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## Original Article

# Participants' confidence in basic life support before and after CPR training

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**Abstract.** [Purpose] Active involvement in cardiopulmonary resuscitation by bystanders is important for more effective life support in out-of-hospital cardiac arrest. There are various factors that make bystanders hesitate to perform the support. We focused on confidence in performing basic life support in this study. [Participants and methods] A questionnaire survey was conducted among participants of our 3-hour cardiopulmonary resuscitation training that had been held from May, 2019 to Sep, 2020. [Results] A total of 174 people participated in the training and 166 valid answers were collected. Significant increases were observed in those who answered that they were confident in checking response, chest compression and automated external defibrillator use. [Conclusion] The results show that the training helped reduce participants' concerns about their knowledge and skills, which led to their enhanced confidence.

Key Words: cardiopulmonary resuscitation training, questionnaire, confidence

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## 1. INTRODUCTION

In the rescue of out-of-hospital cardiac arrest patients, it's critical to promptly recognize cardiac arrest and call the fire department, to rapidly perform cardiopulmonary resuscitation (CPR) and defibrillation, and to move to advanced life support without any interruption. Report and basic life support (BLS) by bystanders who happen to be there improve survival outcome. Early bystander CPR doubled or tripled the survival rate in cardiac arrest due to ventricular fibrillation<sup>1,2)</sup>. CPR and defibrillation within 3 - 5 minutes after collapse increased the survival rate to 49 - 75%<sup>3,4)</sup>. However, one-minute delay in defibrillation reduced survival rate down by 10 - 15%<sup>2,5)</sup>. Thus, bystander CPR is likely associated with a double or triple increase of survival rate in cardiac arrest<sup>6)</sup>. The rate of first aid by bystanders reached 50.7% in 2019. However, despite the increase in the rate of bystanders first aid, the social return rate from cardiogenic cardiac arrest cases even with witnesses is less than 20%<sup>7)</sup>.

Resuscitation education is considered to be effective when the trainees get to acquire skills of providing high quality of BLS as well as to raise their awareness of active involvement in CPR during an actual resuscitation. In our previous study<sup>8)</sup>, to the question "Are you able to provide CPR at the emergency", the trainees who answered "yes", "no idea" and "no" were 57%, 42.5% and 0.5%, respectively. The results show that many trainees were concerned about providing CPR. There are some factors that make bystanders hesitate to provide care. These factors in rescuers include that rescuers get panicked, are

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concerned about infection and are not confident to perform CPR. Factors in patients include that patients are stranger to rescuers, look messy, look like they are using drugs, are bleeding and are throwing up<sup>9</sup>). According to the survey among 3193 high school students in Ishikawa prefecture, Japan, which was conducted by the intensive care unit, Kanagawa university hospital, 40% of them answered “they will not do anything” in an emergency<sup>10</sup>. The dominant reasons for the answer include that it’s critical if they make a mistake, it’s impossible for them to do something, and they may injure the patient. Approximately 75% of the students answered that they were too nervous to perform CPR. Nishiyama et al.<sup>11</sup> reported that university students in the CPR training answered in their survey that “they have no idea what to do, “they can’t not take responsibility” and “they are worried about hurting the patient”. The results suggested that ethical factors and mental issues as well as knowledge and skills on CPR are associated with whether bystanders will perform CPR.

An important role of CPR training is making trainees able to provide CPR with a patient at a critical moment. Various factors affect whether bystanders perform CPR, however, people have taken a bigger role in order to raise the survival rate in out-of-hospital cardiac arrest. In this study, referring to previous studies<sup>11-13</sup>), we report about changes in awareness (confidence) of participants of our CPR training.

## 2. PARTICIPANTS AND METHODS

This study was conducted among participants of the 3-hour BLS training part one in the first aid treatment course, which had been conducted from May, 2019 to Sep, 2020 by First Aid Support Team from Kobe international university<sup>14,15</sup>). The training is conducted following G2015 by Japan resuscitation council<sup>16</sup>) and approximately 90 to 100 minutes out of the 180 minutes was used for hands-on training<sup>17</sup>).

