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ORIGINAL ARTICLE

Using Videos to Analyze the Effectiveness of START Education for Japanese Nursing Students

Kazuyuki AKINAGA[1)] Kaoru SHIBAYAMA[1)] Koichi TAKAHASHI[1)] Setsuko UMEZAKI[2)] Kazue NONAKA[1)] Norihito NOGUCHI[3)] Koichi SHINCHI[1)]

1) Graduate School of Medical Sciences, Saga University, Japan
2) Department of Nursing, School of Health and Medical Sciences, Junshin Gakuen University, Japan
3) Department of Nursing, School of Medical Education, National Defense Medical College, Japan

ABSTRACT

This study aims to evaluate the effectiveness of teaching START (Simple Triage and Rapid Treatment) to nursing students using videos. To this end, we conducted a study from October 1, 2016 to March 31, 2018, instructing nursing students to view a video of 30 simulated cases and to perform triage exercises both before and after START training. Subjects included 57 freshmen and 56 seniors. We calculated the accuracy rate for each case and examined those where students were most likely to make mistakes. We found that after START training, both freshmen and senior students did significantly better on the triage exercises. Before the training, seniors treated an average (± standard error (SE)) of 23.5 ± 0.7 out of 30 patients correctly, while after the training, this number increased to 29.3 ± 0.2 ($p < 0.001$). For freshmen, the increase was even more drastic, increasing from 17.4 ± 0.6 correct before the training to 29.1 ± 0.3 after ($p < 0.001$). While freshmen initially answered far fewer questions correctly, after the training, there was no significant difference in the performance of freshmen and seniors: both groups had an overall accuracy rate of 95% or higher. The drastic performance increase even of freshmen with little medical knowledge suggests that this program may even be effective for the general public, making our results relevant for developing better disaster medical care in the future.

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Corresponding author: shinchik@cc.saga-u.ac.jp (Koichi SHINCHI; Japan)
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I. Introduction

Japan frequently suffers from natural disasters, including the 1995 Great Hanshin-Awaji Earthquake, the 2011 Great East Japan Earthquake, and the 2016 Kumamoto Earthquake. In all of these cases, while nurses helped medically treat those injured after the disaster, there was a shortage in both medical manpower and resources like medicine and supplies, especially during the first 72 hours. Triage, therefore, is a vital tool to prioritize victims' treatment and hospitalization, help the greatest number of patients possible. In cases such as the above example, the lack of doctors means that nurses are often responsible for triage (Fukuyama, Shinchi, Shinchi et al., 2006; Furukawa, Shinchi, Fukuyama et al., 2007; Ishibashi, Fukuyama, Nonaka et al., 2017; Noguchi, Inoue, Shimanoe et al., 2016). Nursing curriculum, therefore, should include triage education (Akinaga, Takahashi, Sakamoto et al., 2012; Matsunaga, Akinaga, Umezaki et al., 2013; Matsunaga, Shinchi, Akinaga et al., 2013).

Triage derives from a French word meaning "sorting" and "choosing." In medical terms, it is a technique to maximize the number of survivors after a disaster by categorizing the injured based on the severity of their wounds and prioritizing treatment and hospitalization accordingly (Donatelli & Somes, 2012; Good, 2008; Somes & Donatelli, 2014). Studies on triage have reported the need for regular training (Akinaga, Takahashi, Sakamoto et al., 2012; Howard & Foley, 2014; Powers, 2007) to teach medical professionals how to engage in triage effectively.

The increased number of natural disasters makes it vital for nurses to be taught the principles of triage in disaster situations (Evans & Baumberger-Henry, 2014); this teaching is most effective when begun through simulations during their ongoing education (Brannigan, Witwer, Rudel et al., 2006; Duarte & Haynes, 2006; Foronda, Shubeck, Swoboda et al., 2016).

To this end, Japanese nursing colleges today provide triage education to their students. However, there are as of now few studies that examine the most effective educational methods for this training (Akinaga, Takahashi, Sakamoto et al., 2012). This study attempts to answer some of those remaining questions. Specifically, we evaluate the effectiveness of using videos to teach the START (Simple Triage and Rapid Treatment) method of triage to nursing students. This triage method was developed in 1983 by the Hoag Hospital and Newport Beach Fire Department in California and is now widely used in the United States (Benson, Koening & Schultz, 1996; United States Department of Health and Human Services, 2018). It is a tool used by first responders to quickly classify victims during a mass casualty incident (MCI) based on the severity of their injury.

Our findings have implications for future human resource development in disaster medical care.

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II. Methods

We showed two groups of nursing students—a group of freshmen and a group of seniors—a video with 30 simulated cases and provided an accompanying lecture (Kawahara & Ishida, 2008). We also asked the students to perform a triage exercise both before and after START training.

The training started with the lecture by a medical professor and doctor experienced in disaster medical treatment. Prior to beginning START training, both freshmen and seniors were told only about the basic concept and definition of triage (Sakai & Kikuchi, 2016) and then shown the accompanying video. After the video, the professor described the START method in detail and, two hours later, students were asked to perform triage on patients with the same symptoms as in the video. Students used an answer sheet to describe the triage category of each patient using the START classification, and the answer sheets were collected after the lecture was over.

Table 1 provides details regarding the 30 simulated cases students viewed on the video and were later asked to triage. Information provided included age, gender, ability to walk on their own, whether they were breathing on their own, number of breaths per minute, capillary refilling time (nail blanch test), whether they were capable of following simple commands, heart rate, and diagnosis.

Because of the course curriculum, the lecture was given on a different day for freshmen and seniors. However, the contents of the lecture were the same for both groups and included information on the purpose of triage, situations that require triage, and how to prioritize patients. Students were also given information about the START method specifically, which involves providing each patient with a colored tag based on their triage classification: minor (green), delayed (yellow), immediate (red), or deceased (black). This classification is made based on whether a patient is capable of walking by themselves, is breathing by themselves, their respiration rate, level of consciousness, and the palpation of radial artery or capillary refilling time of the nail (CRT).

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<Table 1> Characteristics of the 30 cases included in the video

	Age	Sex	Diagnosis	Triage category	Walk	Breathing	Ventilatory frequency	capillary refilling time	Verbal contact	Heart rate
1	Infant	female	Dead	Black	×	×	0	×	×	0
2	82	male	Cut on the ear	Green	○	○	23	○	○	75
3	43	female	Epidermal burn	Green	○	○	22	○	○	56
4	25	male	Intestinal tract hernia	Red	×	○	23	×	○	92
5	19	female	Blow to the head	Green	○	○	28	○	○	96
6	54	female	Previous head abrasion	Green	○	○	20	○	○	82
7	45	female	Right cheek abrasion	Green	○	○	24	○	○	97
8	36	male	Left leg abrasion	Green	○	○	21	×	○	82
9	67	male	Myocardial infarction	Red	×	○	40	○	○	116
10	64	male	Radial artery damage	Green	○	○	29	○	○	104
11	8	male	Fall	Green	○	○	28	○	○	116
12	40	male	facial burn	Green	○	○	24	×	○	106
13	32	male	Crash syndrome	Red	×	○	32	○	△	84
14	32	female	Nose fracture	Green	○	○	20	○	○	80
15	52	male	Head wound	Green	○	○	20	×	○	80
16	23	male	Pelvis fracture	Red	×	○	36	○	○	120
17	67	male	Finger cutting	Green	○	○	28	○	○	72
18	72	male	Upper body burns	Yellow	×	○	28	○	○	112
19	36	female	Cervical sprain	Green	○	○	24	○	○	78
20	71	male	Eye puncture	Green	○	○	24	○	○	78
21	43	male	Left leg open fracture	Yellow	×	○	28	○	○	116
22	60	female	Right second finger extensor tendon tear	Green	○	○	23	○	○	92
23	25	male	Left leg second-degree burn	Yellow	×	○	28	○	○	96
24	28	female	Pregnant, Water broke	Yellow	×	○	24	○	○	64
25	21	female	Left wrist fracture	Green	○	○	25	○	○	82
26	35	female	Glass puncture wound	Green	○	○	29	○	○	104
27	2	male	Right forearm second-degree burn	Yellow	×	○	28	○	○	92
28	51	female	Blow to back of the head	Green	○	○	22	○	○	86
29	10	male	Wrist burns	Green	○	○	27	○	○	94
30	78	male	Intraoral injury	Green	○	○	24	○	○	74

