

Knowledge and Attitude of Junior-High-School Children in Bogor, Indonesia, Related to Climate Change Health Impacts

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Abstract—Sustainable Development Goals require the capacity for resilience and adaptation to climate-related disasters to be strengthened. This capacity is fundamental in healthy city development, which also highlights the importance for youth to have it as early as possible. Therefore, it is crucial to understand their current state before building their capacity. This study aims at measuring the level of knowledge and attitude of junior-high-school students in Bogor City, West Java Province, Indonesia, on health impacts of climate change and identifying predictors of such knowledge and attitude. A cross-sectional study involving purposively selected 142 students aged 12 to 14 years old in a state-owned junior high school was implemented in 2015. A structured questionnaire was used to mine data regarding the knowledge of and attitude towards climate change health impacts, ownership and utilization of information access, school subject, and supports from close related person. Bivariate analysis was conducted with Chi-square test and multivariate analysis with logistic regression at 0.05 significance. Eighty-two female and sixty male students took part in this study. The proportion of students with good level of knowledge on the health effects of climate change was 69%; meanwhile, 51.4% of the students had less supportive attitude toward the issue of climate change health impacts. The multivariate analysis revealed that an association occurred between the knowledge level and family income (income of IDR 2.5-5 million: AOR 4.63 95%CI 1.26-17.04). Similarly, the level of attitude was associated with maternal education (AOR 2.37 95%CI 1.05-5.34). These results suggest that, in climate change impacts, knowledge is not necessarily in line with attitude and family background has a major role to shape both aspects. Health promotion efforts on climate change health impacts should touch on family experience.

Keywords: *climate change, knowledge, attitude, health impact, school children*

I. INTRODUCTION

Climate change is a global issue with many impacts on human life, including health. Direct health effects (death, missing people and injuries) take place when climate-related disasters occur in extremely higher intensity and frequency. Meanwhile, indirect consequences are results from the influence of the changing climate on environment, ecology and society. This type of impact is found more in medium- or longer-term period; and is intermediated by climate variation and weather fluctuation. These cover health issues from reduced water flow, decreasing crop yields and nutritional gain, shifting communicable diseases patterns, and mental health effects from disrupted environment [1].

The health risks of climate change can be minimized through adaptation. It refers to efforts taken to support communities and natural environment to reduce harmful effects of climate change [2]. In this action, community needs to recognize and understand the health consequences and the required response from them, which should be promoted and facilitated by public health sector [1]. Sustainable Development Goals require the capacity for resilience and adaptation regarding climate-related disasters to be strengthened. It also targets improvement in education and awareness on climate change adaptation and impact reduction [3]. In terms of development of healthy cities, these aspects should be taken into account because climate change is a current and, most probably, on-going threat. Without adequate capacities to adapt and to be resilient, the harmful effects will be severe for community's health and the city's economy.

This study was funded under the Health Development Research scheme by the National Institute of Health Research and Development, Indonesian Ministry of Health.

The adaptive capacity strengthening should include all levels of community, inclusive of teenagers. Teenagers are the ones who will experience the adverse climate change impacts in the future. As their worldviews are still constructing [4], it is plausible to overcome their scepticism related to climate change and to encourage their favourable perception as well as action on the issue [5]. They also can play a role as a message carrier for climate change health impacts [6] to others because they have more reliable expert sources on climate change information from school than from politically-biased websites or news [5]. By involving this future generation, it is expected they will fully participate in the adaptation of climate change.

As an archipelago, Indonesia is vulnerable to climate change. Climate change in Indonesia is indicated by the rise of minimum and maximum temperatures ranging from 0.036 – 1.383°C; the increase in extreme rainfall by 21% during 1970-2000 compared to the previous decade; the season shift, including the season onset and duration in Sumatera, Java, and South Sulawesi circa 1971-2000 and 2001-2010; and the reduction of rainfall [7]. Climate-related disasters in the country consist of flooding, drought, sea level rise, and landslide. In addition, eighty percent of disasters that have happened in Indonesia are climate-change-related [8]. With its big population, the magnitude of human toll will be enormous, which can exacerbate given disparities in health services access across the country.