Questionnaire survey was conducted before and after the training. The questionnaire was designed to evaluate the degree of self-awareness (confidence) on checking response, chest compression and use of an automated external defibrillator (AED). Previous studies<sup>12,13</sup>) had used questions that assumed in-hospital cardiac arrest since non-medical workers in hospitals such as administration staff, janitors, guards, chefs and volunteers were included in their studies. Therefore, this study, which included local residents, changed the question from “assuming that a person was lying in the hospital” to “assuming that a person was lying on the street”. Four-point scale; 1 = Yes I can, 2 = I don't know if I can, 3 = No I can't, 4 = never, as it's beyond their capability or as it should be performed by a more skillful person, was used for the questions about “checking response” and “chest compression”. Five-point scale; 1 = I can never use it, 2 = I don't think I can, 3 = I don't know if I can, 4 = I think I can use it, 5 = I can use it, was used for the question on AED use. Furthermore, demographics data of age and gender were added to the questionnaire. A question regarding whether they had previously received training or not was also added. The questionnaire was conducted anonymously. In order to compare each participant's pre-training and post-training answers, questionnaires on pre-training and post-training were printed on the same paper. For ethical considerations, the participants were explained orally and in writing on the purpose of this study and their submission of the questionnaire considered their consent.

Descriptive statistics on participants’ demographics data and results from questionnaires was used in statistical analysis as well as Mc Nemar’s test on whether any differences were observed in their self-awareness between pre-training and post- training. In the questions about “checking response” and “chest compression”, the participants who answered ‘1 = Yes I can’ were classified as ‘confident’ and participants who answered 2 - 4 were classified as “not confident”. In the question about “AED use”, referring to a report by Morioka et al. <sup>18</sup>), “5 = I can use it’ and 4 = I think I can use it’ were categorized as “confident” and others were as “not confident” in this analysis.

Statistical software (Social Survey Research Information Co., BellCurve for Excel) was used for statistical analysis. The statistical significance level was set to 5%.

## 3. RESULTS

A total of 174 people participated in the training during this study. Eight of them were excluded from statistical analysis due to missing entries in their questionnaires. Therefore, data from 166 participants (95.4%) were subjected to statistical analysis (Table 1). The average age of the participants in the

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analysis was  $21.9 \pm 12.0$  years old. As many participants in the training were young, 12 - 29 years old accounted for 89.2% of the participants. The gender ratio was unbalanced with 127 males to 39 females. Forty-two participants (25.3%) had previously received training.

**Table 1. Participants' attributes and questionnaire survey result (n = 166)**

	n (%)
Age (yrs.)	
12 - 29	148 (89.2)
30 - 49	5 (3.0)
50 - 69	12 (7.2)
70 or above	1 (0.6)
Gender	
Male	127 (76.5)
Female	39 (23.5)
Experience in CPR training	
Yes	42 (25.3)
No	124 (74.7)

The questionnaire survey results from pre-training and post-training are shown in Table 2. Significant increases were observed in the number of participants who answered “confident” in “checking response” from 40 (24.1%) at pre-training to 140 (84.3%) at post-training ( $p < 0.001$ ), in “chest compression” from 22 (13.3%) at pre-training to 137 (82.5%) at post-training ( $p < 0.001$ ), and in “AED use” from 53 (31.9%) to 147 (88.6%) ( $p < 0.001$ ).

**Table 2. Questionnaire survey result before and after seminar attendance (n = 166)**

	n (%)			
	Before attendance		After attendance	
<b>Response check</b>				
Yes I can	40	(24.1)	140	(84.3) *
I don't know if I can	98	(59.0)	23	(13.9)
No I can't	27	(16.3)	3	(1.8)
I don't do it	1	(0.6)	0	(0.0)
<b>Chest compression</b>				
Yes I can	22	(13.3)	137	(82.5) *
I don't know if I can	77	(46.4)	28	(16.9)
No I can't	65	(39.2)	1	(0.6)
I don't do it	2	(1.2)	0	(0.0)
<b>AED use</b>				
I can use it	9	(5.4)	87	(52.4) *
I think I can use it	44	(26.5)	60	(36.1)
I don't know if I can	50	(30.1)	11	(6.6)
I don't think I can	36	(21.7)	4	(2.4)
I can never use it	27	(16.3)	4	(2.4)