[1]black = deceased, red = immediate, yellow = delayed, green = minor
[2] ○ = can walk, × = cannot walk, [3] ○ = can breathe by oneself, × = cannot breathe
[4] times/min, [5] ○ = < 2 seconds, × = > 2 seconds, [6] ○ = yes, × = no, [7] times/min
Source: Kawahara K, et al. Disaster triage simulation education material (DVD), Tokyo Metropolitan University and Benesse Corporation (2008).

1. Subjects

We collected data between October 1, 2016 and March 31, 2018. Subjects included 56 senior (1 male, 55 females) and 57 freshmen (2 males, 55 females) nursing students at the Saga Medical School Faculty of Medicine. The average age of the students (± standard deviation (SD)) was 18.9 ± 0.2 for freshmen and 21.6 ± 0.1 for seniors. The participation and valid response rate were 100%.

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For senior students, we taught the START method as part of a lecture on disaster nursing. For freshmen students, we included our curriculum as part of a public health lecture related to disaster nursing. This occurred six months after the students were admitted, before many had attended a medical or nursing lecture.

2. Ethical Consideration

The study passed Saga University Faculty of Medicine's ethical review (approval number: 28-38). We did not require students to include personal information, such as their name or student number, on the answer sheets. We explained the purpose of the study to the students and assured them that refusing to participate or discontinuing halfway through would not adversely affect their grades. All students agreed to participation by submitting their answer sheet for the triage classification exercises.

3. Data Analysis

We analyzed the answers to the triage exercises both before and after START training based on students' age, gender, and number of questions correct (out of 30) using SPSS statistics 23.

There was no standard normal distribution of correct answers for either freshmen or seniors. We compared the distribution of scores before and after START training using the Wilcoxon signed-ranks test. We also used the Mann-Whitney U test to compare the distributions of scores in the same period between freshmen and seniors.

Most studies would make comparisons based on median scores, since these are nonparametric tests. However, we decided to primarily use mean scores, which are easier to understand, and reflect the fact that our data are based on the number of correct answers, and show the median scores in parentheses.

We also calculated the number of students who answered each question correctly and the accuracy rate for each question by class standing before and after the training, examining the examples in which students tended to make mistakes.

III. Results

Table 2 compares the mean and median scores of freshmen and seniors on the triage exercise both before and after START education. We found that seniors had a mean (median) score of 23.5 (24) ± 0.7 (out of a perfect score of 30) before the lecture and 29.3 (30) ± 0.2 after the lecture, a significant increase (p = 0.0001). Likewise, freshman students had a mean (median) score of 17.4 (18) ± 0.6 before the lecture and 29.1 (30) ± 0.3 after (p = 0.0001). In other words, we observed a remarkable change in both groups. Moreover, this marked improvement was more drastic among freshmen than among seniors: while the average number of correct answers increased by 5.8 among seniors, the average among freshmen increased by 11.7 points.

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<Table 2> Comparison of mean/median score before and after START education in the two groups using Wilcoxon signed-rank test

	Before START education		After START education		
	Mean ± SE	Median	Mean ± SE	Median	p-value
Seniors	23.5 ± 0.7	24	29.3 ± 0.2	30	0.0001
Freshmen	17.4 ± 0.6	18	29.1 ± 0.3	30	0.0001

<Table 3> Comparing students' triage ability before and after START education using Mann-Whitney's U test

	Seniors		Freshmen		
	Mean ± SE	Median	Mean ± SE	Median	p-value
Before education	23.5 ± 0.7	24	17.4 ± 0.6	18	0.0001
After education	29.3 ± 0.2	30	29.1 ± 0.3	30	not significant

Table 3 compares freshmen and seniors' number of correct answers before and after START training. Before the training, the mean (median) ± SE was 17.4 (18) ± 0.6 for freshmen and 23.5 (24) ± 0.7 for seniors, showing that seniors did significantly better p = 0.0001). After the training, the mean (median) ± SE was 29.1 (30) ± 0.3 for freshmen and 29.3 (30) ± 0.2 for seniors; there was no significant difference.

Table 4 shows the number of students who answered each question correctly and the accuracy rate for triage cases before and after the training for both freshmen and seniors. Before START education, both freshmen and seniors had less than a 50% accuracy rate for both Cases 10 ("radial artery damage") and 12 ("facial burn"). After the training, the accuracy for these cases increased to 95% or higher for both classes. Other cases did not have as steep of an increase in accuracy. For example, the accuracy rate for Case 4 ("abdominal injury with intestinal tract hernia") remained at 88% for freshmen and 86% for seniors even after the training. Freshmen also had a low accuracy rate (86%) for Case 24 ("Pregnant, water broke"), even after the training. However, overall, both freshmen and seniors had a total accuracy rate of 95% or higher after START education.

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<Table 4> Student accuracy rate before and after START education

Case	Freshmen students (n = 57)		Senior students (n = 56)	
	Before START education	After START education	Before START education	After START education
	Correct answers n (%)	Correct answers n (%)	Correct answers n (%)	Correct answers n (%)
1	48 (84)	57 (100)	44 (79)	53 (95)
2	30 (53)	56 (98)	49 (88)	56 (100)
3	45 (79)	57 (100)	47 (84)	55 (98)
4	51 (89)	50 (88)	47 (84)	48 (86)
5	36 (63)	56 (98)	46 (82)	56 (100)
6	27 (47)	57 (100)	45 (80)	55 (98)
7	53 (93)	57 (100)	50 (89)	56 (100)
8	53 (93)	57 (100)	54 (96)	56 (100)
9	47 (82)	55 (96)	44 (79)	55 (98)
10	14 (25)	54 (95)	26 (46)	53 (95)
11	33 (58)	57 (100)	45 (80)	56 (100)
12	2 (4)	55 (96)	25 (45)	55 (98)
13	53 (93)	56 (98)	56 (100)	56 (100)
14	41 (72)	56 (98)	51 (91)	56 (100)
15	7 (12)	54 (95)	34 (61)	56 (100)
16	38 (67)	56 (98)	28 (50)	53 (95)
17	21 (37)	56 (98)	34 (61)	54 (96)
18	40 (70)	51 (89)	44 (79)	53 (95)
19	38 (67)	56 (98)	48 (86)	55 (98)
20	6 (11)	55 (96)	35 (63)	55 (98)
21	30 (53)	54 (95)	42 (75)	53 (95)
22	47 (82)	55 (96)	49 (88)	56 (100)
23	43 (75)	56 (98)	48 (86)	56 (100)
24	26 (46)	50 (88)	37 (66)	53 (95)
25	45 (79)	56 (98)	51 (91)	55 (98)
26	9 (16)	55 (96)	35 (63)	53 (95)
27	36 (63)	54 (95)	47 (84)	53 (95)
28	30 (53)	56 (98)	50 (89)	56 (100)
29	45 (79)	56 (98)	47 (84)	56 (100)
30	49 (86)	56 (98)	52 (93)	56 (100)

Note: %; Accuracy rate.

