

## 「年間300万円未満」の政策方針は適切か

Is the “less than 3 million Japanese yen a year” policy appropriate?

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**Abstract**—Students from annual parental income families (3 to 5 million Japanese yen) rather than those from the most disadvantaged parental income families implemented the health-promoting behavior (exposure to urban nature) the least. These students were the most vulnerable ones as they lost the opportunity to use exposure to urban nature as a means to counter daily stress and to keep health. Many health-related policies overlooked such a hidden fact and use “less than 3 million Japanese yen each year” to be a universally benchmark to decide who are eligible for government financial support. Policymakers need to pay attention to this issue.

As the public awareness of health and healthy choices has grown, increasing university students' health-promoting behavior is becoming more important than ever. Behavior, in general, is shaped and formed during the stage of university studies. Since the formed behavior can become lifelong behavior and affects a person's lifelong health, whether students implement such behavior during this period becomes important.

Exposure to nature, a widely known promoting behavior, is associated with increased natural killer (NK) cell activities, decreased stress symptoms, and better health outcomes [1]-[2]. In the immune system, NK cells are important innate effector cells as they can kill microbial infections and enhance human immune functions [3]. Any behavior that increases NK cells is of great significance to the health and should be promoted especially during the pandemic.

In Japan, several types of natural setting are available in cities. For example, green city parks, the seas and rivers are available. Despite the easy access to the parks, large differences in the implementation of exposure to urban nature behavior can be observed among students. Little is known about the key factors and the extent to which these factors affect such behavior and generate differences in health-promoting behavior among students.

Past studies have pointed out the powerful influences of income on a person, ranging from the basic food consumption decision to career choices [4]-[6]. Additionally, many college students in Japan tend to rely on parental financial support to pay tuition fees and various living costs. In general, the behavior of exposure to urban nature itself involves moving and walking [7]. Students who have the habit of reducing stress through exercise are more likely to go out and expose to urban nature compared with those who are more sedentary. These two factors may affect students' behavior of exposure to urban nature.

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Thus, this study examined the relationship between these factors and the behavior of exposure to urban nature, and analyzed the extent to which these factors contributed to a greater disparity in such behavior among students during the COVID-19 pandemic.

## Methods

### II.1. Participants and procedures

Three hundred eighty undergraduates aged between 18 and 26 ( $M=20.18$ ,  $SD=1.27$ ) were recruited from the Tokyo metropolitan area of Japan in this study. Of the total participants, 148 participants were females (38.95%) and 232 participants (61.05%) were males. Half of them ( $N=190$ ) exposed to urban nature regularly, and half of them ( $N=190$ ) did not do so during the pandemic. These participants had parents whose education attainment were either high school (81 participants, 21.32%) or undergraduate degree or above (299 participants, 78.68%), with annual household income (unit: Japanese yen) ranged from less than 3 million (27 participants, 7.1%), 3 to 5 million (83 participants, 21.84%), 5 to 7 million (97 participants, 25.53%), 7 to 10 million (86 participants, 22.63%), to greater than 10 million yen (87 participants, 22.89%).

All survey responses were collected by paper questionnaires and online questionnaires during the period from October 2020 to July 2021. The survey was performed following the Code of Conduct for Scientists specified by Science Council of Japan. A clear explanation of survey's objectives, the way to process data, and the rights of participants such as the right of withdrawal and voluntary participations was provided to participants. Consents to participation were obtained from each participant.

### II.2 Measures

#### *II.2.1 Assessment of the behavior of exposure to urban nature*

Interviews were conducted at first with participants. They were asked to provide information about the places they felt to be urban nature. Then, participants were asked to answer the following question. For example, "Do you visit urban parks for more than 30 minutes each time, at least once a week on a regular basis during the Covid-19 pandemic?". Those who responded yes more than once were classified to be exposed to urban nature group. Otherwise, they were considered as not exposed to urban nature group.