\* :  $p < 0.001$

McNemar test was performed for the change in ratio of the persons who were classified as ‘confident’. In the questions about “checking response” and “chest compression”, the participants who answered ‘Yes I can’ were classified as ‘confident’. In the question about “AED use”, the participants who answered ‘I can use it’ and ‘I think I can use it’ were categorized as “confident”.

AED; automated external defibrillator

#### 4. DISCUSSION

Early call for help and bystander CPR is required to improve survival rate and social return rate of out-of-hospital cardiac arrest. Although the bystander CPR is critical to survive from cardiac arrest, various factors contribute to bystander hesitancy. In this study, we focused on bystanders' confidence in performing CPR.

Participants who had never received training prior to our training accounted for 74.7%. The data indicate that the participants' knowledge and skills may not have been good enough for checking response, chest compression and AED use. In fact, in the survey at the pre-training, participants who were classified as 'confident' to perform checking response, chest compression and AED use were 24.1%, 13.3% and 31.9% respectively. The survey results show that participants did not have enough knowledge and confidence in CPR at the pre-training. According to JRC resuscitation guideline 2015, "lack of confidence" is one of factors in rescuers that make them hesitate to rescue, thus, it's important to help them to be confident. In the survey after the 3-hour CPR training, participants who answered "possible" to perform checking response, chest compression and AED use significantly increased to 84.3%, 82.5 % and 88.5%, respectively. The results suggest that self-awareness is enhanced through training, which is consistent with reports by Nishiyama et al.<sup>11)</sup> and Morioka et al.<sup>18)</sup>. The lecture and practice at the training were likely to relieve their concern on knowledge and skills and improve their confidence. Sumitomo et al.<sup>19)</sup> reported that the degree of paramedics' concern on transfer of perinatal patients was significantly reduced after a newborn resuscitation training. Akizuki et al.<sup>20)</sup> reported not only significantly better scores related to quality of chest compression, but also higher confidence after a CPR training than before the training, which led trainees to want to perform BLS. These results suggests that improvement in skills led to higher confidence. In this study, 1.8%, 0.6% and 4.8% of participants still answered "impossible" to perform checking response, chest compression and AED use, respectively. Further study may need to find out the negative answers after the training are associated with quality such as training content and method, or quantity such as training hours and frequency (one-time 3-hour training in this study). Kanna et al.<sup>21)</sup> reported that some people had strong deep-rooted fears and anxiety on performing CPR. Involvement in resuscitation may still be too difficult for people who usually have no choice but to be petrified when someone is in cardiac arrest at an unexpected place.

This research shows that participants developed a positive attitude to perform CPR and use AED through the training. Many participants had hesitated to perform CPR due to lack of knowledge, however, our results suggested that practice in the training eased concerns on knowledge and skills, and then it led to changes in their awareness of rescuing people after the training. Tanigawa et al.<sup>22)</sup> and Swor et al.<sup>23)</sup> reported higher CPR performance rate in CPR-trained people than in untrained people at the time of an out-of-hospital cardiac arrest. The results showed that training is one of the effective methods for enhancing trainees' awareness on life saving.

The limitation is that results can't not be applied to long-term effects as short term changes between before and after the 3-hour training were compared in this study. Furthermore, this study has not verified impacts of past training experience and the participants' gender and age on the effects obtained by training. A further study is needed to determine the relationship between previous training experience and confidence, and factors that prevent bystanders from having a positive attitude to perform CPR.

#### FUNDING AND CONFLICT OF INTEREST

The authors have declared that no competing interests exist.

