

## **The Social Economic Situation of Community Exposed to Radon Radiation in West Java Province**

Bintarsih Sekarningrum\*  
Faculty of Social and Political Science  
Universitas Padjadjaran - Indonesia

Suhardjo Sitam  
Faculty of Dentistry  
Universitas Padjadjaran - Indonesia

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### **ABSTRACT**

The research on the effects of radon on human's health has never been conducted in Indonesia before. This preliminary research was aimed at identifying the social economic conditions in the regions with a high and low-level of Radon in West Java Province. The study used descriptive survey techniques. The random sampling technique was employed with the following criteria. First, the samples were the residents of the investigated area. Second, they were willing to be the participants. Last, but not least, they were adults, according to 2013's WHO. The result of the research showed that people with low-level of education in a high level of Radon area had low-income because of the limited opportunity to get a good job. Furthermore, less income resulted in the difficulty to afford nutritious food and clean environment, including decent places to live in. The conditions gave bad impacts on people's health that was worsened by the absence of social support from the community and the government. The study recommends a model of disease prevention from the perspective of economic, sociology, and health to improve the local people's quality of life.

### **1. INTRODUCTION**

Radon, which is produced by rocks, releases radiation that can affect the human's body. Uncontrollable long-term negative effects on health have been proven by epidemiological studies (William Field, 2001). Radon originates from a radioactive decay of uranium containing rocks and soil.

The mechanism on how radon affects health is through different kinds of exposures, such as inhalation, oral, dermal, and others. The fatal effect may cause death. It can also give the effects on systemic failure, like the immune system, nerve system, growth, reproductive system, genetics, and cancer (US EPA, 1990).

A study about exposure to radon natural ionized in West Java, which has been explained by Ildrem, Hirnawan and Suhardjo (2011) reveals that the exposure to Radon naturally ionized in West Java, particularly in Padalarang and its surrounding areas, falls under the group of low, normal, and high. The situation in Subang area, on the other hand, is described as low-normal, normal, normal-high, and high. The preliminary project of this study held in Padalarang (West Java) shows that the radon as the focus of this study has been comprehensively mapped particularly in terms of high and low radon radioactive level.

Several epidemiology studies in WHO Handbook on Indoor Radon (2009) show the risk caused by radiation for health, which in the long-term, will affect someone's quality of life (QoL). In several developed countries, such as the United States, Australia, Japan, and West European countries, radon gas issue has thoroughly been taken into consideration. The Australian government, for instance, through the Commonwealth of Health, Housing, and Community Services have opened information centers specifying in radon gas in all the states. The purpose is to give exact information about the threat of the radon gas exposure. The government of the United States and Japan have made the mapping for the areas with high level of radon.

In Indonesia, a study about the effect of radon on the health and quality of life has never been conducted. Hence, this pilot study will map the social and economic condition of people who live in the areas with a high and low-level of radon. The findings will be used as a prevention model which is based on the perspectives of the sociology of economic and sociology of health to improve the people's quality of life in the areas with high radon level.

## **2. RESEARCH METHODOLOGY**

A descriptive survey was applied in the research to describe the quality of people's life. The population is those who live in Padalarang (Bandung regency) where the radon level in the area is high and low. The random sampling technique was employed with the following criteria. First, the samples were the residents of the investigated area. Second, they were willing to be the participants. Last, but not least, they were adults, according to 2013's WHO criteria. Following this technique, the sample size of 100 participants was attained.

Variables on socio-economic conditions included income, employment and working conditions, food hygiene, environment and housing, education and literacy, social relation and support, health behavior, and access to the health care. The scales used to score the variables range from 1 to 4 with the following details.

- 1 means very high/perfect mastery/very good/very adequate/very often.
- 2 means high/ good mastery/quite good/adequate/frequent
- 3 means medium/ poor mastery/not good/inadequate/quite often
- 4 means low/ no mastery bad/very inadequate/never

All the collected data were processed and analyzed by using univariate analysis.

## **3. RESEARCH FINDINGS AND DISCUSSION**

### **3.1. General Description of Cipatat Village and Gunung Masigit Village**

The population in Cipatat village reached 14.146 people in 2014 with 7.398 males and 6.748 females who mostly worked as farming labors. There were 4.482 people or 1.494 heads of family who were categorized as living in poverty, according to the monograph of Cipatat village, 2014. The majority of the people only finished primary school and middle school.