IV. Discussion

Our use of videos in START training was very effective, as shown by the increased total scores among both freshmen and seniors after the training. As expected, seniors' initial scores were higher: this makes sense, since they have accumulated nursing knowledge over three years that the freshmen, who have only been in college for about six months, do not have. However, it is interesting that the accuracy rate of both groups improved to almost 100% after the training. This implies that teaching the START method to nursing students was so effective that it could enable freshmen, who have almost no knowledge of medicine and nursing, to achieve an almost perfect score. In other words, using videos and

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presenting simulated patient cases is an effective method of triage education, perhaps because it is easier for students to imagine patients' conditions.

We also examined the problems that students tended to get wrong even after the training. Cases 10 and 12, both of which had an accuracy rate of 50% or lower among freshmen and seniors before the training, are similar in many ways. Both were medical conditions that looked worse than they were: while bleeding and a burned face may initially appear to be severe, both of these patients had stable vital signs. As noticed in our previous studies (Aknaga, Shibayama, Takahashi et al., 2017), freshmen may tend to over-triage, classifying the case based on appearances rather than vitals and other observations. However, this tendency decreased after the training: the accuracy rate for Case 10 increased to 95% among both freshmen and seniors, and that of Case 12 increased to 96% for freshmen and 98% for seniors.

Other cases remained difficult even after the training, even as the overall accuracy rate reached 95% or higher. (For a detailed qualitative study of the cases in which students continue to make mistakes, please see our other article, Aknaga, Shibayama, Takahashi et al., 2017.) For example, the accuracy rate of Case 4 was 88% for freshmen and 86% for seniors after the training. This case may have been slightly difficult because the injury—abdominal injury with intestinal hernia—required the consideration of multiple vital signs when making a judgment. This was an example that even a doctor might have struggled with, so it makes sense that this was a difficult triage classification for nursing students. That said, many nursing students correctly triaged the above case; therefore, the START method has the potential to enable nursing students to correctly triage even the most difficult cases. This also implies that teaching START methods can dramatically improve the triaging ability even of those with little knowledge of medicine and nursing.

This study does have some limitations. First, our study only included 113 nursing students at the Saga University Faculty of Medicine, resulting in a relatively small sample size. Future studies should collect and analyze data from other nursing colleges. In addition, one doctor experienced in disaster medical care was responsible for all lectures and teaching in our study; future research may wish to compare curricula conducted by multiple faculty members, nursing teachers, etc.

There is also a concern that simulation-based education (i.e., video education) may be more limited in effect than practical training that includes actors who simulate triage victims, allowing students to engage in real-life physical examinations. However, such methods are time-consuming and expensive, and realistically, videos are much more likely to be used in such situations. In addition, studies have found that virtual simulations (i.e., videos) can be as effective as practical training in helping students improve their triage skills (Ingrassia, Ragazzoni, Carenzo et al., 2015).

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Our findings are in line with others that find the START method to be useful among nursing students. Sapp, Brice, Myers et al. (2010) studied the triage accuracy of freshmen students using the START method and found them to be as accurate as emergency physicians and nurses. However, Sapp's study does not compare accuracy rates before and after START education. Claudius, Kaji, Santillanes et al. (2015) also reported on the usefulness of JumpSTART for medical students. Our study is also the first to quantitatively evaluate the effectiveness of START education among nursing students, especially using videos.

We found that the START method, an internationally standardized simple triage method, has the potential to greatly improve prehospital care. In Japan, where large natural disasters occur frequently, triage education for nursing students is important to save as many lives as possible after a disaster and should be included as early as possible in the college curriculum. In addition, our results suggest that this method may also be effective for the general public or for others with less medical knowledge. Educating the public as to the START method may therefore also help a community in the aftermath of a large natural disaster.

V. Conclusion

Our study demonstrates that teaching the START method to nursing students can dramatically improve their ability to triage. Using videos and simulated patients is an effective educational tool. After START education, even freshmen with very limited medical knowledge, increased their accuracy rate to 95% or more, and the cases that were often missed were those that were difficult even for doctors. Our results suggest that this method may also be effective for the general public and for others with less medical knowledge.

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ORIGINAL ARTICLE

Effects of the OSCE to Motivate Students to Learn Before Clinical Practice

Yuko FUJIO [1] Shino SASAKI [1] Ryo HAYASHI [1] Junko ISHIZUKA [1]
Yasushi TAKEI [2] Takao OKADA [3]

1) Faculty of Health Science and Nursing, Juntendo University, Japan
2) Health Science University, Japan
3) Department of Medical Education, Juntendo University School of Medicine, Japan

ABSTRACT

Objective: The Objective Structured Clinical Examination (OSCE) as a common examination for medical and dental education was used for nursing education to examine its effects to enhance students' recognition of their learning goals and motivate them to learn before clinical practice. Methods: A self-administered questionnaire survey was conducted immediately after the OSCE. The questionnaire consisted of: goal achievement-related OSCE items; modified <attention>, <relevance>, <confidence>, and <satisfaction> as the 4 key components of motivation in the ARCS model developed by John M. Keller; and free descriptions. Results: Among quantified scores from the ARCS model-based scale, those related to <satisfaction> were the highest. <Satisfaction - the willingness to review> also showed the highest standardizing coefficient in multiple regression analysis (stepwise method) of the items showing a strong correlation with the objective-related OSCE question: [Do you recognize your learning goals?]. The most frequent word contained in free descriptions was 'tension', which showed a tendency to co-occur with 'training' when examining linguistic networks. Conclusion: <Satisfaction - the willingness to review> influenced the effect of the OSCE to motivate students to learn before clinical practice the most markedly. 'Tension' was suggested to be a psychological response of students.

＜Key-words＞
OSCE, clinical practice, effects to motivate students to learn

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yfujio@juntendo.ac.jp (Yuko FUJIO; Japan)

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I. Introduction

As a recent trend, an increased number of institutions providing healthcare education have adopted the Objective Structured Clinical Examination (OSCE). In medical and dental education, it has been formally adopted as a common examination to be taken by all students prior to clinical training since 2005 (Nakamura, 2014). In the literature on medical education, the OSCE has been reported to facilitate the evaluation of psychomotor (skills) and emotional (attitudes) domains, in addition to cognitive (knowledge) areas, and be particularly innovative as a psychomotor evaluation method (Ban, 2003). Similarly, in nursing education, the number of reports discussing the OSCE has increased since 2005 (Kajiwara & Nakanishi, 2011). Such a tendency may have been derived from the definition of nursing abilities to be acquired through undergraduate courses by the Ministry of Education, Culture, Sports, Science, and Technology in 2004 (Ministry of Education, Culture, Sports, Science, and Technology, 2011). Previous studies examining the usefulness of the OSCE in nursing mainly reported its significance in: promoting students' autonomous learning and technical self-training to prepare for it (Takahashi, Asakawa, Numaguchi et al., 2009); clarifying points to be noted during clinical training (Uchida, Tsuchiya, Akahoshi et al., 2008); and facilitating the evaluation of the ability to accurately understand clients, as well as technical assessment from the viewpoint of individuals requiring support (Taga, Hinotsu, Fukushima et al., 2009). On the other hand, the OSCE has not yet been adopted as a common examination for all nursing universities due to challenges, such as the necessity of unifying evaluation criteria, clarifying objectivity and difficulty levels for goal-setting, and addressing personnel and cost-related issues (Kajiwara & Nakanishi, 2011). Under such circumstances, our department was established in 2010, with the educational goal of helping students 'acquire practical nursing abilities to mentally and physically heal clients'. In 2015, 5 years after its establishment, we conducted a trial OSCE immediately before clinical training for third-year students.