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## Original Article

# Disuse syndrome due to COVID-19 restrictions on going out is present in similar proportions in the elderly and young college students' populations

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**Abstract.** [Purpose] In this study, we examined the proportion of people who developed disuse syndrome due to COVID-19 pandemic restrictions, revealing different trends between young college students and elderly people. [Participants and methods] The participants were 271 people (129 healthy elderly people aged > 65 years and 142 healthy young university students enrolled in a medical university aged > 20 years). We investigated the presence of disuse syndrome using a questionnaire adapted from the Disuse Syndrome Inventory. We clarified the differences between the elderly and young cohorts. The survey period was from November to December 2020. [Results] The valid response rate was 95.2% (n = 258). We found no significant differences in the numbers of elderly and young college students with disuse syndrome (healthy young college students: 34.0%, n = 48; healthy elderly people: 38.5%, n = 45). However, we found some differences in the questionnaire items. Those in which the number of healthy young college students was significantly smaller than that of healthy elderly people were the following: (2) Walking in the home, (6) Is it more difficult to walk than before the COVID-19 pandemic? and (7) Is there anything else that has become difficult? [Conclusion] Management of the adverse effects of the COVID-19 pandemic should focus on the young college students and elderly populations.

Key Words: COVID-19, going out restrictions, age difference

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## 1. INTRODUCTION

The COVID-19 pandemic has had a serious negative impact on the health of people around the world<sup>1)</sup>. The World Health Organization declared COVID-19 a pandemic on March 11, 2020, calling on countries to further strengthen their measures. In response to that request, the Government of Japan declared its first state of emergency on April 7, 2020. Infection was suppressed, and then, the state of emergency was lifted temporarily. However, infection spread again across the country, and the state of emergency and its cancellation were repeated. As of October 17, 2021, when this article was submitted, the state of emergency has not been lifted in some areas of Japan<sup>2)</sup>.

With the spread of the COVID-19 infection, many reports regarding reduced physical activity caused by refraining from going out, which has had an adverse effect on physical function<sup>3-5)</sup>, have emerged. In particular, it has been thought that elderly people are more likely to have had adverse effects because of their existing decline in physical function due to age<sup>6)</sup>. Therefore, we previously investigated 117 healthy elderly people to determine the number of elderly people with disuse syndrome caused by the influence

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of COVID-19<sup>7)</sup>, finding that 38.5% of these participants had disuse syndrome and that being a woman and living in a moderately depopulated city were factors.

However, previous studies reported that not only elderly people but also young college students have been adversely affected. Ishizaka et al.<sup>8)</sup> investigated the relationship between depression and lifestyle-related habits in 46 healthy university students during a state of emergency, demonstrating that the items related to depression include a decrease in study time and sleep time. Romero et al.<sup>9)</sup> investigated factors related to decreased physical activity for COVID-19 infection status in 213 healthy college students, clarifying that gender, year of study, body mass index, alcohol consumption, tobacco use, and anxiety symptoms are involved. Therefore, support for individuals experiencing the adverse effects of COVID-19 is needed across the generations.

Therefore, in the present study, we examined the proportion of people who developed disuse syndrome due to the COVID-19 pandemic, revealing differences in trends. Previous studies have reported that an age-related reduction in sex hormones, as associated with muscle gain, causes apoptosis<sup>10)</sup>. Therefore, we expect that more elderly people than young people will be adversely affected by the COVID-19 pandemic.

## 2. PARTICIPANTS AND METHODS

### 2.1. Participants

The participants were 271 people (129 healthy elderly people aged > 65 years and 142 healthy young college students aged > 20 years).

The young college student's cohort comprised 3rd- and 4th-year college students enrolled in the Department of Physical Therapy at a medical college. We solicited the students from November 3 to December 15, 2020, and those for whom we obtained consent were targeted to complete the questionnaire.

The healthy elderly participants were those who also participated in previous studies conducted by the authors<sup>7)</sup>. The elderly cohort regularly used health and welfare services, including health prevention activities and purpose-of-life measures provided by O City Hall, with the goal of living without depending on nursing care. We excluded participants if they had received Japanese nursing care insurance. City Hall staff regularly visited the facility to perform services that ensured that the older adults in the program did not require nursing care. The authors accompanied the service staff nine times in November and December.