People of Gunung Masigit village reached the number of 15.304 in 2014 with 7.771 males and 7.771 females and 3.407 heads of family. The majority of people in this village

worked as labors in chalk mining factories (Monograph of Gunung Masigit village, 2014). 183 people were graduated from kindergarten, 1.363 people were from primary school, 2.959 people were from middle school, 1.974 people were from high school, 125 people were from college, 54 people were from the undergraduate program, and 283 people do not have any academic qualifications. The number of poor people in 2014 reached 10.712 or 69%, according to the monograph of Gunung Masigit village in 2014. The research also took the data of 10 major ailments into consideration. The most common ailment from which people suffer from was URI (Upper Respiratory Tract Infection) with 2.124 cases. This was related to the number of the chalk minings in the area.

**Table 1. 10 Most Common Ailments in Gunung Masigit village in 2014**

No	Type of Ailments	Months										Total
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	
1	URI	192	325	264	178	238	270	126	182	173	176	<b>2124</b>
2	Hypertension	303	242	109	67	99	123	50	146	65	149	1353
3	Indigestion	161	124	96	81	72	93	85	79	77	96	964
4	Myalgia	52	61	49	29	35	45	39	55	40	54	459
5	Diarrhea	0	43	18	18	39	42	30	71	40	40	341
6	Common Cold	61	45	11	0	38	0	17	32	26	44	274
7	Dermatitis	0	0	38	0	32	31	32	30	33	50	246
8	Pharyngitis	47	83	0	10	0	30	0	0	25	36	231
9	Fever with unknown cause	100	0	0	38	20	27	0	33	0	0	218
10	Migraine	37	24	17	37	0	28	0	0	28	29	200

(Source : Cipatat Health Center, 2014)

### 3.2. Characteristics of the Respondents

The respondents in Cipatat (28.0%) and Gunung Masigit (30%) were mostly 41 – 50 years old. The location in which they lived was mostly in the village areas and only a few number of them lived in the outskirts of the city. Most of them had been living in the area for more than 20 years. 88% of respondents in Cipatat and 86% of them in Gunung Masigit had been married.

In terms of education, the majority of the men in Cipatat village graduated from primary school (24.0%) and middle school (26.0%). Similarly, in Gunung Masigit, the level of education of the men graduated from primary school was 36.0% and from middle school were 36.0%. The women graduated from middle school were 34.0%. Whereas, in Gunung Masigit, the majority of the wives only finished primary school (42.0%). The data clearly showed that the level of education of the men in the two villages was similar while the women's condition appeared to be different since there were more wives graduated from middle school in Gunung Masigit than in Cipatat.

In terms of job, the husbands mostly worked as factory labors both in Cipatat (32.0%) and Gunung Masigit (30.0%). Meanwhile, the women from both villages were housewives (64% in Cipatat and 48% in Gunung Masigit). However, most of the

respondents in the two villages were quite literate (52% in Cipatat and 64% in Gunung Masigit).

According to the Central Statistics Agency, 34% of the married men in Cipatat earned middle category income (IDR. 1.500.000 to 2.499.999). In Gunung Masigit, 44% of married men earned less money thus they were categorized as having low income (<1.500.000). Meanwhile, both in Cipatat and in Gunung Masigit, the wives did not make money since the majority of them were housewives.

### 3.3. Working Condition

The working condition elements of the research included lighting condition both inside and outside the working space, noise, gas/vapor/smoke/dust, animals (mosquitoes, cockroaches, and flies), working tools, and the relation between superiors and subordinates. It reveals that in Cipatat village, all the working condition elements are in good condition. On the other hand, In the Gunung Masigit village, all the elements are not supportive since noise, and gas/vapor/smoke/dust are highly produced. This is related to the condition of the Gunung Masigit village as a chalk mining location which produces very thick smoke and dust as well as loud noises every single day.



