INTEGRATION OF SPATIAL CHARACTERISTIC TO HEALTH SERVICES FOR IMPROVEMENT OF CHILDREN HEALTH

Irene Sondang Fitrinitia [1]*, Esty Suyanti[1], Purnawan Junadi[1], Hardya Gustada[2]

[1]School of Strategic and Global Studies, Universitas Indonesia, Indonesia

[2]Faculty of Medicine, Universitas Indonesia, Indonesia

* Corresponding Author, Received: 13 Nov. 2018, Revised: 07 Jan. 2019, Accepted: 25 Jan. 2019

ABSTRACT: Health issues are always related with environment condition. Regarding urban context, city has a double burden diseases in addition to infectious diseases as well as for degenerative diseases because life's pattern in city increasingly aggravating. Environmental risk factors are related to the type of diseases, evidently. Hence, in realization these several kind of diseases is not comparable and proportional to the number and coverage of health services. In particular children health, their growth is very sensitive to environment exposures. So environment factors could be the important aspects that consider with the children activities. At least, it happened in Depok City, one of middle city where close to the capital city of Indonesia. Through this research we would like to see the relevance of urban spatial elements especially the environmental aspects with the health risk factors of children compared to the number of health services and their coverage. In addition, we will also conduct spatial mapping of Depok City against the risk factors of children's health on the urban environment. The methodology that we used was a mix method between qualitative through FGD and quantitative including GIS. Based on the findings, it is known that the health risk including children due to the decrease of environmental character in Depok is divided into three classes that are dominated in high risk class. However, health facilities such as hospitals, Puskesmas (small hospitals), treatment services are low in coverage. This suggests that there is less integration between the spatial characteristics of the region and urban planning specifically related to health issues.

Keywords: Water sensitive city, Water supply, Middle city, Peri-urban

1. INTRODUCTION

As a city demanded to be dynamic, transformations that occurred are often caused by changing demands and conditions of city inhabitants [1] [2]. The changing could be the positive or the negative ones. The easiest identification to support that statement is the development of infrastructure, which indirectly has an effect on the health status of its citizens, whether good or bad. The health status of a person or even a community is the result of the interaction of various factors, both internal and external factors from human itself [3]. This internal factor composed physically and socially elements. External factors consist of various factors such as social, cultural society, environment, politics, economics, education and so on. Interactive relationships between humans and their behavior deal with potentially hazardous environmental components, also known as the process of disease incidence. Meanwhile, the process of disease incidence with each other has its own characteristics. In this case, environmental factors play a very important role. Human interaction with the environment has caused contact between germs and humans. Oftenly, the germs that live in the host body then migrate to humans because humans are not able to keep the environment clean. This is reflected in the high incidence of environment-based diseases that are

still the biggest health problem of Indonesian society. To reduce the health problems caused by environmental diseases is to plan and implement a region-based disease management [4].

Most of discussions in this paper are about of urban health then deciding factor to be considered is the environmental health of the city. The impact of industrialization in the form of exposure to pollution, misuse of innovation and technology up to environmental threats adds health risks to city dwellers.

Lack of public awareness due to the dynamic and high pressure of city life causes the disease is also known at the stage that is already acute. Generally, because the character of urban society is dynamic and has a lot of harmony to the action of health is curative rather than preventive.

Urban environment studies plays an important role in minimize public health risks including on child health. It leads many research to cope with many problems in tropical cities like Indonesia that consist a mixture of vectors, climatic conditions and the connection of local environment and human behavior which triggers for the rapid spread of epidemics of infectious diseases. Children become the media most at risk of exposure to diseases caused by environmental factors such as poor sanitation, poor water quality to air pollution. With the city conditions in such a way can be a threat to the health of children

ranging from diarrhea, respiratory infection, skin diseases and other infectious diseases.

Therefore through this paper, we want to contribute the spatial pattern of health status in middle city like Depok. It means to convey the characteristics of space that are risk to the child's special health. We chose Depok city to study more deeply as a case study. Depok city as a medium-sized city that became the satellite city of Jakarta experienced massive growth and rapidly. The location directly adjacent to Jakarta makes the city of Depok as a dormitory for workers in Jakarta. Therefore this city is growing based on high demand for housing but inadequate planning. Another indication of this massive development is the side effects on degraded environments and ultimately harmful to the health of their citizens. Also, we would like to see the relevance of urban spatial elements especially the environmental aspects with the health risk factors of children compared to the number of health services and their coverage. In addition, we will also conduct spatial mapping of Depok City against the risk factors of children's health on the urban environment.