This study aimed to clarify the effect of the OSCE to enhance nursing students' recognition of their own learning goals and motivation to learn in preparation for clinical training, using the ARCS Model developed by John M. Keller (Keller, 2010). The ARCS Model, consisting of 4 key components: <attention>, <relevance>, <confidence>, and <satisfaction>, has already been used at some medical and nursing universities to evaluate educational programs and their effects to motivate students to learn (Taniguchi, Yagi & Kabeyama, 2011; Muranaka, Kumagai, Hattori et al., 2011).

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II. Subjects and Methods

1. Subjects and Procedures

Questionnaires were conducted to 119 students in their third year as of 2015 were studied after OSCE was implemented. Using an anonymous, self-administered questionnaire, the students' attributes, frequency of reviewing their previous studies to prepare for the OSCE, duration of each review, and the effect of the OSCE to enhance their technical level and recognition of their own learning goals were examined. The questionnaire also contained statements, created by modifying the 5 subscales of the 4 ARCS components. Each statement was rated on a 4-point Likert scale. A space to freely describe overall impressions of the OSCE was also inserted.

2. Data Collection

To avoid obligating the students to participate in the study, the questionnaire and an explanatory document outlining the study were distributed to them by fourth-year students as volunteers in a different room than the examination venue. The students were asked to directly drop their responses into a collection box after filling out the questionnaire.

3. Statistics analysis

Responses to the questionnaire items were simply totaled, and ordinal scales for the modified ARCS items were quantified (-2 to 2) to calculate scores. Subsequently, the correlation between the effect of the OSCE to enhance students' recognition of their own learning goals and 4 ARCS components was analyzed to calculate Spearman's rank correlation coefficient (ρ). Among the study items, those showing a markedly strong correlation, represented by $\rho>0.4$, were used as independent variables, and the effect of the OSCE to enhance students' recognition of their own learning goals was used as a dependent variable when performing multiple regression analysis (stepwise method). For analysis, the statistical analysis software SPSS Ver. 22.0 was used, with the significance level set at $p<0.05$. The students' free descriptions were examined through word frequency analysis using Text Mining Studio Ver. 5.1 to extract the 10 most frequent words. Furthermore, dependency and topic analyses were performed to examine words showing dependency and co-occurrence relationships, respectively, with the most frequent word 'tension'.

4. Ethical Considerations

Prior to the study, the approval of the Ethics Committee of the Faculty of Health Science and Nursing, Juntendo University was obtained (approval number: 27-04). To prevent the identification of individuals, an anonymous, self-administered questionnaire was used. In addition, to avoid obligating the students to participate in the study, the

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questionnaire was distributed by fourth-year students as volunteers in a different room than the examination venue, asking respondents to directly drop their responses into a collection box after filling it out. The explanatory document outlining the study specified that preventive measures against the identification of individuals were adopted, and participation in the study was completely unrelated to academic achievements. The submission of each response was regarded as consent from a student.

III. Results

All of the 119 students taking the trial OSCE responded to the questionnaire (response rate: 100%). As for their attributes, there were 10 males (8.4%) and 109 females (91.6%), with a mean age of 20.53±0.68. To prepare for the OSCE, 109 (91.6%) had reviewed their previous studies. The mean total number of reviews was 4.67 (range: 1-20), and the mean duration of each review was 2.65 (1-5) hours.

The students rated each statement to clarify the effect of the OSCE, as follows: [The OSCE has enhanced my technical level]: <Strongly agree>: 9 (7.6%), <Agree>: 80 (67.2%), <Disagree>: 28 (23.5%), and <Strongly disagree>: 2 (1.7%); more than 70% positively responded; and [The OSCE has led me to recognize my own learning goals]: <Strongly agree>: 73 (61.4%), <Agree>: 42 (35.3%), <Disagree>: 3 (2.5%), and <Strongly disagree>: 1 (0.8%); more than 90% positively responded. Among the 4 ARCS components, <satisfaction> achieved the highest quantified score. Similarly, among the subscales, {I want to review the items for which I had poor results in the OSCE} achieved the highest quantified score (Table 1).

On the correlation analysis between the effect of the OSCE to enhance students' recognition of their own learning goals, which was positively rated by 90%, and ARCS Model, all of the 4 components, <attention>, <relevance>, <confidence>, and <satisfaction>, showed a strong correlation, with r>0.2. Among these, <attention>: {The OSCE has provided me with new insights}, <confidence>: {The OSCE has clarified my learning goals} and {The OSCE has enhanced my motivation to learn}, and <satisfaction>: {I want to review the items for which I had poor results in the OSCE} and {The OSCE has been useful to develop autonomous learning behavior} showed a markedly strong correlation, with r>0.4 (Table 2).

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<Table 1>Quantified Scores for Each Component of the ARCS Model (n=119)

ARCS component	Statement	Quantified score
<Attention>	The OSCE has been helpful for the visualization of clinical training.	.59
	The OSCE has enhanced my interest in clinical training.	.37
	The OSCE has increased my curiosity about clinical training.	-.18
	The OSCE has provided me with new insights.	1.37
	I want to repeat the OSCE many times.	-.86
	Total	1.25
<Relevance>	The OSCE has made me feel familiar with clinical training.	.14
	I had prepared for the OSCE through autonomous learning.	.97
	I had prepared for the OSCE through learning focusing on my strong points.	.18
	I had prepared for the OSCE through elaborated or repetitive learning.	1.17
	The OSCE has been helpful to understand the relevance between knowledge and practical skills.	.53
	Total	3.25
<Confidence>	The OSCE has clarified my learning goals.	1.16
	The OSCE has contributed to my stable learning.	.55
	I have become more confident through leaning to prepare for the OSCE.	-.38
	It has been productive for me to take the OSCE.	.35
	The OSCE has enhanced my motivation to learn.	.79
	Total	2.47
<Satisfaction>	The OSCE has stabilized my acquired knowledge.	.59
	Preparation for the OSCE has been enjoyable.	-.61
	The OSCE has enhanced my preparedness for clinical training.	.78
	I want to review the items for which I had poor results in the OSCE.	1.61
	The OSCE has been useful to develop autonomous learning behavior.	1.07
	Total	3.44

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<Table 2>Correlation between the Recognition of Learning Goals and Each Component of the ARCS Model (n=119)