#### *II.2.2 Assessment of the habit of reducing stress through exercise*

Participants were asked to answer the following question. "Do you have the habit of reducing stress through exercises, for more than 30 minutes each time, at least once a week on a regular basis?". Those who responded yes were classified to be actively engaged group. Otherwise, they were considered as sedentary group.

#### *II.2.3 Assessment of annual parental income level*

Annual parental income level was assessed using the following question. "Which of the following choices would most describe your parents' total annual income?". Five choices were provided,

including less than 3 million Japanese yen a year (group 5), 3-5 million Japanese yen a year (group 4), 5-7 million Japanese yen a year (group 3), 7-10 million Japanese yen a year (group 2), and greater than 10 million Japanese yen a year (ref).

#### *II.2.4 Covariates*

Participants were asked to provide information about their gender, age, and the highest education attainment of their parents. These variables were used as covariates. A question that asked participants to report their parental education attainment had two choices: high school or lower; undergraduate degree or equivalent or above. Participants who chose high school or lower were classified to be low, whereas those who chose the other choice were classified to be high.

#### *II.3 Statistical analyses*

Descriptive statistics for annual parental income level and the habit of reducing stress through exercise were estimated and their differences under two statuses of exposure to urban nature were examined using t-tests and chi-squared tests. These analyses were followed with logistic regression analyses to further assess the extent to which annual parental income level and the habit of reducing stress through exercise affected students' behavior of exposure to urban nature. In the logistic regression analyses, exposure to urban nature was treated as a dependent variable. Annual parental income level and the habit of reducing stress through exercise were treated as independent variables. The estimated results were described as odds ratio (OR) and adjusted odds ratio (OR) with 95% confidence intervals after controlling the effects of covariates in the analyses. In this study, a p-value of  $\leq 0.1$  was used as a criterion for statistical significance as past studies indicated that  $p < 0.05$  frequently failed to diagnose the key variables that affected the dependent variable in the model [8]-[9]. All statistical analyses were conducted using the version 15.1 of STATA software.

### Results

#### *III.1 Descriptive statistics*

Descriptive statistics were presented in Table 1. When the annual parental income was greater than 10 million Japanese yen, 68.97% of undergraduates exposed to urban nature, which was significantly higher than those from lower annual parental income families. Students with the habit of reducing stress through exercise also had a significantly higher rate of exposure to urban nature than those without such a habit (59.47% vs 40.53%).

#### *III.2 Effects of annual parental income level and the habit of reducing stress through exercise on the behavior of exposure to urban nature*

The logistic regression model, after controlling the effects of age, gender and parental education attainment, revealed that both the annual parental income level and the habit of reducing stress through exercise were associated with the behavior of exposure to urban nature ( $\chi^2(9) = 38.29$ ,  $p < 0.01$ ) (Table 2). Lower annual parental income groups were less likely to expose to urban nature. While undergraduates in group 2 (7 to 10 million Japanese yen) were 0.4 times less likely to report

Table 1 Descriptive statistics of study variables, overall and by exposure to urban nature statuses.

Variables	Overall	Exposure to urban nature		$\chi^2/t$ -test
	(N=380) <i>Mean ± SD or</i> n (%)	Exposed <i>Mean ± SD or</i> n (%)	Not exposed <i>Mean ± SD or</i> n (%)	
Parental income (Japanese yen)				19.61***
>10 million ( <i>ref.</i> )	87 (22.89%)	60 (68.97%)	27 (31.03%)	
7 to 10 million (group 2)	86 (22.63%)	43 (50%)	43 (50%)	
5 to 7 million (group 3)	97 (25.53%)	42 (43.3%)	55 (56.7%)	
3 to 5 million (group 4)	83 (21.84%)	31 (37.35%)	52 (62.65%)	
<3 million (group 5)	27 (7.11%)	14 (51.85%)	13 (48.15%)	
Habit of reducing stress through exercise				13.64***
Actively engaged ( <i>ref.</i> )	190 (50%)	113 (59.47%)	77 (40.53%)	
Not engaged	190 (50%)	77 (40.53%)	113 (59.47%)	