In consideration of COVID-19 infection countermeasures, careful explanations, and an increase in the response rate, in both cases, a large number of people did not concurrently submit a questionnaire. In small groups of approximately 10 people, a face-to-face questionnaire was administered.

As an ethical consideration, we provided the participants with a written explanation of the study, which stated that by answering the questionnaire, the participants agreed to the study's purpose. We also stated that the study's results were to be published academically. We verbally provided a similar explanation. The study was approved by the Research Ethics Committee of the International University of Health and Welfare (authorization no.: 20-Io-201).

### 2.2. Study Design

The study was cross-sectional and used a face-to-face questionnaire to investigate the effects of refraining from going out due to the COVID-19 pandemic on the lives of elderly and young college students during November and December 2020, which was the survey period.

### 2.3. Methods

We investigated the presence of disuse syndrome using a questionnaire partially adapted from the Disuse Syndrome Inventory<sup>11)</sup> (Table 1). We published this questionnaire to detect early and subsequently alleviate the disuse syndrome caused by natural and human-made disasters. Disuse syndrome is a condition of reduced mental and physical function, along with difficulty of movement, caused by a prolonged state of inactiveness<sup>11)</sup>. We identified disuse syndrome for those participants who indicated that their condition had worsened after the onset of the COVID-19 pandemic in response to any of the first five questions or if the answer to Question 6 or 7 on the Disuse syndrome inventory was "yes". Disuse syndrome requires caution, and consultation with local governments and medical institutions is recommended for cases that arise<sup>11)</sup>.

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**Table 1 Details of Disuse Syndrome Inventory**

A Please circle one of the numbers before the COVID-19 pandemic and currently.

	<b>Before the COVID-19 pandemic (November 2019-December 2019)</b>	<b>Currently (questionnaire implementation date)</b>
1 Walking outdoors	1. I was walking alone in the distance. 2. I walked alone if it was nearby. 3. I was walking with someone. 4. I hardly walked outside. 5. I was not walking outside.	1. I'm walking alone in the distance. 2. I walk alone if it is nearby. 3. I am walking with someone. 4. I hardly walk outside. 5. I am not walking outside.
2 Walking in the home	1. I was walking without support. 2. I was walking with the support of the walls and furniture. 3. I was walking with someone's assistance.	1. I am walking without support. 2. I am walking with the support of the walls and furniture. 3. I am walking with someone's assistance.
3 Activities around the house (Bath, washbasin, toilet, meal, etc.)	1. There was no inconvenience when going out. 2. There was no inconvenience at home. 3. There were some inconveniences, but I was able to manage. 4. I sometimes spent time with others.	1. There is no inconvenience when going out. 2. There is no inconvenience at home. 3. There are some inconveniences, but I was able to manage. 4. I sometimes spend time with others.
4 Number of outings	1. Almost every day 2. Three times a week or more 3. One time a week or more 4. I hardly went out.	1. Almost every day 2. Three times a week or more 3. One time a week or more 4. I hardly go out.
5 How much physical activity do you do during the day?	1. I was moving well outside. 2. I was moving well at home. 3. I was often sitting. 4. I was lying down sometimes.	1. I am moving well outside. 2. I am moving well at home. 3. I am often sitting. 4. I am lying down sometimes.
B Please tell us about your current status. Please circle the applicable status.		
6 Is it more difficult to walk than before the COVID-19 pandemic?	Yes	• No
7 Is there anything else that has become difficult?	Yes	• No
8 Please answer only those who answered "yes" in 7. What kind of motion has become difficult? * Multiple answers allowed	1. using a Japanese-style toilet 2. going up and down steps (high places) 3. getting up from the floor 4 . other (Specific example: )	

The Disuse syndrome inventory<sup>11)</sup> was created by the Ministry of Health, Labor and Welfare of Japan to understand the condition of victims at the time of the earthquake. In this study, we used this questionnaire because there is no other checklist prepared by Japanese national institutions for the purpose of comparing physical functions before and after a disaster for Japanese people. In Japan, following the Great East Japan Earthquake<sup>12)</sup> and the Noto Peninsula Earthquake<sup>13)</sup>, the Disuse syndrome inventory was used to understand the status-of-living functions as a guideline for recovery after a disaster. Although the ramifications of refraining from going out due to COVID-19 differ from those for an earthquake, they are similar in the sense that life becomes inactive. Thus, in this study, the use of this checklist is considered an effective measure.