Picture 1. Working Condition in Gunung Masigit

Table 2. Working Conditions in Cipatat Village and Gunung Masigit Village

No	Cipatat Village	Very good (4)	Good (3)	Not good (2)	Poor (1)	No Response
1	Lighting inside and outside work space	22.0	<b>70.0</b>	8.0	0.0	0.0
2	Noise	12.0	<b>50.0</b>	32.0	6.0	0.0
3	Gas, favor, smoke and dust	12.0	<b>54.0</b>	28.0	6.0	0.0
4	Animal (mosquito, cockroach, fly)	14.0	<b>46.0</b>	36.0	4.0	0.0
5	Working equipments (according to the body size)	16.0	<b>78.0</b>	6.0	0.0	0.0
6	Relation with superior and colleagues	24.0	<b>76.0</b>	0.0	0.0	0.0
No	Gunung Masigit Village	Very good (4)	Good (3)	Not good (2)	Poor (1)	No response
1	Lighting inside and outside work space	0.0	<b>88.0</b>	10.0	0.0	2.0
2	Noise	12.0	36.0	<b>46.0</b>	4.0	2.0
3	Gas, favor, smoke and dust	4.0	22.0	<b>66.0</b>	6.0	2.0

4	Animal (mosquito, cockroach, fly)	0.0	<b>46.0</b>	44.0	8.0	2.0
5	Working equipments (according to the body size)	2.0	<b>74.0</b>	18.0	4.0	2.0
6	Relation with superior and colleagues	12.0	<b>82.0</b>	4.0	0.0	2.0

(Source : Research findings, 2015)

### 3.4. Food Security

Food security is one of the aspects related to the family income. Those with low income cannot fulfill the need of the nutrition all the time. The data about the quality of food in Cipatat and Gunung Masigit showed that the two villages were similar in terms of having the low fulfillment of daily food availability, variety, and affordability. Concerning the fulfillment of the need to consume meat, milk, and poultry, people from both villages could not always provide the kinds of foods every day. The situation was clearly seen in Gunung Masigit where most of the respondents worked as factory labors whose income was low (< IDR. 1.500.000).

**Table 3. Food Security in Cipatat Village and Gunung Masigit Village**

No	Cipatat Village	Very adequate (4)	Adequate (3)	Inadequate (2)	Very inadequate (1)	Total
1	Daily food availability for all family members	16.0	<b>70.0</b>	14.0	0.0	100
2	Weekly consumption of meat, milk, and poultry	12.0	<b>44.0</b>	40.0	4.0	100
3	Daily food variety	16.0	<b>66.0</b>	18.0	0.0	100
4	Daily food affordability	20.0	<b>60.0</b>	20.0	0.0	100
No	Gunung Masigit Village	Very adequate (4)	Adequate (3)	Inadequate (2)	Very inadequate (1)	Total
1	Daily food availability for all family members	6.0	<b>78.0</b>	16.0	0.0	100
2	Weekly consumption of meat, milk, and poultry	6.0	<b>44.0</b>	<b>44.0</b>	6.0	100
3	Daily food variety	10.0	<b>56.0</b>	32.0	2.0	100
4	Daily food affordability	8.0	<b>62.0</b>	26.0	4.0	100

(Source : Research Finding, 2015)

### 3.5. Social Relation

Another social economy factor which affects public's health is the social relation. Social relation is people's interaction that can influence their health and it can also result in an improvement of health behavior either for individual or people in a group. The data on the social relation in Cipatat and Gunung Masigit show that there was a good relation between family members, friends, and other members of the society. Cooperation among them was well established thus no clash occurred.

### 3.6. Social Support

Social support and social network can protect people's health, especially those who live under unfortunate circumstances. The data from the two villages concerning social supports show that there was a good social support from family, friends, and society. The supports are in the forms of information, emotion, instrument, and evaluation. The source of the social support was obtained from family in the form of emotional and instrumental aspects. This type of support was frequently received either from friends or from people around the Gunung Masigit village. However, there were no supports in the form of material or financial aspects. The condition was seemingly related to the people's social economy due to their low income (<IDR. 1.500.000).

### 3.7. Environmental and Housing Condition

There is a correlation between income and the condition of housing. Those who have very low income often have a poor housing environment which furthermore affects their health. The environment and health conditions in Cipatat and Gunung Masigit are overall quite good, except for the garbage and waste water disposal condition in Gunung Masigit which still needs serious attention.