2. METHODOLOGY

In this research we use several approaches to underpin the assumption of the findings. Based on the concept we had, we used to as fond to collect and analyzed the data. The approaches consist of qualitative and quantitative techniques. It makes information from data collecting could be wide and depth as well.

By using GIS Depok City divided unto district (kecamatan) area. Furthermore, the data collecting and analyzing are using "district" as mapping unit. In Indonesia district means "kecamatan", the third layer administrative boundaries after province, city/municipalities then after that district.

In Depok case, there are 11 districts consist of : beji, Bojong Sari, Cilodong, Cimanggis, Cinere, Cipayung, Limo, Pancoran Mas, Sawangan, Sukmajaya, Tapos. These eleven districts will be peeled with several spatial topics related with health issues like potential disease or health services at city scales.

GIS helps to analyze data within region, shows the distribution of regions that have the same data group or data characteristic in particular health issues. The objectives of GIS are the information system management with analysis tools (statistical and spatial modeling) and can be displayed of spatial information and made meaningful results [5]. We also use the overlay techniques to present the comparison between the health risks condition and the needs of Depok City due to health facilities.

We collected the tabular and spatial data to enrich the article with visualization. Each data in this research are secondary source, based on the report literature or previous research in Depok. We did not use the primary data since it costly and long duration achievement.

Actually, this research was conducted while we had community development research regarding the use of self-diagnose mobile application to children health in Depok. We need to attach the spatial map and region characteristic to the apps. Therefore we should have data to give the big picture of Depok city.

3. ENVIRONMENTAL RISK TO HEALTH STATUS

Health status in one city is very affected from the physical environment. The better is the environment condition so the healthier people who lived on it. It is based on the empirical studies on the connection between the health status and the condition of environment. The connection are shown by the measurement of human function from physically, mentally, emotionally and socially [6]. It been indicated from life expectancy, physical disability, mental disability, social behaviors, self-reported feelings about one's health, presence of disease, lab test values, and assessed emotions

Furthermore we can check to Blum's classic model due to elements that determine health status consist of health as physical (somatic), mental (psychic), and social well-being. The environmental risk occurs when physical and sociocultural conditions affect the human lives. Many environmental elements affect health, such as sanitation, violence, sunlight, employment opportunities, population density, and air pollution. According to Blum the environment has the most powerful effect on health, indicated by environment having the thickest (strongest) arrow in the exhibit. Not only the natural physical environment but also the man made built environment like park, private and public building. The quality of building materials and equipment varies greatly that gives healthy living environment potentially harmful. Staying in such living environment lurking high levels of dangerous environmental factors for a long time become an issue particularly children's health problems that need attention [7]. The environmental elements are the ultimate factors that define children's health. Critical situations due to access to drinkable water, sewage disposal and housing conditions are the factors remarkable morbidity and mortality of children in developing countries [8].

The report of UNICEF Indonesia 2012 stated that child mortality becomes a trend in Megapolitan Jabodetabek. According to the report, rapid urbanization has an effect on excessive population density, poor sanitation conditions for the urban poor, poor service quality in urban areas. Ultimately this big city became endemic to diarrhea and claimed to

account for 31 percent of child deaths between the ages of 1 month to 1 year, and 25 percent of child deaths between the ages of one to four. Therefore, the study that has been done by many stakeholders is to convey that there is a valid relationship between the quality of the environment with the main health status of children. The worse the environmental conditions make the child's health is also to be worse [9].

The approach of Environmental Risk Health Assessment was the best choices to shown the environment status that can be risked to ruin one's health condition. The assessment had been conducted in several countries as a background of decision maker to decisive to policy actions in several countries [10]. In Indonesia especially Depok city they assessed according with Depok characteristics.

Factors that use to be as the indicator of Environmental Risk Health Assessment in Depok such as waste disposal management, clean water existences, sanitation condition, settlement drainage until hygiene behavior of Depok's residents. This assessment also insert on indicator which is the occurrence of diarrhea disease in child. These factors made a comprehensive approach in terms of environment profile.

4. DEVELOPMENTS IN DEPOK AND ITS IMPACT TO HEALTH CONDITION

Massive developments that happened in middle cities in Indonesia trigger nation growth. Depok is one of middle city that includes in Jakarta Megacities. The role as satellite city made Depok certainly under pressure from Jakarta and has a significant impact such as an increase in population. The population growth doubled increase because of the existence of UI campus that trigger mix used area to be developed.

Then, Depok City for 16 years since it was declared has 2,106,102 of population or increased by 75% in 2015 with the density of population reaching 10,255 people per km2 [11]. The composition of the population based on the general structure of the population <5 year is the second largest, reaching 202,831 people.