Indonesia has implemented efforts related to climate change effects on health. The Ministry of Health has issued a Regulation of Ministry of Health No 1018 Year 2011 concerning Adaptation Strategy in Health Sector for Climate Change Impact, Guideline for Identification of Climate Change Health Risk Factors No 35 of 2012, and Indonesian Climate Change Sectoral Roadmap (ICCSR) 2010. They also have implemented socialization and advocacy for the Adaptation Strategy, capacity building of healthy human resources for climate change adaptation, and mapping of vulnerability to malaria and dengue haemorrhagic fever (DHF) in 5 provinces [9,10]. Article 3 in the Adaptation Strategy states that community empowerment for climate change adaptation must be enhanced according to local context. It is, therefore, the task of provincial and local governments to implement health promotion regarding health sector adaptation in the community to comply with the Adaptation Strategy [11]. Teenagers must be included as target and actor in this action; although, there is still limited initiative to involve them in Indonesia.

Bogor City, one of districts in West Java Province, Indonesia, is susceptible to harmful effects of climate change. With a remarkable rainfall throughout the year (around 4,086 mm annually), even in the driest months, Bogor is called the Rain City [12]. During the period of 2004-2011, the trends for rainfalls decreased, rainy days increased, temperature was stable and humidity declined;

yet, DHF cases went up until more than one hundred cases in average per month all year long [13]. Climate change vulnerability index calculation categorized the majority of Bogor sub-districts into moderately vulnerable with moderate risk of flooding and drought [14]. Moreover, it has a high risk of diarrhoea and moderate risk of DHF based on climate-change-related health risk assessment [10]. Bogor local government claimed DHF was constantly endemic in Bogor [15,16].

The background indicates that building adaptive capacity for teenagers regarding climate change related health concerns is required. The first step to implement it is to assess their knowledge and attitude towards the issue. However, studies on such topic, with teenagers as participants, are very few. The previous ones generally recruited tertiary-level students or adults [17–19]. Therefore, this study aims at assessing the level of knowledge and attitude of junior-high-school students in Bogor City, Indonesia, on health impacts of climate change and identifying predictors of such knowledge and attitude.

II. METHOD

A. Data Collection

A cross-sectional study was conducted in a state-owned junior high school in Bogor City, West Java Province, Indonesia. Selection of state-owned school was purposive because the students tend to come from heterogeneous background. Junior High School 4 (SMPN 4) was chosen because it was located in West Bogor Subdistrict, where dengue haemorrhagic fever (DHF) was prevalent [15].

Respondents were Class VII and VIII students aged 12-14 years old. Due to school policy, these classes were appointed by the school administrator to minimize disturbance to in-class study activities.

Using pre-tested self-administered structured questionnaire, data on level of knowledge and attitude regarding health impacts of climate change, ownership and utilization of information access, school subject, supports from close related person and characteristics were collected in 2015.

B. Data Analysis

Dependent variables were students' level of knowledge and attitude towards climate change health impacts (Table 1). The level of knowledge was a composite variable from nine yes-no questions asking the students' awareness of the relation between climate change and several diseases (malaria, DHF, chikungunya, filariasis, Japanese Encephalitis/JE, diarrhoea, influenza, heart disease, stress). Each yes response was scored 1. The total score of each respondent and the mean score of all respondents' total score were calculated. A good level of knowledge was obtained when a respondent's total score was the same as or more than the mean of all respondents' total score.

TABLE I. VARIABLES, QUESTIONS, AND ANSWER OPTIONS

Variable	Question	Answer Options
<i>Dependent Variables</i>		
Level of knowledge	Do you know that the following diseases are related to climate change? a. Malaria b. Dengue haemorrhagic fever c. Chikungunya d. Filariasis e. Japanese Encephalitis f. Diarrhoea g. Influenza h. Heart disease i. Stress	Yes or No
Level of attitude	Do you think that the following diseases are related to climate change? a. Malaria b. Dengue haemorrhagic fever c. Chikungunya d. Filariasis e. Japanese Encephalitis f. Diarrhoea g. Influenza h. Heart disease i. Stress Do you think that vector-borne diseases are not related to climate change?	Strongly disagree, Disagree, Neutral, Agree, Strongly agree *reverse scored
<i>Predictor Variables</i>		
Gender	Your gender is....	Male or female
Paternal education	The highest level of education your father graduated from is....	No education, Did not graduate from elementary school, Elementary school, Junior high school, Senior high school, Tertiary school. Categorized into two groups: <Tertiary education and Tertiary education
Maternal education	The highest level of education your mother graduated from is....	No education, Did not graduate from elementary school, Elementary school, Junior high school, Senior high school, Tertiary school. Categorized into two groups: <Tertiary education and Tertiary education
Family income	Your family monthly income is....	< IDR 2.500.000, IDR 2.500.000 – IDR 5.000.000, > IDR 5.000.000
Ownership of information access	Do you/your family have any subscription of print media? Do you/your family have television? Do you/your family have any access to internet?	Yes or No. A composite variable is composed from three questions. A respondent is said to have an access to information if they answer 'yes' to all questions.
Use of information access	Do you read any print media (newspaper, magazine, bulletin, etc.)? Do you read any electronic media (e-newspaper, e-magazine, etc.)?	Yes or No. A composite variable is composed from two questions. A respondent is said to use an access to information if they answer 'yes' to at least one of the questions.
School subject as source of knowledge	Do you know about climate change health impacts from any of school subjects?	Yes or No
School subject influence attitude	Do you think the school subject influences your attitude regarding the climate change health impacts?	Yes or No
External encouragement to gain knowledge Family Teachers Friends	Does the following person support you to know about climate change health impacts? a. Family b. Teachers c. Friends	Yes or No Yes or No Yes or No
External encouragement to feel concern Family Teachers Friends	Does the following person support you to feel concern about climate change health impacts? a. Family b. Teachers c. Friends	Yes or No Yes or No Yes or No