Note:  $\chi^2$  tests or *t*-test for comparing differences under two statuses of exposure to urban

Table 2 Logistic regression analysis with annual parental income and the habit of reducing stress through exercise as the inputs in predicting the behavior of exposure to urban nature

			Outcomes			
	OR	95%CI	Exposure to urban nature		bOR <sup>b</sup>	95%CI
			aOR <sup>a</sup>	95%CI		
Annual parental income (Japanese yen)						
>10 million ( <i>ref.</i> )	1		1		1	
7-10 million (group 2)	0.43***	0.23-0.82	0.41***	0.22-0.78	0.4***	0.21-0.77
5-7 million (group 3)	0.35***	0.19-0.64	0.34***	0.18-0.64	0.33***	0.17-0.63
3-5 million (group 4)	0.27***	0.14-0.51	0.26***	0.13-0.5	0.25***	0.13-0.49
<3 million (group 5)	0.5	0.21-1.23	0.53	0.21-1.3	0.63	0.24-1.63
Habit of reducing stress through exercise						
Actively engaged ( <i>ref.</i> )	1		1		1	
Not engaged (group 2)	0.46***	0.3-0.7	0.48***	0.31-0.74	0.48***	0.31-0.74

Note <sup>a</sup>Adjusted for age (years), gender (0=male, 1=female); <sup>b</sup>Adjusted for age (years), gender (0=male, 1=female) and parental education attainment levels (0=low, 1=high). OR=odds ratio; CI=confidence interval, \*p≤0.1, \*\*p≤0.05, \*\*\*p≤0.01.

exposure to urban nature (95%CI: 0.21-0.77) compared with the reference group, those in group 4 (3 to 5 million Japanese yen) were 0.25 times less likely to report exposure to urban nature (95%CI: 0.13-0.49) compared with the reference group. Unexpectedly, undergraduates from the lowest annual parental income families (group 5) were 0.63 times less likely to report exposure to urban nature (95%CI: 0.24-1.63) compared with the reference group, which was even higher than the annual parental income group that was the second highest. Additionally, undergraduates without the habit of reducing stress through exercise also reported less exposure to urban nature (OR: 0.48; 95%

CI=0.31-0.74) compared with those with such a habit.

Predicted probabilities of exposure to urban nature at different levels of annual parental income and different conditions of the habit were also examined following the logistic regression analysis (Fig. 1 and Fig. 2). Probability of exposure to urban nature was the highest (0.7) when the annual parental income was above 10 million Japanese yen, and was the lowest (0.37) when the annual parental income was between 3 to 5 million Japanese yen, holding other variables at their means. It was 0.59 when the annual parental income was below 3 million Japanese yen, holding other variables at their means. The probability of exposure to urban nature was 0.59 among undergraduates who had the habit of reducing stress through exercise, whereas it was 0.41 among those without such a habit, holding other variables at their means.

#### IV Discussion

This study provided insight into the key factors and the extent to which these factors affecting the health-promoting behavior like exposure to urban nature. The findings suggested that annual parental income level and the habit of reducing stress through exercise played the key roles in doing so (Table 2).

Lower annual parental income in general was associated with less exposure to urban nature, leading to almost two times (1.89) the difference in the predicted probability of exposure to urban nature between the most exposed to urban nature group (*ref.*) and the least exposed to urban nature group.

