https://dx.doi.org/10.22161/ijreh.2.1.7 *ISSN: 2456-8678*

Distribution of Health Care in Sigi Regency using Analysis of Spatial Structure

Bambang Riadi, Nadya Oktaviani

Badan Informasi Geospasial (BIG) Jl. Raya Jakarta - Bogor Km 46, Cibinong- INDONESIA

Abstract— *Good Health services as part of the important points in the program of Sustainable Development Goals (SDGs), has driven for efficiency and effectiveness of public health services. Spatial analysis of Puskesmas distribution is needed, to know the level of public health service can be seen from the service of puskesmas and doctor. PHC is one of health services by the government in the society, with affordable health care facilities.Integrating Puskesmas into spatial data systems is done by assigning coordinates to each PHC position. The position coordinates of PHC observed using GPS (Global Positioning System). The study parameter used consisted of the distribution of the health center, service coverage, the number of residents and doctors that refer to the Minister of Health Regulation Number. 75 in 2014. The observations in the study area coordinate obtained 19 Public Health Center, 43 Health Center (Pustu) and 81 Clinic (Poskesdes). This study is limited to the availability of health centers and doctors to the analysis unit of the districts. An Analysis is the availability of doctor based on the ratio of the needs of society and the existence of health centers. It based on the number of people who can be served. The spatial analysis using buffering techniques. Efforts to approach the health center to society and the ideal ratio of doctors to serve the society in Sigi has not been fulfilled.*

Keywords— SDGs, spatial analysis, health centers, buffer.

I. INTRODUCTION

Population growth still continues in Indonesia. This condition makes government need to be concern to bring good public facilities and social facilities. Act No. 36 of 2009 on Health, Article 17 states that the Government is responsible for the availability of information, education, and health care facilities to improve and maintain people health status. Infrastructure such as transportation, buildings and other public facilities are required for basic human needs. In this case, the infrastructure is part of facilities and infrastructure (networks) that are not separated from each other [16]. Health facilities are very important because it's related to human development. In Indonesia, we have health facilities beside hospital that we called Public Health Center (PHC)/ PUSKESMAS. PHC role and position is spearhead of the health care system in Indonesia. This Health Center aims to help people in district resolve their health problems.

PHC is a public organization under Local Government that responsible for health care and emergency service in the district. PHC ensure quality in health service although this center don't have health equipment as complete as hospital. Quality of service is closely related to the fulfillment of patient expectations, affordable and standardized [8].

Provision of health facilities based on the population become a program of Indonesia Sehat 2010. Government targeting the availability ratio of general practitioners of 40 doctors for 100,000 population[18]. Or the ideal ratio between general practitioners and patients is 1: 2500, it means that one doctor serves 2,500 patients[3]. Formal health services such as hospitals, physician practices, health centers, clinics, for people who are a user these facilities will get more benefit. Analysis of distribution and adequacy of health care to find out the real situation about existing health care center. With these analysis we can manage the existing health facility, improve in quantity and quality of health facility, and predict how much health facility that must be built to fulfill people needs. One of the basic principles that underpin the description, assessment and disclosure of the symptoms, factors, variables, and geography is the principle of distribution.

Health facilities has strategic role in accelerating the improvement of public health as well as to control the population growth. Health care center must be built consider from the radius of coverage of health services related to basic needs that should be fullfill for serving patients in certain areas [15].

Some health facilities are required such as:

a. Public Health Center, serves as a first-level health care facilities in the community.
b. Health center, medical center, clinic, Integrated Service Post (Posyandu), serves as a means of simple health care than part of the Public Health Center.

https://dx.doi.org/10.22161/ijreh.2.1.7 *ISSN: 2456-8678*

Coverage units of the Regency/City for distribution of health facilities or service coverage regulated by Decree of the Minister of Settlement and Regional Infrastructure No. 534 / KPTS / M / 2001. In addition, the guidelines the Minimum Service Standards set forth in SNI 03-7013-1989 (Table. 1.).