Similarly, the level of attitude towards the issue of climate change health impacts was measured from ten Likert-scale questions. Nine questions examined the students' attitude regarding the association between climate change and several diseases (the same diseases as in the knowledge questions); while the last question was about the absence of relation between vector-borne diseases and climate change. A 1-to-5 score was given to the response 'strongly disagree' to 'strongly agree' in the nine questions; meanwhile, a reverse score was presented for the tenth item. Each student's total score and mean score of all students' total score were calculated. Students whose total score was the same as or more than the mean total score were considered to have a good level of attitude.

Predictor variables consisted of gender, paternal and maternal education, family monthly income, ownership and utilization of access to information, school subject, and support from close related person. Each parental education was categorized into below tertiary level and tertiary level. The monthly income was divided into <IDR 2.5 million, IDR 2.5 million – 5 million, and >IDR 5 million.

A composite variable of information access ownership was composed from three questions asking possession of print media, television and internet access. 'Yes' responses in all three questions defined the ownership. Meanwhile, the use of information access was made up from two questions inquiring whether the student read print and electronic media. A positive response in either question was considered as utilizing the access.

Variables of school subject examined whether any school subject was the student's source of information on and influenced their attitude towards climate change health impacts. These were asked in two separate questions.

Moreover, support from close related person was described as encouragement received by the student from family, teacher or friend to know and feel concern about the climate change effects on health. Three questions were asked about the support for gaining knowledge and the other three questions were on the external motivation to be concerned about the issue.

Descriptive analysis described the frequency of all variables in percentage. Relationship between each predictor variable and both dependent variables were analyzed with Chi-square ($P < 0.05$). Crude odd ratio for these predictors was also calculated. All predictor variables were put in the multivariate analysis using logistic regression because it was assumed that they were all substantially important to the analysis. Significance was set at $P < 0.05$ and adjusted odd ratio was estimated for each predictor. All analysis was conducted in Stata version 14.2 [20].

This study was granted an ethical clearance by the Ethical Committee, National Institute of Health Research and Development (NIHRD), and Indonesian Ministry of Health in 2015. Parental consent form was provided to request approval from parents regarding their children's participation in the study.

III. RESULTS

A-hundred-and-forty-two students of class VII and VIII aged 12 to 14 years old participated in the study (82 girls

and 60 boys). Many came from family of highly educated parents and at least mid-level income as described in Table 2. As for the level of knowledge and attitude towards the issue of climate change impacts on health, almost 70% students had a good understanding of the issue; however, a little over 50% had less supportive attitude towards it.