ARCS component	Statement	Recognition of learning goals
<Attention>	The OSCE has been helpful for the visualization of clinical training.	.341**
	The OSCE has enhanced my interest in clinical training.	.387**
	The OSCE has increased my curiosity about clinical training.	.392**
	The OSCE has provided me with new insights.	.449**
<Relevance>	The OSCE has made me feel familiar with clinical training.	.270**
	I had prepared for the OSCE through autonomous learning.	.210*
	I had prepared for the OSCE through elaborated learning.	.269**
	The OSCE has been helpful to understand the relevance between knowledge and practical skills.	.371**
<Confidence>	The OSCE has clarified my learning goals.	.553**
	The OSCE has contributed to my stable learning.	.278**
	I have become more confident through learning to prepare for the OSCE.	.183*
	It has been productive for me to take the OSCE.	.373**
	The OSCE has enhanced my motivation to learn.	.429**
<Satisfaction>	The OSCE has stabilized my acquired knowledge.	.279**
	The OSCE has been enjoyable.	.205*
	The OSCE has enhanced my preparedness for clinical training.	.324**
	I want to review the items for which I had poor results in the OSCE.	.437**
	The OSCE has been useful to develop autonomous learning behavior.	.442**
	* p< 0.05 ** p< 0.01	Spearman's ρ

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Furthermore, on multiple regression analysis (stepwise method), with the 5 subscales showing a markedly strong correlation represented by r>0.4 as independent variables and the effect of the OSCE to enhance students' recognition of their own learning goals as a dependent variable, the following subscales were shown to influence such an effect: <satisfaction>: {I want to review the items for which I had poor results in the OSCE}; and <confidence>: {The OSCE has clarified my learning goals} and{The OSCE has enhanced my motivation to learn}. Among these, {I want to review the items for which I had poor results in the OSCE} showed a particularly high standardizing coefficient (β=0.383) (Table 3). Through this analysis, the following regression formula was obtained:
[Recognition of learning goals] = 0.409 × <willingness to review> + 0.178 × <clarified learning goals> + 0.146 × <enhanced motivation to learn> + 0.551.

<Table 3>Multiple Regression Correlation between the Recognition of Learning Goals and Each Component of the ARCS Model (n=119)

	Standardizing coefficient
I want to review the items for which I had poor results in the OSCE (<satisfaction>).	.383**
The OSCE has clarified my learning goals (<confidence>).	.219**
The OSCE has enhanced my motivation to learn (<confidence>).	.207*
R^2 (coefficient of determination)	.413
Adjusted R^2 (adjusted coefficient of determination)	.398
F-value	26.513**
df (degree of freedom)	3

* $p < 0.05$ ** $p < 0.01$ Stepwise method

On word frequency analysis, the word that most frequently appeared in the students' free descriptions was 'tension (48)', followed by 'think (30)', 'can do + cannot do (22)', 'training (20)', 'self-training (17)', 'feel (15)', 'good (14)', 'do (13)', 'goals (12)', and 'understand (10)', in this order. On dependency analysis to examine dependency relationships, 'tension' most frequently depended on the following combinations of words: 'tension - can do + unavailable (3)', 'tension - submit + cannot do (3)', 'training - commute (3)', 'training - go (3)', 'dropping number - calculate (3)', 'mind - panic (3)', 'care - do (2)', 'tension - good (2)', 'case - read (2)', and 'explanation - want (2)'. Similarly, on topic analysis to outline topics appearing throughout texts, and clarify the characteristics of sentences from the perspective of semantics, word networks were analyzed, focusing on the most frequent word 'tension'. The results revealed a co-occurrence relationship among 'tension', combinations/words connected to the former, such as 'review + want to

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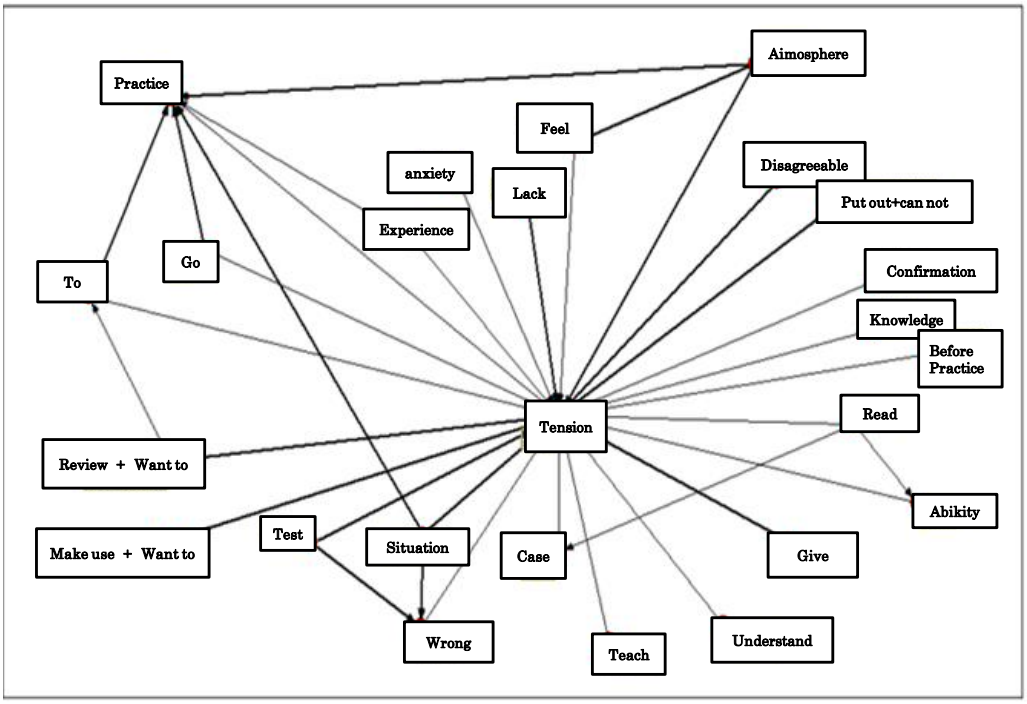
do', 'do', 'go', 'experience', 'atmosphere', 'feel ', 'test', 'wrong', and 'situation', and 'training', to which the former and all of these combinations/words were connected (Figure 1).



<Figure 1> Word Network Graph

IV. Discussion

More than 90% of the students had reviewed their previous studies to prepare for the trial OSCE, and the rates of positively rating the statements to clarify the effect of the OSCE to enhance students' technical level and recognition of their own learning goals exceeded 70 and 90%, respectively. This is consistent with students' opinions regarding the OSCE collected in a previous study, such as {The OSCE has been useful for me to improve my own skills} and {I cannot use the most of my skills due to my insufficient technical level} (Takahashi, Asakawa, Numaguchi, et al., 2009), which explain the significance of the examination from the viewpoint of students. Based on this, the OSCE as a process to prepare for clinical training may have provided the students with a more practical learning opportunity. In another previous study, the importance of the participation of nursing students and faculty members in practical lectures and pre-clinical training was noted (Matsunaga, Shinchi, Akinaga, et al., 2013).

In order to clarify the effect of the OSCE to motivate students to learn, it may be useful to refer to motivational concepts and theories that have been increasingly introduced to date, the latter of which are classified into 4 major categories: 1) those addressing genetic characteristics based on physiology and neurology, 2) those adopting behavioristic approaches, 3) expectancy-value theories, and 4) those focusing on feelings and emotions.