Table.1: Minimum Service Standards of Health Facility
By SNI 03-1733-1989 dan SNI 03-7013-2004

No.	Facilities	The Population	Coverage Area	Location
1	Clinic	1.000	500 m	Join with RW Office
2	Polyclinic	1.000	1.000 m	in the middle of society
3	Maternity Clinic	10.000	1.000 m	Can be reached by public transportation
4	Health Center (Pustu)	30.000	1.500 m	In the center of the village government
5	Public Health Center (Puskesmas)	30.000	3.000 m	In the center of the district government

Area of Interest in this study is located at coordinates 0˚52' S - 0˚03' S and 119˚38' E - 120˚21' E. This regency approximately 5,196.02 km² in area, divided into 15 districts, 176 villages and 1 transmigration areas.The population of Sigi in 2015 was 229,474 inhabitants. The Highest number of inhabitants in the Sigibiromaru District with a population of 45,736 people, while the population of the lowest in the Lindu District with a population of 5,028 inhabitants [14]. Sigi has a total road section along 462.92 Km. Paved roads in the Regency throughout is 218.46 Km. While others are the pebble road (111.06 Km), the path away (18.42 Km) and not specified along 115 Km [14]. Sigi has three districts are geographically isolated, i.e. the region with the geographical conditions are difficult to reach in the mountains or swamps and the unavailability of public transport [13]. The District are Lindu, Pipikoro, and Nokilalaki. Road infrastructure in this area is only accessible by motorcycle, walking or riding [14].

The existence of some people who have can't reach the health care units (PHC) as a caused by the geographical conditions, but it can be solved by build Clinic (Poskesdes). Poskesdes built based on the principle of affordability and the density of the surrounding population. Poskesdes Services include promotive, preventive and curative implemented by health professionals, especially midwives with the involvement of volunteers.

II. METHODS

Non-experimental method or descriptive methods aimed to observe the variables of research. Subjects in the study are building geographical information system of health care facility in Sigi Regency in Central Sulawesi Province. The primary data are coordinates of the location of health facilities, while the secondary data, the distribution of health facilities, distribution data of general medical octors, population data, administrative maps, road network map and a map of the settlement. Measurement coordinate points of health center using GPS (Global Position System),then integrated into a topographical map [9].

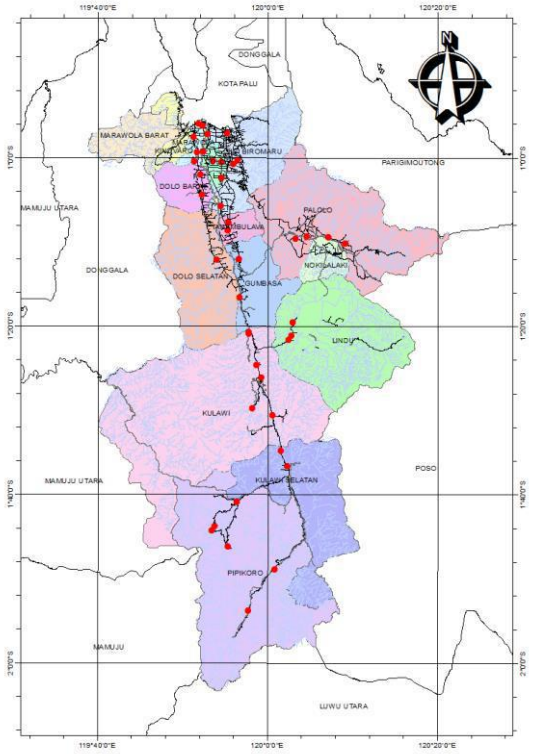

Fig.1: Distribution of Health Centers

Buffer analysis used to generate new spatial data or a polygon-shaped zone with a certain range of spatial data being input. For example, spatial data point will generate new spatial data in the form of a circle around the center

https://dx.doi.org/10.22161/ijreh.2.1.7 *ISSN: 2456-8678*

points. For spatial data lines will generate new spatial data in the form of a polygon-polygon surrounding the lines. Analysis using GIS (Geographical Information System) software. Further analysis based on the availability of public health services and affordability of health care.

Availability of health services can be seen from the process or the real action in society [13]. Based on the data, the availability of Public Health Centers in Sigi Regency as many as 19 units, 43 units of the health center and 81 units clinics. Distribution of health centers illustrated in the form of points (Figure.1).

The principle of affordability of health care in this study is more emphasis on accessibility to reach the financing aspects of health center care. Flow chart the research method in Figure 2.