In Japan, college students tend to rely on parental financial assistance for paying tuition fees and living costs. Differences in annual parental income levels can powerfully influence students' deci-

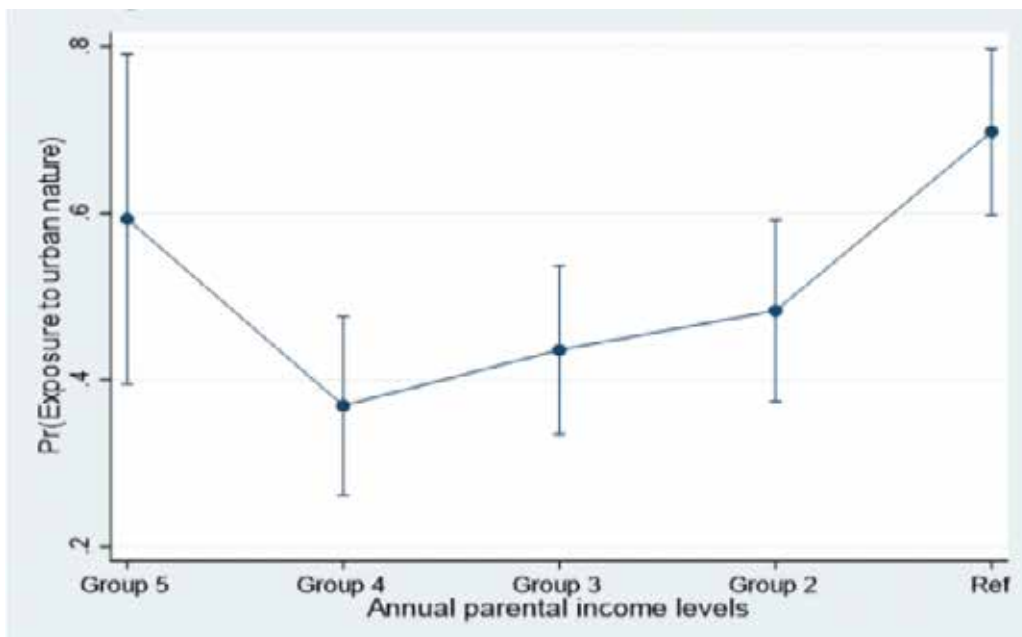


Figure 1 Predicted probability of exposure to urban nature at each level of annual parental income (Processing software, Stata)

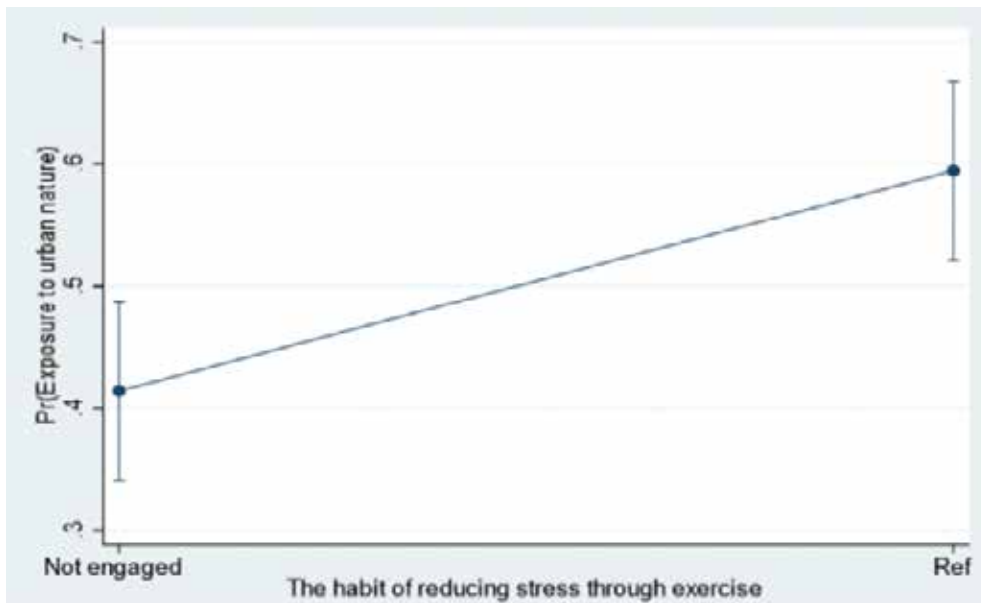


Figure 2 Predicted probability of exposure to urban nature at each condition of the habit (Processing software, Stata)