**Table 4. Environmental and Housing Conditions in Cipatat Village and Gunung Masigit Village**

No	Cipatat Village	Very good (4)	Good (3)	Not good (2)	Poor (1)	No response
1	The cleanliness of housing environment	18.0	<b>62.0</b>	20.0	0.0	
2	Fecal waste disposal	18.0	<b>74.0</b>	8.0	0.0	
3	Provision of clean water	22.0	<b>62.0</b>	14.0	2.0	
4	Garbage disposal	12.0	<b>56.0</b>	32.0	0.0	
5	Waste water disposal	16.0	<b>66.0</b>	16.0	2.0	
6	Location of farm animals and housing	28.0	<b>48.0</b>	16.0	20	6.0
No	Gunung Masigit Village	Very good (4)	Good (3)	Not good (2)	Poor (1)	No response
1	The cleanliness of housing environment	4.0	<b>64.0</b>	32.0	0.0	
2	Fecal waste disposal	6.0	<b>76.0</b>	8.0	10.0	
3	Provision of clean water	2.0	<b>60.0</b>	28.0	10.0	
4	Garbage disposal	4.0	<b>46.0</b>	<b>40.0</b>	10.0	
5	Waste water disposal	2.0	<b>60.0</b>	<b>36.0</b>	2.0	

6	Location of farm animals and housing	24.0	<b>50.0</b>	18.0	40	4.0
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(Source: Research Findings, 2015)

### 3.8. Health Condition

The condition of someone's health also gives a correlation with other social-economic factors such as income. Those with low income tend to have a poor health condition. The data show that the health condition in the two villages was not very good. The people frequently suffered from ailments almost every month. The only nearby medical care facility was the community health center since other health facilities such as public/ private hospitals, clinics, and doctor's office were not available. This is due to the long distance. Nonetheless, most of the respondents also never tried to find an alternative health treatment to cure their sicknesses, such as traditional medicine or herbs.

**Table 5. Health Conditions in Cipatat Village**

No	Cipatat Village	Very frequent (4)	Frequent (3)	Quite frequent (2)	Never (1)	No response
1	Frequency of ailments monthly	8.0	14.0	<b>50.0</b>	28.0	
<b>Access to medical care</b>						
2	Public hospital	0.0	0.0	22.0	<b>78.0</b>	
3	Private hospital	0.0	2.0	6.0	<b>90.0</b>	2.0
4	Health center	2.0	12.0	<b>64.0</b>	20.0	2.0
5	Doctor's office	0.0	4.0	20.0	<b>76.0</b>	
6	Clinic	0.0	4.0	22.0	<b>72.0</b>	2.0
7	The use of traditional medicine/ herbs	6.0	14.0	16.0	<b>64.0</b>	

(Source: Research Findings, 2015)

**Table 6. Health Conditions in Gunung Masigit Village**

No	Gunung Masigit Village	Very frequent (4)	Frequent (3)	Quite frequent (2)	Never (1)	No response
1	Frequency of ailments monthly	8.0	10.0	<b>52.0</b>	30.0	
<b>Access to medical care</b>						
2	Public hospital	4.0	2.0	14.0	<b>80.0</b>	
3	Private hospital	0.0	0.0	10.0	<b>90.0</b>	
4	Health center	0.0	16.0	<b>58.0</b>	26.0	
5	Doctor's office	0.0	4.0	8.0	<b>86.0</b>	2.0
6	Clinic	0.0	2.0	12.0	<b>82.0</b>	4.0

7	The use of traditional medicine/ herbs	6.0	4.0	12.0	<b>78.0</b>
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(Source: Research Findings, 2015)

Referring to Hendrik L. Blum's theory of Health Determinant Factor, environment and behavior are essential factors which influence the condition of human health. Furthermore, Canada's Public Health Agency (2008) explains that age, sex, and heredity are the key factors determining one's health. The condition is also influenced by the environment, experience, culture, and other factors which determine one's health. Social and economic factors such as low income, mostly result in the lack of resources and access to nutritious food, decent living and good working condition which may affect someone's state of health. Social support and social network can ensure people's health, particularly for people who live in unfortunate condition (Public Health Agency of Canada, 2008).

The scrutiny of the social and economy of people who live in an area with low radon level (Cipatat Village) and high radon level (Gunung Masigit Village) shows that poor education level, low income, and not proper working condition negatively affect their health. This was indicated by the frequency of the maladies suffered by people living in the two areas in every month. In Gunung Masigit, the people with low education level had limited access for having jobs with higher income. Furthermore, low-income gives them limited access to working safety, nutritious food, and clean housing environment which affect the individual's or group's state of health. Lack of social support from the society in this area worsened the health condition of those with low income.

#### 4. CONCLUSION

According to the study about the effects of Radon in Cipatat and Gunung Masigit Village, it can be concluded that low education level, bad working condition, low income, and social environment obviously affected health. The health condition was worsened by the lack of support from the society, particularly in the area with high level of radon.

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