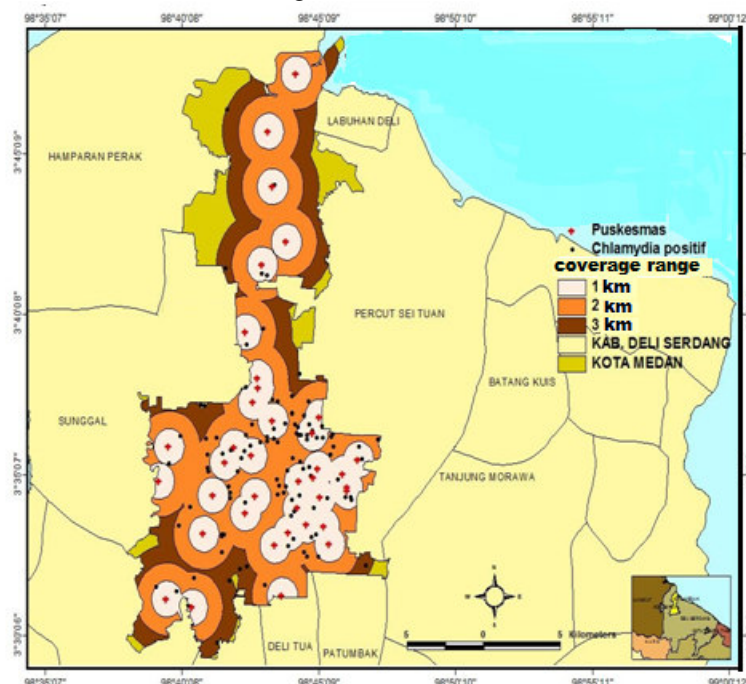


Figure 2. Primary health care (*Puskesmas*) coverage against chlamydial infection

Based on the picture above it can be seen that there are some cases of chlamydia that can only be reached by the health center services when reaching the maximum distance at a radius of 3 km. Handling cases of chlamydia can actually be done at the level of primary health care (health centers) by applying the diagnostic of syndromic approach and treatment of chlamydial infection can be done with medications that have been available in the primary health care. However, in general perception of community about health services of vaginal discharge problem services provided by primary health care still low as shown in Table 4 below.

Table 4. Mother perceptions of the access to primary health care

Primary Health Care Access	Number (n)	Percentage (%)
Health Center location		
- Far	116	36,3%
- Near	204	63,8%
Availability of facilities		
- Available	22	6,9%
- Not available	298	93,1%
The ability of medical personnel		
- Not able	288	90,0%
- Capable	32	10,0%
Cost		
- Not affordable	5	1,6%
- Affordable	315	98,4%

Based on the table above, we can see the relationship between the factors of access to health services for vaginal discharge problem. Factor of the location of primary health care, the results above showed that there were still many mothers who consider access to primary health care or community health center still far from home (36.8%). Utilization of health services by the community was also influenced by the availability of facilities and health workers in the primary health care. Based on the table above, the mother's perception about health care facility showed that 93.1% of mothers consider health care facilities still inadequate. As for the medical personnel, 90% of mother who consider the ability of medical personnel at community health centers unable to treat the disease or complaint of vaginal discharge. Regarding financing in health centers, 98.4% of mothers assume access to a health clinic was more affordable.

#### 4. Discussion

Complaints of vaginal discharge are the most common complaint that brought a woman come for treatment. Vaginal discharge can be founded normally, but vaginal discharge can also indicate a pathological process or infection. Vaginal discharge caused by infection can be recognized in greater amounts than the usual, smelling, green, yellow or gray, and cause itching and inflammation. Some of these infections can be caused due to sexual intercourse with a person who has been infected with gonorrhoea, trichomoniasis, or chlamydia. In pre-pubertal female Chlamydial infection symptoms may include vaginal discharge and smell the presence (vaginitis). In post-pubertal women, vaginal discharge can also be found and odors emanating from the infected cervix. Symptoms can occur within 3 weeks after infection, a persistent lower abdominal pain, vaginal discharge of milky and yellowish light, nausea and fever, pain during urination, pain during sexual intercourse, and menstrual spotting beyond (WHO, 2007b). Almost 80% of adult women do not show any symptoms (asymptomatic). Women can carry the bacteria for months or even years without knowing it.

Various studies have been conducted to make an approach to the diagnosis of chlamydial infection. WHO has made an algorithm for diagnosis and treatment of sexually transmitted infections, including chlamydial infection (WHO, 2007c). However this algorithm, according to some research its validity is low, so other approaches pursued and studied to be applied, especially on health services with limited facilities such as primary health centers and for group of low risk behavior.