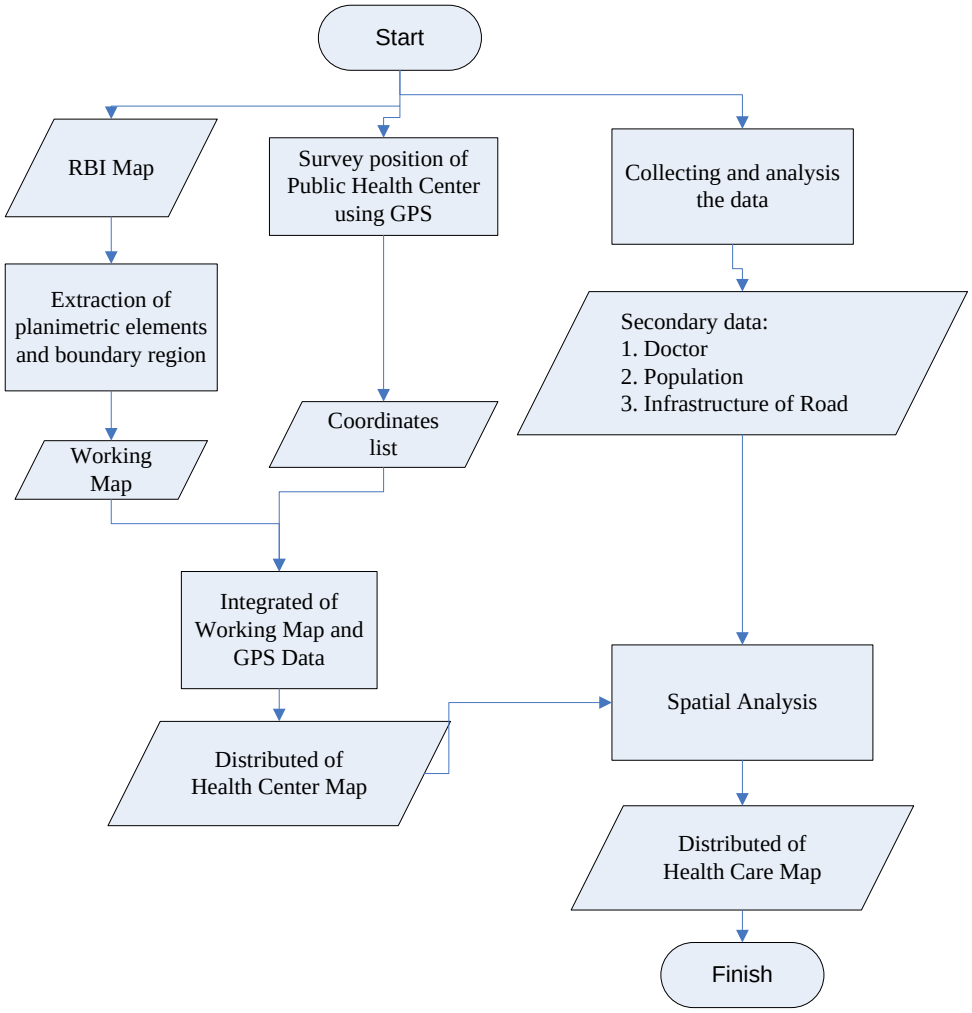

Fig.2: Analysis Distributed Health Care Flow chart

III. RESULTS AND ANALYSIS

Totally therea are 19 Public Health Center and 43 Clinic in Sigi Regency(Table 2.), As data shown from Table 2, we can see that Public Health Center in Sigi is very limited (1 or 2 Public Health Center each District). Table 2. describes the efforts of local governments to provide health services to the society, but geography conditions be an obstacle.

Furthermore, these data integrated with an RBI base map to see the distribution of health centers and other health services as a spatial data (Figure 1.). Location of health care facilities (health centers) preferably in a strategic location such

As near major roads or collector roads that easy to reach by public accessibility. Poskesdes as a provider of basic health services for rural communities, scattered in a location close to the settlement.

The distance between the citizen settlement and health center is closely related to the amount of Public Health Center. This means getting further the citizen settlement with Public

https://dx.doi.org/10.22161/ijreh.2.1.7 *ISSN: 2456-8678*

Health Center, the health care cost will be more expensive [6]. Access to health care facilities near to citizen settlement will facilitate the society to use the service. The distance and a good road network will provide a positive influence for the society because people will more easily reach the location of health services.