Since Depok was an area that included of Jakarta Megacities, so Depok had an impact of Jakarta development automatically. Hence, the developments are being run from the Jakarta and local development from Depok itself. At north of Depok where the neighborhood with Jakarta are consist of dense area/district. However the densest one is in the middle of Depok. While the east, west or even the south still undeveloped yet as much as center part.

The rapid changes can be shown from the composition of land uses that been developed in Depok. The built-up area are dominated at the land use map since the last 2 decades. Overexploitation because of development decreased the quality of environment These situations cause a negative impact

to health risk. Moreover, contagious disease could harm peoples includes in Depok City.

Toddler age is quite susceptible to the type of disease either contagious or not contagious. Based on outpatient data in hospitals at Depok City in 2015, for age <1 year URI (Upper Respiratory Tract Infectionsuffered) suffered by 32%, followed by flu (19%) and dermatitis (12%). Most of the illnesses suffered by children 1-4 years was URI as much as 51%, diarrhea (13%) and febris (9%). Data from Puskemas (Health Public Center) showed that most of the disease suffered by children <1year was URI of 28%, nasopharyngitis (27%) and cough (11%). Most of the illnesses suffered by children aged 1-4 years were URI as much as 30%, nasopharyngitis (23%) and cough (14%). [12].

In Depok, infants and toddlers are also susceptible to other infectious diseases, some potentially infectious diseases to infants and toddlers are dengue fever, filariasis, diarrhea, leprosy, pneumonia, diphtheria, tetanus, measles, hepatitis, pertussis, and poliomyelitis. [13].

The contagious with un-contagious were sometimes lead infants to dead attack. The infant mortality rate in Depok City quite high [14].

Table 1 Infant Mortality Index by District

No	District	Infants	Mortality Index
1	Beji	13	Low
2	Bojongsari	3	High
3	Cilodong	5	High
4	Cimanggis	14	Moderate
5	Cinere	6	High
6	Cipayung	3	High
7	Limo	0	High
8	Pancoran Mas	14	Very High
9	Sawangan	5	High
10	Sukmajaya	12	Very High
11	Tapos	6	Low

Based on this report we knew that Pancoran Mas and Cimanggis were the severe districts regarding the average of mortality.

This result also strengthens the finding from the environmental health risk assessment map. It concludes the center area of Depok which are Pancoran Mas and Sukmajaya were in the class of high risk district exposed by the environment degradation.
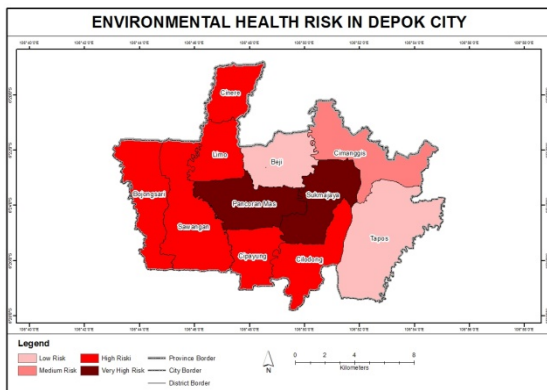
Fig. 1   Environmental health risk map

Due to the densest district in Depok, Pancoran Mas and Sukmajaya have the largest of slum area. The data from Settlement and Housing Agency Depok stated that almost 6 percent of Pancoran Mas is slum and squatter. Even though the percentage is small but it is the highest number among the whole districts in Depok. The characteristics of slum area contribute the high risk of environmental health. Although it not automatically related to health issues, daily practices tendentious to have un-hygiene behavior. So, it affect to the exposure having the disease.

Depok Health Data in 2015 states that the coverage of healthy homes in Depok has reached 85.93%. Community access to clean water is filled from groundwater and Water Supply Company. Residents who have access to clean water use health standards as much as 74%. Fulfillment of sanitation (latrines) healthy in Depok declared feasible as much as 73.5%. In addition to the environmental factors of society behavior also affect the health status of society. The coverage of clean and healthy households in Depok city by 2015 is 77.5%.

5.   HEALTH INFRASTRUCTURES SERVICES IN DEPOK

The population of Depok City is 2,106,100 peoples with growth of 3.57 percent in 2015. This number is huge enough for the middle city like Depok. Consequently, sufficient public facilities needed to be fulfilling for daily life. This also includes health facilities and infrastructures. However, the fact is not as proper as the planning. Number and distributions of health facilities were enough for existing condition, but still did not meet for the ideal condition. It exacerbated for disease impacts exposure. The symptom already occurred when environmental risk is high and it should treat as soon as possible by the health services. This role should be taken by the government or private sector to provide hospital, clinic and health center. Furthermore, children as the most vulnerable exposed

by this risk need special treatment deal with the environment degradation.