TABLE II. DISTRIBUTION OF KNOWLEDGE, ATTITUDE, CHARACTERISTICS, AND OTHER PREDICTORS

Variable	Frequency	
	n	%
Level of knowledge		
Good	98	69.01
Poor	44	30.99
Level of attitude		
Supportive	69	48.59
Less supportive	73	51.41
Age		
12	41	28.87
13	61	42.96
14	40	28.17
Gender		
Boy	60	42.25
Girl	82	57.75
Paternal education		
<Tertiary education	37	26.06
Tertiary education	102	71.83
Maternal education		
<Tertiary education	57	40.14
Tertiary education	85	59.86
Family income		
< 2.500.000	17	13.28
2.500.000 – 5.000.000	65	50.78
> 5.000.000	46	35.94
Ownership of information access		
No	76	53.52
Yes	66	46.48
Use of information access		
No	31	21.83
Yes	111	78.17
School subject as knowledge source		
No	13	9.15
Yes	129	90.85
School subject to influence attitude		
No	19	13.38
Yes	119	83.80
Family to encourage knowledge		
No	13	9.15
Yes	128	90.14
Teachers to encourage knowledge		
No	6	4.23
Yes	136	95.77
Friends to encourage knowledge		
No	63	44.37
Yes	78	54.93
Family to encourage attitude		
No	7	4.93
Yes	133	93.66
Teachers to encourage attitude		
No	7	4.93
Yes	133	93.66
Friends to encourage attitude		
No	62	43.66
Yes	79	55.63

More students did not have access to information; but surprisingly, the ones using the access were more prevalent. More than 80% of the students said that school subjects were where they got their information on the climate change health effects from and those subjects motivated their

concern over the topic. In addition, the majority stated that family and teachers supported them to be aware and concerned with the issue; but the proportion was lower for support from friends.

In the bivariate analysis, family income was related to the level of student knowledge with regards to the health effect of climate change (Table 3). The associations occurred with both middle and high family income, although the latter had lower magnitude (OR 3.63 compared to 4.38). On the other hand, no predictor variables were associated with the

student's attitude level. The logistic regression analysis showed that family income remained as the predictor for knowledge level even though only the middle income did. Students from middle income family had four times higher odds to have good knowledge level than the ones from low-income family. Maternal education was associated with the attitude level. The odds of students whose mother graduated from tertiary school were two times higher to have a favourable attitude towards the health impacts compared to their counterparts with less-educated mother.

TABLE III. RELATIONSHIP BETWEEN PREDICTOR VARIABLES AND LEVEL OF KNOWLEDGE AND ATTITUDE

Variable	Level of knowledge				Level of attitude			
	OR ^a (95% CI)	P value	AOR ^b (95% CI)	P value	OR (95% CI)	P value	AOR (95% CI)	P value
Gender								
Male	ref		ref		ref		ref	
Female	1.06 (0.51-2.17)	0.88	1.05 (0.43-2.53)	0.92	1.28 (0.66-2.50)	0.46	1.25 (0.56-2.81)	0.59
Family income								
<2.5 million	ref		ref		ref		ref	
2.5 – 5 million	4.38 (1.43-13.39)	0.01^d	4.63 (1.26-17.04)	0.02^d	1.22 (0.41-3.61)	0.71	1.09 (0.33-3.58)	0.88
>5 million	3.63 (1.14-11.56)	0.03^d	4.04 (0.97-16.83)	0.06	1.56 (0.51-4.80)	0.44	1.35 (0.36-5.02)	0.65
Paternal education								
<Tertiary	ref		ref		ref		ref	
Tertiary	0.64 (0.27-1.51)	0.31	0.38 (0.11-1.28)	0.12	1.02 (0.50-2.24)	0.89	0.77 (0.29-2.08)	0.61
Maternal education								
<Tertiary	ref		ref		ref		ref	
Tertiary	1.37 (0.67-2.82)	0.39	1.50 (0.61-3.70)	0.38	1.74 (0.88-3.44)	0.11	2.37 (1.05-5.34)	0.04^d
Having information access								
No	ref		ref		ref		ref	
Yes	0.63 (0.31-1.28)	0.20	1.05 (0.45-2.45)	0.92	0.89 (0.46-1.71)	0.72	0.98 (0.46-2.09)	0.95
Using information access								
No	ref		ref		ref		ref	
Yes	0.58 (0.23-1.48)	0.26	0.50 (0.16-1.60)	0.25	0.86 (0.39-1.90)	0.70	0.77 (0.29-2.04)	0.60
School subject as source of knowledge/influence								
No	ref		ref		ref		ref	
Yes	2.05 (0.65-6.51)	0.22	1.94 (0.47-8.00)	0.36	1.40 (0.53-3.72)	0.50	1.46 (0.47-4.50)	0.51
Family support to know/ to feel concern								
No	ref		ref		ref		ref	
Yes	1.01 (0.29-3.49)	0.98	1.15 (0.27-4.94)	0.85	1.31 (0.28-6.10)	0.73	1.39 (0.25-7.70)	0.71
Teacher support to know/ to feel concern								
No	ref		ref		ref		ref	
Yes	1.11 (0.20-6.35)	0.90	1.20 (0.15-8.95)	0.89	0.37 (0.07-1.98)	0.25	0.27 (0.04-1.63)	0.15
Friend support to know/to feel concern								
No	ref		ref		ref		ref	
Yes	0.74 (0.36-1.53)	0.42	0.55 (0.23-1.31)	0.18	1.04 (0.53-2.02)	0.91	1.03 (0.46-2.33)	0.94