Table. 2: Distribution of Health Centers and Doctor in District

No.	District	Total Population	Doctor	Hospital	Public Health Center	Health Center/Clinic
1	Pipikoro	8.346	0		2	3
2	Kulawi Selatan	9.042	2		1	1
3	Kulawi	15.125	1		2	4
4	Lindu	5.028	1		1	1
5	Nokilalaki	6.005	1		2	2
6	Palolo	29.183	6		2	6
7	Gumbasa	12.467	2		1	4
8	Dolo Selatan	15.420	3		1	3
9	Dolo Barat	13.422	1		1	3
10	Tanambulava	8.396	1		1	3
11	Dolo	21.973	2		1	2
12	Sigi Biromaru	45.736	5	1	1	7
13	Marawola	22.404	5		2	3
14	Marawoloa Barat	6.814	1		1	
15	Kinovaro	10.113	2		1	1
	Jumlah	229.474	33	1	19	43

Source: BPS Sigi Regency, 2015

The structure of spatial is the framework of activities centers of service in the city that hierarchical and linked by the road infrastructure network system. Structuring of space should consider of distribution health centers and other health care proportionately. This relates to the transportation network and other infrastructure. Figure 3 gives an explanation of infrastructure systems in the Sigi Regency with the distribution of urban activities are located along collector roads (road connections between districts).

District of Pipikoro, Lindu, and Nokilalaki are areas of Regency that lack of road infrastructure and transport. Communities in the Regency using a motorcycle, walking, and riding horses for their activities. It can be stated the District is remote areas, and these conditions have an impact on the lack of interest the Doctor who wants to serve this place [11]. This indication is reinforced by data that can be seen in Table 2. about the distribution of health centers and doctors in District. Other than three districts have a fairly good road infrastructure.

Furthermore, buffering 3 km on every point that representative of Public Health Center to display the optimum radius of service as the basis for spatial analysis. 3 km serve as the ideal distance of the public can access the health center.

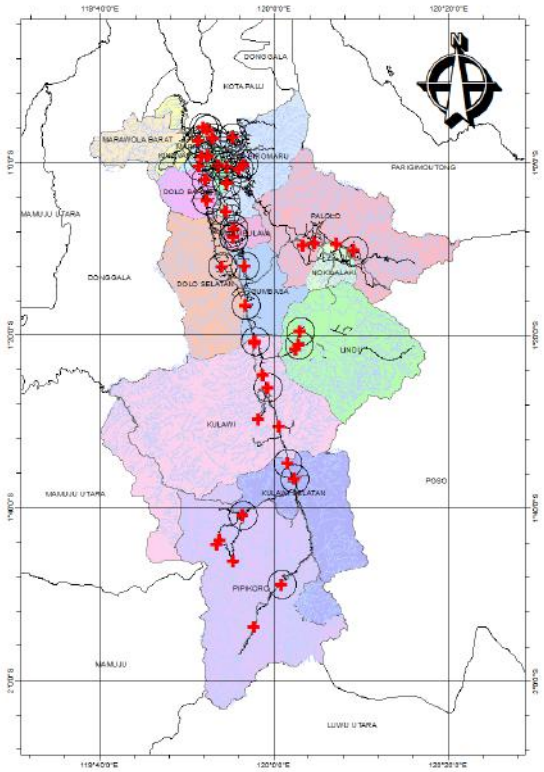

Fig.3: Buffering distance of Public Health Center

https://dx.doi.org/10.22161/ijreh.2.1.7 *ISSN: 2456-8678*

*(Puskesmas)*This research carried out on the availability of Public Health Centers, the range, and population based on ISO 2004 and the type of minimum standard of the health for Public Health Center by Minister of Health Regulation No. 75 in 2014. The analysis was limited to the availability of general doctors and requirement ratio (Table 3) as well as the existence of health centers based on its service area effectively. Calculations using the data residing in the Tabel. 2. Table. 3. and Figure 2

Table.3: Analysis of requirement of Doctor in District, (ideal ratio on scale 1:2.500)

No.	District	Population	Densitypeople/ km²	Dctors		Condition
				Requirements	Available	
1	Pipikoro	8.346	9	4	0	not fulfilled
2	Kulawi Selatan	9.042	21	4	2	unfulfilled
3	Kulawi	15.125	14	6	1	unfulfilled
4	Lindu	5.028	9	2	1	unfulfilled
5	Nokilalaki	6.005	79	3	1	unfulfilled
6	Palolo	29.183	46	12	6	unfulfilled
7	Gumbasa	12.467	70	5	2	unfulfilled
8	South Dolo	15.420	26	6	3	unfulfilled
9	Dolo Barat	13.422	118	5	1	unfulfilled
10	Tanambulava	8.396	147	3	1	unfulfilled
11	Dolo	21.973	603	9	2	unfulfilled
12	Sigi Biromaru	45.736	156	19	5	unfulfilled
13	Marawola	22.404	573	9	5	unfulfilled
14	Marawola Barat	6.814	45	3	1	unfulfilled
15	Kinavaro	10.113	142	4	2	unfulfilled
	Total	229.474		94	33	