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Motivational theories and concepts have been reported to influence the level of effort to fulfill a purpose and the ability to maintain such effort until a successful outcome is achieved (J. M. Keller, 2010). Furthermore, the ARCS Model used in the present study to examine the effect of the OSCE to motivate students to learn is based on the Macro Model of Motivation and Performance, and it also functions as a system theory to explain relationships using the concept of input/process/output. Among the key components of the ARCS Model, <attention>, <relevance>, and <confidence> represent the input values of the OSCE as a process to prepare for clinical training. <Satisfaction>, the fourth component of the ARCS Model, depends on positive/negative emotions or attitudes students show toward their OSCE results as an output in comparison with a consequence of performance they expect after the process of making effort based on their recognition of the OSCE as a valuable method to prepare for clinical training. <Satisfaction> showed the highest quantified score of all components. Similarly, {I want to review the items for which I had poor results in the OSCE} showed the highest score of all subscales. Correlation and multiple regression analyses also confirmed that <satisfaction> and {I want to review the items for which I had poor results in the OSCE} most markedly influence the effect of the OSCE to enhance students' recognition of their learning goals. These results indicate that the students accepted their OSCE results, with positive emotions and attitudes, and such acceptance resulted in the high willingness to review observed in the subscale of <satisfaction> as an output, supporting the effectiveness of the examination to motivate students to learn. With respect to students' willingness to review, representing their <satisfaction>, a previous study examining the relationship between OSCE examinees' psychological responses and motivation to learn reported that those with higher achievement levels were not motivated to re-learn, and positive feedback simply enhanced their sense of security, not necessarily motivating them to re-learn (Fujii, Shindo, Uchida et al., 2012). At this point, <satisfaction>, which was shown to most markedly influence the effect of the OSCE to motivate students to learn, may be different from psychological responses such as senses of accomplishment and security.

On analyzing the students' free descriptions to identify psychological factors that confirm the effect of the OSCE to motivate students to learn, the most frequent word was 'tension'. When focusing on the word 'tension' to discuss the students' psychological responses to the OSCE, it is noted that individuals attach importance to being favorably evaluated by others, and 3 factors: evaluation apprehension, impression management, and self-presentation promote self-attention, as explained by the Objective Self-Awareness Theory (Oshimi, 1990). In the OSCE, students are evaluated by 3 parties: faculty members, examiners, and simulated patients. Therefore, in the present study, these factors may have been promoted in the students being evaluated by others in an environment similar to the clinical setting, consequently increasing their 'tension'. Conversely, this word most frequently appeared in their free descriptions, indicating that

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self-attention was promoted in the majority. Promoted self-attention has been reported to lead to 2 patterns of self-discrepancy: 1) evaluating real self based on an intrinsic standard of value; developing ideal-real self-discrepancy; intensifying the senses of worthlessness and discomfort; and distracting one's attention to environments to ignore such discrepancy, in order to avoid or escape from uncomfortable feelings (distraction or avoidance of self-attention); and 2) being motivated to improve real self to meet the standard of value (reduced self-discrepancy) (Oshimi,1990). On word network analysis focusing on 'tension', the students showed positive responses representing their enhanced motivation to learn, as well as negative ones, such as 'do not want' and 'submit + cannot do'. 'Tension' was connected to 'review + want to do', 'do', 'go', 'atmosphere', 'feel ', 'experience', and 'situation', and these combinations/words were connected to 'training'. Such a co-occurrence relationship suggests that the students' willingness to review their previous studies and preparedness for clinical training were promoted. Although the object is unclear, the combination of words: 'make the most of + want to do' may also explain the students' desire to step forward based on their experience as a positive outcome of the OSCE that reduces ideal-real self-discrepancy. On examining the results of dependency analysis and factors influencing the effect of the OSCE to enhance students' recognition of their own learning goals, 'review + want to do' depended on {I want to review the items for which I had poor results in the OSCE}, and 'review + want to do' and 'make the most of + want to do' depended on {The OSCE has enhanced my motivation to learn} and {The OSCE has clarified my learning goals}, without inconsistency. The students' overall impressions of the OSCE also supported its effect to motivate students to learn in preparation for clinical training. Their willingness to review their previous studies, representing their <satisfaction>, was shown to most markedly influence such an effect, and 'tension' as a psychological response may explain their situation.

A trial use of the OSCE, which is being adopted as a common examination for medical and dental education, provided the nursing students with a more practical learning opportunity. On examining its effect to motivate students to learn in preparation for clinical training, the willingness of review of previous studies as a subscale of <satisfaction> most markedly influenced such an effect of all components of the ARCS Model. The results support the effectiveness of the OSCE to motivate students to learn, while suggesting that 'tension' as a psychological response explains their situation in terms of reduced ideal-real self-discrepancy.

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ORIGINAL ARTICLE

The Current Status and Its Implications of Public-Private Partnerships for Official Development Assistance in Korea:
Focusing on Disability-Inclusive Development Cooperation

Juhee HWANG [1] Hyekyoung PARK [2]

1) Korea Institute for Health and Social Affairs, Korea
2) Rehabilitation Welfare Department, Hanshin University, Korea

ABSTRACT

Korea's international development cooperation needs collaboration with private organizations to achieve goals such as reduction of poverty in developing countries, support for developing countries and an increase in government's assistance, effectiveness and influence. This study aims to examine PPP strategies for disability-inclusive development cooperation, grasp the current condition of PPP in Korea, and propose a plan for disability-inclusive official development assistance in the utilization of public-private partnership. In terms of official development assistance to promote public-private partnership strategies, the policy implications for disability-inclusive development cooperation are as follows. First, PPP projects shall be supported in a diversified manner, including expanded budget allotment and continuous support for years for disability-inclusive development cooperation. Second, it is necessary to apply the twin-track approach, which is an effective disability-inclusive development method, to selecting PPP projects. Particularly, the disability-inclusive approach needs to be adopted for such projects. Third, it is vital to collaborate with civic organizations and domestic organizations for the disabled to implement PPP projects effectively.

<Keywords>
disability-inclusive international development cooperation, public-private partnership, civic organization, organization of the disabled

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hwangju99@hanmail.net (Juhee HWANG; Korea)

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I. Introduction

In 2010, Korea became a member country of the Organization for Economic Cooperation and Development's Development Assistance Committee (OECD DAC), and since 2013, it has been a leader in the Third Asian and Pacific Decade of Disabled Persons. As a member country, Korea has the role and responsibility to facilitate official development assistance in the area of disability. Plans for disability-inclusive development assistance need to be created and practiced for optimal implementation. Particularly with official development assistance, effective use of limited financial resources and increased effectiveness in development are essential. Likewise, strategies for disability-inclusive development assistance in the utilization of public-private partnership (PPP) have received keen attention in recent years (Maeng, 2012). In the Fourth High Level Forum on Aid Effectiveness (HLF-4) held in Busan in 2011, cooperation with private organizations was one of the significant issues discussed in the context of sustainable effects of international development cooperation projects. Korea International Cooperation Agency (2017)[1)] put efforts into specific areas of development assistance to include the matter of disability among major cross-cutting issues. While advanced donor nations cooperate with private organizations for international development cooperation and propose guidelines and initiatives for disability-inclusive development, Korea has made little use of efficient strategies for disability-inclusive development cooperation, specifically for public-private partnership. Accordingly, this study aims to examine PPP strategies for disability-inclusive development cooperation, grasp the current condition of PPP in Korea, and propose a plan for disability-inclusive official development assistance in the utilization of public-private partnership.