sion making and attitudes toward the health-promoting behavior, resulting differences in health-promoting behavior among students. For instance, decision-making such as housing choices that are limited by the parental income levels may increase such a difference. The consolidated theories on urban economy [10] have pointed out the value of a real estate is determined by location. Real estates with better access to public services and are proximity to green spaces (e.g., urban parks) tend to be higher, whereas those with opposite characteristics tend to be lower. Students in higher parental income groups could receive more financial support and rented more expensive urban apartments close to urban parks. In contrast, those with limited budget in the lower parental income groups were only capable of renting cheaper apartments surround by human-made objects (less green can be seen). These choice differences might further facilitate or hinder the behavior of exposure to urban nature.

Additionally, it should not be neglected that parental influences also significantly shape the next generation's attitudes. Such an influence might also contribute to the differences in the behavior of exposure to urban nature among students. A recent study conducted by Dickman et al. (2016) pointed out that health care spending was the highest among wealthy people [11]. Parents in higher income groups might place more importance on health-promoting behavior and evaluate more on the connection with nature compared with those in the lower income groups. Usually, children develop similar attitudes as their parents. Students raised in higher parental income groups might connect more with nature and actively engaged in related activities. In contrast, students in lower parental income groups might give less attention to the health-promoting behavior and spent less time in the urban nature setting like their parents.

Interestingly, undergraduates in group 4 rather than those in the most disadvantaged SES group (<3 million, group 5) exposed to urban nature the least (Fig. 1). The most disadvantaged SES group

(group 5) on the other hand had the predicted probability of exposure to urban nature 1.22 times higher than the second highest income group (7-10 million), but lower than the wealthiest group (Fig. 1). These findings suggested that something important and affected students' behavior of exposure to urban nature was overlooked by previous studies.

Differences in the degree of urbanization and housing costs brought about by urban design might be reasons. In Japan, the further away from the city center, the fewer artificial buildings and the more natural the environment. Correspondingly, the rental fees were cheaper. For students in group 4, their financial situations might allow them to rent a tiny apartment surrounded by concrete buildings in a city. However, such living environment could not provide them any incentive to connect with nature. For those in the lowest annual parental income group (group 5), they might only be able to rent cheaper apartments located further distance from the city center. Although areas away from the city center were more inconvenient, the living surroundings were more natural. Such environment might make students expose to urban nature easier. Moreover, the finding suggested that the habit of reducing stress through exercise were associated with more exposure to urban nature, resulting the predicted probability of exposure to urban nature of students with such a habit having 1.43 times of those without such a habit. In general, exposure to urban nature involves outdoor walking and moving. A recent study conducted by Otto and Pensini (2017) [12] has indicated that outdoor activities increase the connection with nature. Compared with students with such a habit, those without such a habit might engage in outdoor activities less and were more sedentary. These differences might also be the causes of different behavior.

## V. Policy implications and conclusion

The study indicated that annual parental income level and the habit of reducing stress through exercise played the key roles in determining the behavior of exposing to urban nature. The finding elucidated a hidden fact that students from annual parental income group between 3 to 5 million Japanese yen rather than those from the most disadvantaged SES group exposed to urban nature the least. These students were the most vulnerable ones who need more societal concerns and support since they lost the opportunity to use exposure to urban nature as a means to counter daily stress and to maintain good health during the pandemic.

In Japan, many policies from local to national use “less than 3 million Japanese yen each year” to be a universally benchmark to decide who are eligible for government financial support. The current study suggested that such a one for all measure should be used in caution since it can mistakenly assess people who need more policy support in some circumstances.

These results suggested that policymakers and planners who design intervention programs for promoting students' health-promoting behavior and for achieving the health goal of the SDGs may need to pay special attention to these issues.

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