From the analysis of requirement of doctors (Table 3.), the availability of doctors in fourteen districts is unfulfilled. There is one of the districts Pipikoro is not satisfied because there are no available doctors.

Table.4: Analysis the requirement of health centers based on the effective area of services

No.	District	Population	Area(km²)	Public Health Center		Condition
				Requirements	Available	
1	Pipikoro	8.346	956	12	2	unfulfilled
2	Kulawi Selatan	9.042	418	5	1	unfulfilled
3	Kulawi	15.125	1 053	13	2	unfulfilled
4	Lindu	5.028	552	7	1	unfulfilled
5	Nokilalaki	6.005	75	1	2	unfulfilled
6	Palolo	29.183	626	8	2	unfulfilled
7	Gumbasa	12.467	176	2	1	unfulfilled
8	South Dolo	15.420	584	7	1	unfulfilled
9	Dolo Barat	13.422	112	2	1	unfulfilled
10	Tanambulava	8.396	56	1	1	filled
11	Dolo	21.973	36	1	1	filled
12	Sigi Biromaru	45.736	289	4	1	unfulfilled
13	Marawola	22.404	38	1	2	filled
14	Marawola Barat	6.814	150	2	1	unfulfilled
15	Kinavaro	10.113	70	1	1	filled
	Total	229.474		16	19	

*The ideal ratio to effective services from Public Health Center based an area is (78.5 km²) / radius of 5 km

https://dx.doi.org/10.22161/ijreh.2.1.7 *ISSN: 2456-8678*

The results of the analysis about the requirement of health centers (Table. 4.), There are 11 districts unfulfilled by area of effective service. While four other district health care have been met. A number of doctors in Sigi assessed to be less based on the ideal ratio of Doctors needs. This study assesses the available doctors is 33 Doctors from needs of 94 Doctors. The ideal ratio of the health center at Sigi Biromaru unfulfilled. But, in this case, there are Hospital in Sigi Biromaru, so that the criteria have not fulfilled less precise.

Table. 3. Analysis using the ideal ratio of doctors and health centers, there is one of the districts are not met because the doctor not available is at the district Pipikoro. Geographical situation and difficult to reach transportation, making the doctors less comfortable working in the Pipikoro distric. Working conditions are limited, making them uncomfortable, and doctors want to leave their jobs[12].

There are five districts if given 3 km radius buffer on the point (Public Health Center), there are area will overlapping. This condition can be expressed this area that has a health center with good accessibility (Figure 2 and Table 4). The districts are Marawola, Kinavaro, Dolo, West Dolo and Sigi Biromaru. Government at Sigi Regency set up 43 units of Health Center, and 81 units of Clinic that distributed in the District region [14]. The government hopes that no impediment for a community to reach health service [17].

Descriptive analysis to describe the physical condition of the road in each of the districts should follow the rules and ideal guidelines. Total effective area for a health center, is an area with a radius of 5 km, while the optimum area for working in an area with a radius 3km, it means an optimum distance of health center between each other is 3 to 5 km. The absolute distance (absolute) is the distance calculated from the settlement to reach the health facilities. And the mileage is the time taken by the society to reach the distance to the health center either by using transportation or on foot [2].

IV. CONCLUSION

Hilly geographical condition in Sigi Regency causes the health center is difficult to implementing their good services. The results of the analysis provide information that health care in Sigi Regency can be grouped into 3 parts. The first is a health service that spatially illustrates the overlap in the buffer of 3 km, which means that people's needs can be fulfilled with a health facility whose position can serve each other, they are a health center in the district Marawola, Kinovaro, Dolo, Dolo West and Sigi Biromaru. The second is based on the fulfillment of the ratio of physician demand for health services in the sub-district Pipikoro not fulfilled because it has no doctor. The third is based on comprehensive health center needs effective service area, eleven of the districts have not fulfilled, only four regions that had fulfilled, namely: district Tanambulava, Dolo, anddistrict Marawola Kinavaro. Efforts to approach the provision the clinic and the polyclinic to a community is not substantially meet the ideal ratio of doctors and the ideal ratio of the area of effective service.