II. Disability-inclusive International Development Cooperation

Before disability-inclusive international development cooperation strategies are discussed, the concept of disability-inclusive development cooperation needs to be defined. To this end, it is necessary to understand the meaning of the word “disability” in this context and what disability-inclusiveness and general disability-inclusive strategies are in terms of international development cooperation. The following section will briefly discuss those concepts.

People with disabilities are 'people with long-term physical, mental, intellectual, or sensory impairments that hinders social participation as equal, complete, and effective as others in interactions with various barriers' (Article 1 of the Convention on the Rights of Persons with Disabilities: CRPD). Around the globe, there are about one-billion disabled people (15% of the population), and among them, 100.1 million to 100.9 million are severely disabled. Eighty percent of disabled individuals live in low-income developing countries; it is probable that these individuals have few opportunities for

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preventing or treating their disabilities due to poor medical benefits in those nations (UN, 2012). Even if they can receive medical treatment, they are unlikely to bear the continuous expenditure of medical service, with their disabilities and poverty getting worse. Because their access to schools or public facilities is low, disabled individuals have few opportunities to receive education or training. Thus, they are unlikely to develop effective capabilities, and after school age, they easily fall into severe poverty due to challenges in finding or maintaining a job; this leads to a status of low income or unemployment (WHO, 2011). Insufficient infrastructure and low standards of living in developing countries increase the risk of poor residents becoming disabled, and such disabilities make their poverty increasingly worse in a vicious cycle.

Since long ago, global society has put forth efforts to overcome the challenge of disability based on the high connectivity between disability and poverty in recognition of this reality of disability. In other words, although the problem of disability was a critical hindrance to poor people's quality of life and long-term development of a country, this cross-cutting issue has often been neglected in the process of development.[1] Accordingly, the UN General Assembly set the issue of disability as a challenge that must be addressed for the goal of millennial development. In 2009, it adopted the 'Resolution of the Realization of New Millennial Development for the Disabled (A/RES/64/ 131).' In 2012, the UN included the issue of disability in the context of development among cross-cutting issues, paving an official foundation for 'disability-inclusive development' so this matter of disability could be considered in every area of international development (Hwang & Park, 2013). In 2016, five out of the UN's 17 goals for sustainable development specifically included disability, indicating that the issue of disability must be addressed for sustainable development (refer to <Table 1>).

'Disability-inclusive development' means to consider disability universally in every area of international development based on the UN's 2006 CRPD. This term emphasizes the need to prevent the disabled from being neglected or alienated from every area of life such as education, medical service, employment, and welfare in the perspective of human rights for the sake of complete social integration.

[1] In the context of international development cooperation, cross-cutting issues include problems that have been neglected in the process of development such as gender, environment, and governance. Such issues should be taken into consideration in every area, step, and procedure of development.

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<Table 1> Specific Goals of SDGs That State Disability

Goals NO.	Contents
4.5	By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations.
4.7a	Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all.
8.5	By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value.
10.2	By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status.
11.2	By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.
11.7	By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities.
17.8	Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology.

Source: KOICA, 2017, p.215.

In general, disability-inclusive development strategies adopt the 'twin-track' approach. The twin-track approach is divided into two types: (1) the 'disability-inclusive approach' to include 'disability indexes' in the process of design, implementation, monitoring, and evaluation for development policies and practices; and (2) the 'disability-specific approach' to conduct projects based on the needs and demands of the disabled (UN, 2012; Hwang & Park, 2013; Kim, 2016). Most donor countries adopt the twin-track approach of the disability-inclusive type (refer to <Figure 1>).

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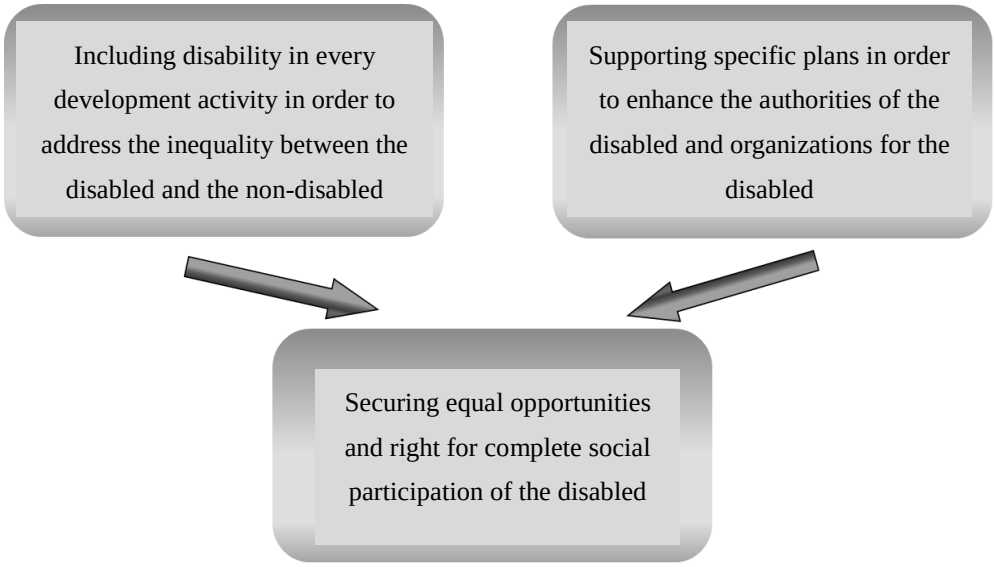

<Figure 1> The Twin-tract Approach

Source: Coleridge, et al., 2009; Hwang & Park, 2013 recitation, p.199.

III. The Tendency of Private Organizations' Participation in International Development Cooperation

For the last decade, the primary purpose of international development cooperation was to reduce poverty in the global society. In order to address the rigidity of funds for traditional official development assistance (ODA), the focus has been on inducing public-private partnership. The OECD report on the flow of financial resources for international development cooperation[2] clearly indicates the expansion of private funds <Figure 2>. As to the recent flow of international development funds among OECD DAC member countries, the percentage of private funds in the year of 2014 was 76% (PF 70%, GP 6%) while there was little expansion of official development assistance and other public funds.

[2] International development funds may be divided mainly into (1) public fund and (2) private fund. (1) Public fund is divided to (a) official development assistance and (b) other official flow (OOF). (2) Private fund is divided to (a) bi-lateral/multi-lateral private flow (PF) and (b) grants by private sectors (GP) such as NGO resources. As for private fund, (a) Bi-lateral/multi-lateral private funds include overseas direct investment, private export credit, portfolio investment, and securities for the benefits of a private organization.