In Indonesia beside clinic and hospital, we have public health center called Puskesmas. Based on the regulation the existence of Puskesmas minimal must be 1 unit at 1 sub-district (Kelurahan). Below is the number of hospital and Puskesmas in Depok:

Table 2.   Health Care Service by District

No	District	A	B	C	D	E
1	Beji	3	2	2	5	9,8
2	Bojongsari	2	0	0	2	3,92
3	Cilodong	3	0	2	5	9,8
4	Cimanggis	6	1	4	10	19,61
5	Cinere	1	0	1	2	3,92
6	Cipayung	2	1	0	2	3,92
7	Limo	1	0	0	1	1,96
8	Pancoran Mas	3	0	4	7	13,73
9	Sawangan	4	1	2	6	11,76
10	Sukmajaya	4	0	2	6	11,76
11	Tapos	5	1	0	5	9,8

Note: A (puskesmas), B (2nd class Puskesmas), C (Hospital), D (Total), E (% /Percentage of Settlement)

Based from the table above describes that Cimanggis has the biggest number of health infrastructures. Not only in a matter of quantities, have Cimanggis also had the complete range of services from Puskesmas, hospital until 2nd class Puskesmas. Hospital as the first grade health services centralized in Cimanggis and Pancoran Mas as seen in the distribution map (Fig 2). From the map below we can see the distribution either disperse or centralized at some certain places
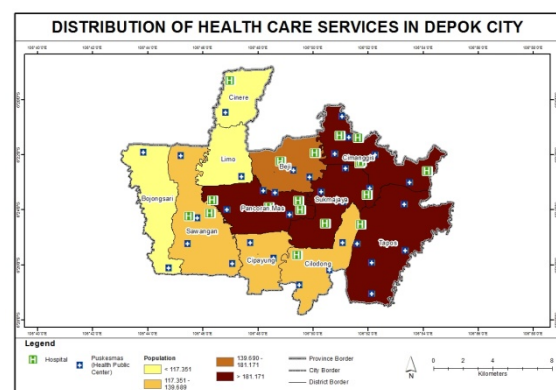

Fig. 2   Health care service distribution

6.   HEALTH RISKS STATUS OF DEPOK

Discussing in terms of health status, we must have a comparison analysis between the "problems" and "potential solutions". In this context, "problems" will be the environment risk that affect to health and

the other side "potential solution" will be the health services facilities.

Moreover by using the overlay techniques in GIS, we can compare two models of data which are tabular and spatial map. We have two result pictures and one table recapitulation to describe the finding.
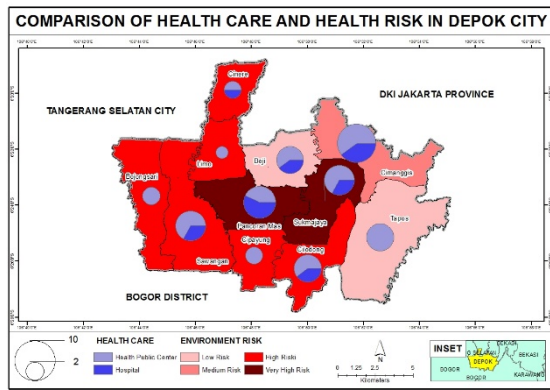

Fig. 3   Health care and health risk comparison

Despite the health infrastructure already developed for the Depok population, it still did not meet with the environmental risk that potentially harms the Depok's residents.

The figure 3 showed the comparison of the size (quantity and quality) health care and environment risk. Even though Pancoran Mas is the worst at environment risk, but at this scale it already has the sufficient of health facilities. Slightly different with Sukmajaya that has significant level of harmful risk but have a moderate number of health services. Tapos is under services but it is logic since the environment not too risky. Meanwhile Limo and Bojong sari are the worst case, the environment quite risky but the health services still in moderate level. So it is inadequate to fulfill the services.