^a OR = crude odds ratio in bivariate analysis; ^b AOR = adjusted odd ratio in multivariate analysis; ^c CI = confidence interval; ^d statistically significance at P < 0.05

IV. DISCUSSION

This study showed that most students had a good understanding about but were not supportive of the idea that climate change can have effects on health. This further confirms that knowledge does not always translate to certain attitude or that attitude is not easily changed by knowledge alone. There might have been other factors besides knowledge that influenced their attitude, such as personal experience, emotional factor, influence from religious organization, and culture [21], which were not measured in the study. Meanwhile, the ones incorporated in this study did not show any significant association with the students'

attitude (influence from other people, education institution, and mass media).

Unfavourable attitude towards the health impacts from climate change indicates their scepticism on the issue. It may be because climate change is not perceived as health risk [17], or even if it is considered a risk, it is more threatening to other people's health than to their personal and their family's health [22]. It may be true for these Bogor students. With exceptional rainfall throughout the year in Bogor [12], any non-extreme climatic change would not be viewed as a potential health concern. Moreover, the students may also perceive that evidence regarding health effects from climate change is not conclusive and still debatable [6].

However, it is important to learn and think of the health relevance because it stimulates personal or public actions and policy, including from vulnerable groups [22,23]. In Indonesian context, this kind of public engagement in climate change adaptation is in line with recommendations in health sector [24]. Teenagers are also expected to take part because they are the future generation. In this regard, overcoming their sceptical sentiment regarding the health risk as early as possible is necessary when their worldview is not fully shaped yet [4,5].

An association between family income and the students' knowledge about climate change and health effects occurred in this study. This was also observed in other studies with students in India [25] and a community in Bangladesh [26]. A positive relationship found in this study means that income is in line with knowledge level. Family with better income is more likely to provide enabling environment for their children to learn something. For example, access or resources to top level school, internet, books, and nature-related contents. This condition may stimulate their curiosity and knowledge on the impacts of climate change.

Maternal education was associated with the students' attitude towards climate change related health effects. It confirms the finding from one study in Nigeria, where level of attitude of senior secondary school children was related to their mother's education [27]. Higher level of education is correlated with better knowledge about climate change and health [26], which subsequently translates to more supportive attitude. Because a mother is likely to spend more time with her children than a father is, children may learn and adopt that favourable attitude through the mother-children interaction. Family may serve as reliable and appealing sources in a successful message communication [28]. For instance, one study in Indonesia found that family was a major source for children to learn about climate change [6].

The association between information access and knowledge and attitude was different from a previous study. In Ethiopia, electronic media was related to the knowledge of health science students about harmful effects of climate change on health [29]. This discrepancy is probably because the information mostly sought by the students in this study when using the access was unrelated to climate change, such as entertainment and sports [30].

The implication of this study is that a one-for-all approach may not be effective in health promotion on climate change health impacts. It should touch on family experience in local context. The local government should pay attention to the vulnerable communities and come up with relevant solution according to their situations. That way, all levels of community will have their adaptive capacity against climate-related hazards strengthened, which is essential in healthy city development.

This study results should be interpreted with caveat. They are not eligible for generalizing the condition in school-going teenagers because this study incorporated a non-probability sampling. Moreover, given the cross-sectional study design, the relationship between the dependent and predictor variables should not be implied as causation. Future research should include more locations with different

climatic characteristics using probability sampling and larger sample.

V. CONCLUSION

While junior secondary school children in Bogor City had a good knowledge of climate change health effects, they had unsupportive attitude towards the issue. The dominant factor associated with the knowledge and attitude of those children was their family background, namely household income and mother's education.

ACKNOWLEDGMENT

Highest gratitude was extended to the administrators, teachers and participating students of Junior High School 4, Bogor; the enumerators for data collection; and Dra. Athena Anwar, M.Si for the guidance during study preparation and implementation.

The authors declare no conflict of interest. The funding sponsor had no role in the design of the study; the collection, analyses, or interpretation of data; the writing of the manuscript; and the decision to publish the results.

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