#### **2.4. Data Analysis**

To determine the impact of refraining from going out, we expressed the aggregated results as both numbers of people and percentages. To clarify the different trends between the elderly and young college student cohorts, we conducted a chi-square independence test on the number of people in the results of each questionnaire item. In addition, we used a logistic regression analysis (direct entry) to examine the onset factors of disuse syndrome. The objective variable was the presence or absence of disuse syndrome, each item in the questionnaire, and the explanatory variable was age. To determine the degree of conformity in the logistic regression analysis, the Hosmer-Lemeshow test was used. We used IBM SPSS version 26.0 (SPSS Inc., Cary, NC, USA) as the statistical software. A p value of < 0.05 was considered statistically significant.

### **3. RESULTS**

#### **3.1. Effective Response Rate, Age, and Gender**

The overall effective response rate was 258 of 271 (95.2%). For the healthy young cohort, the effective response rate was 141 of 142 (99.3%), and the young college students were  $20.5 \pm 1.1$  years old and included 75 men and 66 women. For the healthy elderly cohort, the effective response rate was 117 of 129 (90.6%), and the elderly people were  $78.8 \pm 7.4$  years old and included 24 men and 93 women.

#### **3.2. Number and Age Differences for Disuse Syndrome**

Disuse syndrome of all participants was identified in 93 of 256 (36.0%; Table 2). We found no significant difference in the number of healthy young college students and elderly people.

We found no item for which the number of the young college students cohort was significantly higher than that of the elderly cohort. The items for which the number of healthy young college students was significantly smaller than that of healthy elderly people were the following: (2) Walking in the home (healthy young college students, 0 of 141 [0.0%]; healthy elderly people, 6 of 117 [5.1%]), (6) Is it more difficult to walk than before the COVID-19 pandemic? (healthy young college students, 0 of 141 [0.0%]; healthy elderly people, 25 of 117 [21.4%]), and (7) Is there anything else that has become difficult? (healthy young college students, 0 of 141 [0.0%]; healthy elderly people, 14 of 117 [12.0%]).

As a result of the logistic regression analysis, (2) Walking in the home (partial regression coefficient: 18.285, p: 0.002, odds ratio: 87322964.603), (6) Is it more difficult to walk than before the COVID-19 pandemic? (partial regression coefficient: 19.900, p: 0.000, odds ratio: 438987684.424), and (7) Is there anything else that has become difficult? (partial regression coefficient: 19.207, p: 0.000, odds ratio: 219579064.916) were identified as significant objective variables.

The rate of decline for the young college students was highest in questions (5) How much physical activity do you do during the day?, (1) Walking outdoors, and (4) Number of outings.

**Table2. Relationship between age and disuse syndrome**

		young people (n = 141)		elderly people (n = 117)		p
		n	%	n	%	
Disuse syndrome (decrease at least one of each item)		48	34.0%	45	38.5%	
Number of people (%) whose condition has deteriorated for each checklist item	1 Walking outdoors	21	14.9%	19	16.2%	
	2 Walking in the home	0	0.0%	6	5.1%	<0.05
	3 "Activities around the house (Bath, washbasin, toilet, meal, etc.)"	3	2.1%	6	5.1%	
	4 Number of outings	15	10.6%	14	12.0%	
	5 How much physical activity do you do during the day?	23	16.3%	11	9.4%	
	6 Is it more difficult to walk than before the COVID-19 pandemic?	0	0.0%	25	21.4%	<0.05
	7 Is there anything else that has become difficult?	0	0.0%	14	12.0%	<0.05

#### 4. DISCUSSION

We found no significant differences in the trends for healthy young college students and healthy elderly people, which was different from our hypothesis that more elderly people would be affected by disuse syndrome. The discussion of the results of the healthy elderly cohort is described in a different article<sup>7)</sup>, so we will omit it here.