Completing the comprehensive analysis due to comparison, we also insert the overlay map between environmental risk and health workers (Fig 4)
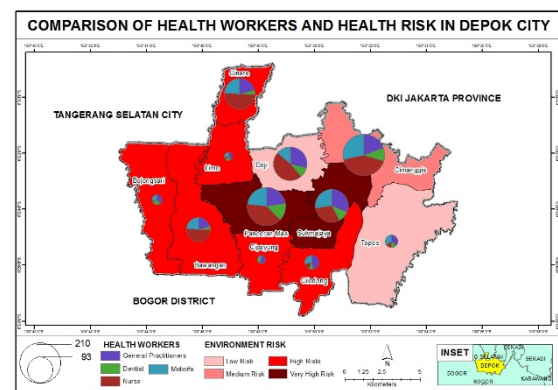

Fig. 4   Health workers and health risk comparison

Table 3. Recapitulation Results Among 11 Districts

District	Settlement (%)	Slum (%)	Environment Index	Infant Mortality	Health Cares (%)	Health Workers (%)	Distribution of Health Cares
Sawangan	49.18	1.20	High Risk	Medium	11.76	8.22	Disperse
Bojongsari	32.99	-	High Risk	Low	3.92	1.86	Rare
Pancoran Mas	43.20	-	Very High Risk	High	13.73	18.55	Centralized
Cipayung	50.92	0.40	High Risk	Low	3.92	1.24	Disperse
Sukmajaya	56.74	2.73	Very High Risk	High	11.76	14.40	Disperse
Cilodong	42.84	4.82	High Risk	Medium	9.80	3.36	Disperse
Cimanggis	38.92	-	Medium Risk	High	19.61	21.20	Centralized
Tapos	49.21	5.82	Low	Medium	9.80	2.74	Disperse
Beji	29.32	3.87	Low	Medium	9.80	14.75	Disperse
Limo	53.78	2.94	High	None	1.96	1.24	Rare
Cinere	33.22	-	High	Medium	3.92	12.46	Rare

Based from the picture above the highest number of health worker and practitioner were in Cimmangis and Pancoran Mas. Both of these districts have a similarity which dominated with settlement area. Although, the difference between them are associated to environmental risk exposures. Pancoran Mas has a high rank of health harmful, meanwhile Cimanggis slightly below for the risks. The best one is Beji, with the low risk of environment harmful but it has moderate number of health worker and practitioners.

To sum up the findings, we establish recapitulation table that compare on indicator to others. According the recapitulation we can classify into three class regarding the health and environmen status among 11 districts in Depok. The three classes in districts will be:

1. Manageable But Risky, consist of Sawangan, Cipayung, Sukmajaya, Cilodong, Cimanggis
2. Manageable, consist of Beji, Tapos
3. Unmanageable and Risky consist of Bojongsari, Pancoran Mas, Limo, Cinere

The manageable but risky means, the districts has already enough modal to manage the health issues even though the harmful possibilities from the environmental degradation still wide open. Depok has 5 districts in this category.

The unmanageable and risky will be the worst case. Double burden issues like less health services combine with the high risk environmental degradation. Depok has 4 districts in this category

The last should be the best one is the manageable. It means number of health services are sufficient enough compare to the low risk of health issues. In Depok case, there are only 2 districts in this categorize.

7. CONCLUSION

Based on the findings, it is known that the health risk including children due to the decrease of environmental character in Depok is divided into three classes which are district with manageable but risky status, district with manageable status and district with the unmanageable and risk status. This suggests that there is less integration between the spatial characteristics of the region and urban planning specifically related to health issues.

8. ACKNOWLEDGMENTS

9. REFERENCES

[1] Wilson, D. (2007). City transformation and the global trope: Indianapolis and Cleveland. Globalizations, 4(1), 29-44.

[2] Malone, P. (2013). City, capital and water: Routledge.

[3] Blum, Henrik L. (1983): "Health Planning: Lessons for the Future." (390-391).

[4] Profil Kesehatan Indonesia (2015) Kementrian Kesehatan 5.Republik Indonesia

[5] Kandwal, Rashmi P.K. Garg, R.D. Garg (2009) Health GIS and HIV/AIDS studies: Perspective and retrospective. Journal of Biomedical Informatics Vol 42 page 748–755

[6] Fos P.J, D. Fine, (2005)Managerial epidemiology for health care organizations (2nd ed), Jossey-Bass, San Francisco

[7] Wei, Shanshan, Yang Lv, Baiin Fu, Hiroshi Yoshino (2016) The correlation study on the living environment and children's health problem in Dalian. Procedia Engineering, Volume 146, Pages 158-165

[8] Mello-da-Silva, Carlos Augusto, Ligia Fruchtengarten (2005) Environmental chemical hazards and child health. Jornal de Pediatria

[9] Laporan Tahunan UNICEF Indonesia. 2012

[10] Tal A (1997). Assessing the environmental movement's attitudes towards risk assessment. Environmental Science and Technology, 31 (10):470A–476A.

[11] Ali, Firdaus, et al (2018) Initiative Urban Water Studies At Depok, Peri-Urban City - Toward The Implementation Of Water Sensitive City Concept. International Journal of Geomate

[12] [13] [14] Profil Kesehatan Kota Depok 2016