ACKNOWLEDGMENTS

Further thanks to the Regional Planning Board of Central Sulawesi and Bappeda Sigi that was support the data and survey for this study.

REFERENCES

[1] Baker TD, Reinke WA, 1994. Dasar Epidemiologi untuk Perencanaan Kesehatan. Dalam: Perencanaan Kesehatan untuk Meningkatkan Efektivitas Manajemen. Yogyakarta: Gadjah Mada University Press. BPS, 2015.

[2] Decree of the Minister of Settlement and Regional Infrastructure, 2001. Guidelines for Minimum Service Standards for unit coverage area district / city distribution of health facilities / Minimum service coverage. Ministerial decreeof Settlement and Regional Infrastructure No.534/KPTS/ M/ 2001.

[3] Ghufron. 2013. Indikator Indonesia Sehat 2010, Ideal Ratio of Doctors and patients

[4] Herman, Mubasyir H. 2008. The Evaluation of Health Force Deployment Policy in The Very Remote Community Health Centre in Buton Regency,Journal of Health Services Management, Vol. 11, No. 3 September 2008

[5] Indonesia National Standard 03-1733-1989 about The planning of the residential area of the city and revised using Indonesia National Standard 03-7013-2004 about Procedures for Urban Housing Planning.

[6] Laij, F. 2012.Analisis Permintaan Jasa Pelayanan Kesehatan. Kesehatan Masyarakat, Universitas Hasanudin

[7] Law of the Republic of Indonesia Number 36 Year 2009 on HealthWulansari RR. 2010. "Efisiensi Relatif Operasional Puskesmas di Kota Semarang Tahun 2009". Thesis, Not Published, University of Indonesia

[8] Mawarti F, Nuraini FK, Thamrin MH, 2015. Analisis Kualitas Pelayanan Puskesmas Terhadap Kepuasan Ibu Hamil Di Kota Pangkalpinang. Medical and Health Journal, Volume 3, No. 1, Januari 2016:363-371

[9] Pranasetia AN**,** Riadi B. 2009. Aplikasi Geomedic Mapping Untuk Mengetahui Hubungan Faktor Lingkungan Dengan Angka Kejadian Penyakit DBD di

https://dx.doi.org/10.22161/ijreh.2.1.7 *ISSN: 2456-8678*

Kecamatan Purwokerto Selatan; Scientific Magazines of Geomatics Vol.15 No.2 December 2009. ISSN.0854-2759 Hal. 32-40. Accreditation:128/Akred-LIPI/P2MB/06/2008.

[10] Regulation of the Minister of Health RI No. 75 tahun 2014 about Public Health Center

[11] Regulation of the Minister of Health No.949/Menkes/ Per/VIII/2007 about Criteria for services of Health center in remote area.

[12] Ricards, H.M, Farmer, J., Selvaras, S., Sustaining The Rural Primary Health Care Workforce:Survey of Healthcare Professional in The Scottish Highlands, Rural and Remote Health. 2005

[13] Sitorus H, Ambarita LP. 2007. Gambaran Aksesibilitas Sarana Pelayanan Kesehatan di Provinsi Kepulauan Bangka Belitung (Riskesda of Data Analysis .2007) Workshop P2B2 in Baturaja

[14] Statistics of Sigi Regency. 2015. Sigi Regency Profile 2015 (BPS. 2015)

[15] Suharmiati, Handayani L, Kristiana L. 2012. Factors Influence Accesibility of Health Servicesat a Remote and Border Health Service in Sambas District. Journal Research of Health System n– Vol. 15 No. 3 Juli 2012: 223–231

[16] SusantonoB. 2012. Menajemen Infrastruktur dan Pengembangan Wilayah. Jakarta. Publisher of University of Indonesia

[17] Syah I, Darwin E, Bachtiar H, Pujani V. 2014. The Development of Free Health Care Policy Model in Puskesmas. Public Health Center Journals Vol. 8 No. 7 February 2014: 325 - 329

[18] Wulansari RR. 2010. "Efisiensi Relatif Operasional Puskesmas di Kota Semarang Tahun 2009". Thesis. Not Published, Universitas Indonesia.