In this study syndromic approach model determined by identifying cases of chlamydia and identify the signs and symptoms found in these subjects. Through a review of various literatures, there are several variables that are constitute of signs and symptoms of a chlamydial infection, which is consist of smell, color, consistency of vaginal discharge, itchy symptoms, symptoms of lower abdominal pain, pain during sexual intercourse, vaginal inflammation and inflammation of the cervix. We found four variables with significant results (p value <0.05) that consist of discharge odor variable, discharge color variable, discharge consistency variable and inflammation of the cervix variable with odd ratio respectively 2.423, 2.426, 2.060 and 2.057. The highest odds ratio was the color of vaginal discharge, which means that mother who has a complaint of vaginal discharge with yellowish to greenish color 2,426 times is more likely to develop chlamydial infection.

Based on the scoring of the variables that are significant, then syndromic approach in this study revealed the

sensitivity values of 67% (95% CI:58-76%) and specificity 57% (95%:CI 50-64%). In general, the value obtained was still relatively low and the value obtained in the ROC curve also showed the AUC value also relatively low at 66%. Nevertheless the accuracy of this approach still yield good performance in comparison with other approaches. A study of STI using syndromic management in high-risk populations in Peru by Clark revealed the presence of dysuria and or urogenital discharge for diagnosing gonorrhoe and or chlamydial infection, with sensitivity of 50% (Clark et al, 2009). Another study in India that uses algorithms of NACO (National AIDS Control Organization) for the management of vaginal discharge also got a low sensitivity of 5% although specificity is 93% in predictive chlamydial infection (Vishwanath, 2000). Based on these findings and several other studies, we can conclude that the presence of vaginal discharge complaints only cannot have a high diagnostic value to predict chlamydial infection, therefore characteristics of the vaginal discharge should be explored as in this study in order to get a higher diagnostic value .

Clinically chlamydial infection can cause cervicitis, endometritis, salpingitis, pelvic inflammatory disease, infertility or ectopic pregnancy. Approximately 5-13% of women infected with chlamydia will have cervicitis (Bebear and Barbeyrac, 2009). Clinical models obtained in this study concluded there are four variables that contribute to the prediction of the probability of chlamydial infection: bad smell of discharge; yellowish to greenish discharge color; mucopurulen consistency of discharge, and the presence of cervix inflammation.

In this study, the proportion of chlamydial infection in Medan was found by 35%. This proportion is relatively high because the study was conducted on a group of low-risk behavior of mother, where all subjects claimed not to have sexual partners other than her husband. This situation shows sexually transmitted infections has increased in the group of low-risk behavior. Previous research on mothers attending maternal and child health clinics, pregnant women, family planning acceptors as a group of low-risk behavior, found prevalence of chlamydial infection 3.6% - 12% (Putra, 2010; Jazan, 2004). While research on high risk group (female sex workers) in Jakarta obtained prevalence chlamydial infection by 41.8% and the prevalence of chlamydial infection in the Medan 44% (Wahyudi et al, 2009; Jazan, 2004).

Medan as one of distric in Sumatra Utara province has 21 subdistricts and 158 villages. Mapping cases of chlamydia in Medan are relatively high, indicating that the spread pattern of evenly distributed throughout the area of Medan with a tendency to cluster in the central region of Medan, especially in Medan Perjuangan Subdistrict, which in this region proved to have the highest population density in Medan (BPS, 2010). This high population density would facilitate the relationships or interactions between individuals in the community and will also facilitate the spread of sexually transmitted diseases including HIV/AIDS. This need to be considered given Medan is also an area for the highest number of cases of HIV/AIDS compared to other regions in the province of North Sumatra. Chlamydial infection can be a clue possibility of other sexually transmitted infections, especially HIV/AIDS (WHO, 2007b).

Spatial analysis of the existence of health centers (Puskesmas) in Medan shows all cases of chlamydia were scattered throughout the area of Medan can be reached by the health center with a range of 3 km radius. There are 39 health centers in Medan, mean that almost all cases of chlamydia that occur in entire of Medan actually can be reached by the health center. Thus the handling of complaints of vaginal discharge and the possibility risk of getting chlamydial infection can be handled at health centers level, but the perception of subject about the ability of primary health care to provide health services is still low, this due to 93.1% of the subjects consider lack of available health care facilities and 90% subject consider health workers in health centers are still less capable to deal with vaginal discharge. Indeed laboratory facilities at the health center are not able to perform PCR. Therefore syndromic approach to complaints of vaginal discharge can be used to estimate the probability of chlamydial infection and health care workers at health center level can apply this approach.

## 5. Conclusion

The study results indicate that the spread of chlamydial infection in the low-risk group was relatively high and evenly spread throughout Medan. Therefore syndromic approach models obtained from this research can be used as a useful and simple approach in predicting risk of getting chlamydial infection. The primary health services (*Puskesmas*) should be empowered to provide services as well as perform early diagnosis and prompt treatment to the mother with vaginal discharge and increased awareness to the risk of other sexually transmitted diseases particularly HIV/AIDS.

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