##### 4.1. Age Differences

For all participants, we found disuse syndrome in 93 of 256 (36.0%). No significant difference existed in the number of healthy young college students and healthy elderly people; ~1 in 3 people, both elderly and young college students, were adversely affected in their physical function due to COVID-19 restrictions on going out. This finding is different from our expectation that older people would be more affected by the COVID-19 pandemic than younger people would.

The possible reason for this result is that the young college students in this study are university students who have weak social regulations and are prone to disturbed lifestyles. Tokunaga et al.<sup>14)</sup> conducted a survey targeting junior high school students to working adults, finding that college students report the least desirable health and lifestyle of all ages. Therefore, it is possible that the students' physical function was likely to decline as much as that of the elderly participants did because of the students' lifestyle.

The questionnaire items for which the number of young college students was significantly smaller than that of the elderly people were the following: (6) Is it more difficult to walk than before the COVID-19 pandemic? and (7) Is there anything else that has become difficult? This was similar to our expectation that older people are more susceptible to the COVID-19 pandemic than younger people are. Items (6) is related to walking, which can become more difficult with age. For example, the Asian Working Group for Sarcopenia's Sarcopenia Criteria uses reduced walking speed as a symptom identifier<sup>15)</sup>.

#### **4.2. Results from Healthy Young college students**

The questionnaire items for which the young college students scored worse were the following: (5) How much physical activity do you do during the day?, (1) Walking outdoors, and (4) Number of outings. All of these items include going outdoors. The Tokyo Metropolitan Government has conducted an online survey of young college students regarding their awareness of and behavior during COVID-19<sup>16)</sup>, reporting that ~70% of young college students have refrained from going out during the state of emergency 2 days a week. This finding is similar to our study's results. In addition, Nakamura et al. investigated the leisure activities of Japanese college students during the normal state before the COVID-19 pandemic<sup>17)</sup>, reporting that the students' most common leisure activities were playing sports and games for men and eating out and shopping for women. Because many college students' leisure activities require going out, COVID-19 restrictions were likely to adversely affect their physical activity.

#### **4.3. STUDY LIMITATIONS**

First, this study did not consider cognitive or mental function as the questionnaire that we used focused only on body functions and activities. Previous studies<sup>8, 18)</sup> reported that COVID-19 restrictions on going out have adversely affected mental health and cognitive function. Therefore, additional questionnaire validation should examine these topics.

Second, this study was not longitudinal. Depending on future COVID-19 cases, refraining from going out may continue periodically for a long while. Therefore, examination of these changes over time is needed.

Third, in this study, the participants may have been biased. The young college students were in the 3rd and 4th grades in the Department of Physical Therapy in a medical university. A similar study with young college students of the same age who did not attend a college, with young college students who work, and with students at a nonmedical college may yield different results. The elderly people were those who regularly used health and welfare services with the goal of living without dependence on nursing care. When examining elderly people who are not voluntarily attending the facility or who are in need of nursing care, the results may differ. Therefore, future studies should target both young and elderly people under various conditions.

Fourth, in this study, the number of participants was small. About 21,000 elderly people live in the city where this survey was conducted. The number of elderly people who answered the questionnaire in this study was 129, which is about 0.5% of the elderly people in the city. Therefore, it may be difficult to apply this result to all elderly people. Owing to the fact that the city hall limited the number of people who can participate in the long-term care prevention class at one time to about 10 for infection control, the number of participants has decreased. In the future, it will be necessary to find research methods that can be secured by many participants, in consideration of infection.

Fifth, in this study, detailed information on the subjects was not collected, and factor analysis was not sufficiently performed. The reason why it could not be collected was that a questionnaire survey was required in a short time in order to prevent infection. Factors that affect disuse syndrome include underlying disease, social participation, physical activity, medical history, and family. In the future, it is necessary to consider including them.

#### **CONFLICTS OF INTEREST**

The authors declare that they have no conflicts of interest related to this work.

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