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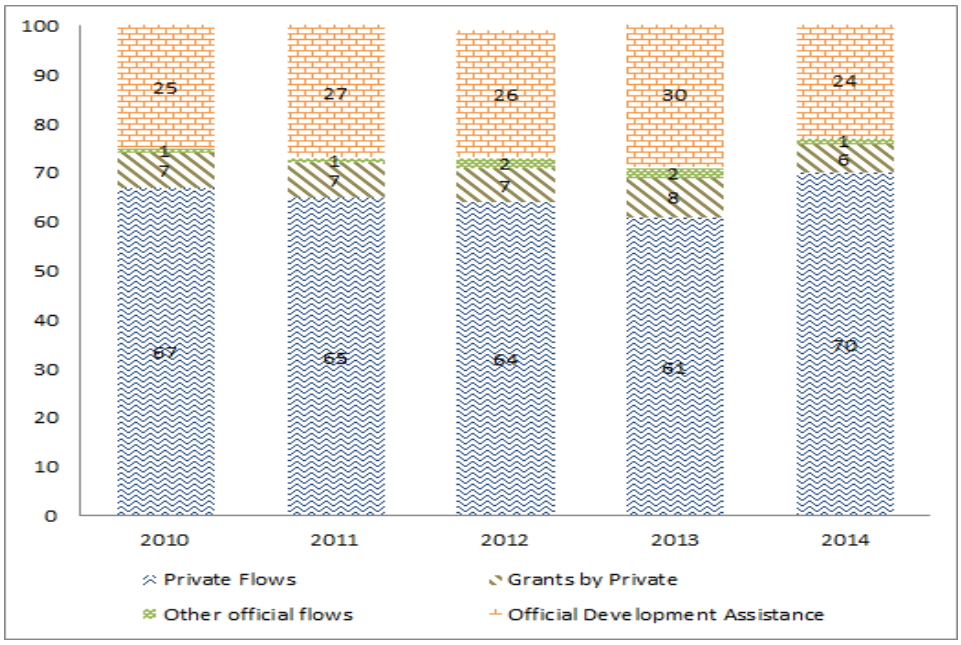

<Figure 2> Current conditions of support for developing countries depending on the financial resource types of DAC member countries
Source: Kwon & Lee (2016), recitation, p.6.

In Korea's international development cooperation sector, private organizations' participation is active and expanding. Among 241 civic organizations, 114 participated in research regarding international development cooperation projects in the Korean private sector, according to which, more than 1,300 projects are being conducted over more than 100 developing countries. Except for seven large-size organizations whose project expense amounts to 10 billion won, most small- and medium-size organizations practice international development in a private sector. Among financial resources for private projects, 38 percent are personally funded; 14 percent have corporate funding, and ten percent are funded by the governmental. Among civic organizations, large-size organizations whose project expense is more than 10 billion won include "Good Neighbors", "World Vision", "Save the Children", "Child Fund", "Food for the Hungry", and "Good People" which are the names of international organization in South Korea. They account for an overwhelming portion of funding. International development cooperation projects conducted by such large organizations account for 65.7 percent of governmental support, 82.6 percent of personal support, and 76.6 percent of corporate support (Foreign Ministry, 2016). As such, Korea's international development cooperation needs collaboration with private organizations to achieve goals such as reduction of poverty in developing countries, support for developing countries, and an increase in government's assistance, effectiveness and influence.

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IV. KOICA Public-private Partnership

Korea has made it a goal to strengthen cooperation with civic organizations as part of 'Working Together with ODA' in the Second Basic Plan for International Development Cooperation (2016-2020). The 4th Busan HLF-4, held in 2011, emphasized the participation and role of civic organizations as a major subject of development cooperation (Foreign Ministry, 2016). In October 2010, 16 governmental offices under the Office of the Prime Minister jointly announced the Plan to Advance International Development Cooperation, making it clear that 'the NGO would be recognized as a partner for substantial development cooperation and that diversified measures for cooperation and co-prosperity would be established.' To this end, Office of the Prime Minister announced that the budget for PPP would increase ten times, from nine billion in 2010 to about 90 billion won by 2015.

KOICA's international development cooperation areas to be supported are divided into seven areas: (1) education, (2) public health, (3) public administration, (4) agriculture, forestry, and fishery, (5) industrial energy, (6) miscellaneous areas (environment, woman, ICT, human rights), and (7) response to climate changes. Projects in these seven areas are divided into the following types: (1) project, (2) development survey, (3) dispatch of volunteer groups, and (4) public-private partnership. Among these, PPP[3] projects seek development cooperation with civic organizations, private enterprises, and schools that are important when it comes to international development cooperation. Project contents include (1) civic society cooperation programs, (2) global social contribution (global CSR) partnership programs, (3) development cooperation projects through partnership with colleges, (4) Creating Shared Value (CSV) projects (innovative public-private partnership projects), and (5) civic organization strengthening projects (support for and joint conducting of seminars and education projects). Main partners in the public-private partnerships defined here are domestic private organizations, and private organizations in the beneficiary country are not stated as official partners.

[3] The public-private partnership specified in this research indicates international development cooperation projects based on Article 3 of the Specific Directives for Public-Private Partnership Projects made known by KOICA (Enacted on December 15, 2006; Directive No.113). In Article 3 of the Specific Directives for Public-Private Partnership Projects (Terminologies), 1. “Public-private Partnership Project” indicates that cooperation organizations establish a bi-lateral or multi-lateral partnership with private sectors in order to support the economic or social development of a developing country. Such international development cooperation projects conducted in a developing country meet requirements specified in Article 7 of the same Directives. 7. Among partner organizations for public-private partnership projects, “financing partner organizations (hereunder, referred to as ”financing partners”)” indicate private organizations at home and abroad including the following items that bear financial burdens through horizontal partnership with cooperation organizations in a project of multi-lateral consortium. Partner organizations of each item below are defined based on separate criteria. However, there may be separate criteria that specially specify other types of cooperation partners than those in each item below. A. Civil society groups, B. Private enterprises and market-type public enterprises, C. Educational organizations and research organizations, D. Other private foundations and private consultative bodies.

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To facilitate PPP based on the financial resources and expertise of domestic private enterprises, KOICA was founded in 2012 as the executive office for development cooperation. It has become the center of information exchange and mutual consulting in cooperation with civic organizations, enterprises, academic circles, and so forth (Foreign Ministry, 2016). With such efforts, the scale of KOICA's support for public-private partnership has increased continually from about 9.1 billion won in 2010 to 16 billion won in 2011, 31 billion in 2012, 36 billion in 2013, and 34.6 billion in 2014. KOICA's PPP projects are selected through public subscriptions by private organizations such as civic organizations, colleges, and enterprises, and then financial support is provided to projects selected in a way of matching. Disability-related projects as well are chosen and conducted in the same manner. The matching ratio is 8:2. KOICA bears 80 percent of the development cost.

V. Disability-inclusive Public-private Partnership at KOICA

With the influence of the Third Asian and Pacific Decade of Disabled Persons led mainly by Korea since 2013, disability-inclusive international cooperation has been facilitated by KOICA, a leading organization when it comes to international development cooperation. KOICA's '2015 disability policy directions and promotion plans' present steps of promotion principles in the area of disability. The first step seeks to raise awareness of disability and specifies the establishment of partnership among related organizations. The second step relates to dispatching volunteer groups and expanding civic organization projects, and the third step is associated with expanding disability-related projects (Kim, 2016). More specifically, in September 2015, KOICA founded the disability department in its development cooperation union, and 13 organizations for the disabled have joined it and acted since 2017. KOICA holds joint seminars with the disability department of the development cooperation union and US Agency for International Development (USAID). It also announces international development strategies and current conditions of USAID. KOICA has become a center of debates for facilitating international development through an effective public-private cooperation system in Korea (Lee, July 6, 2016).

Among KOICA projects, disability-inclusive PPP projects have increased continually since 2012. Table 3 below shows ODA statistics from KOICA which indicate that 'public-private partnership' projects represent implications of disability prevention, disability, and rehabilitation. This material also analyzes the ratio of projects related to special education, the disabled, and disability. In 2012, the scale of disability-inclusive public-private partnership projects was as large as 0.9 billion won. In 2013, it amounted to 1.6 billion, and in 2014, 1.8 billion won.

Specifically regarding the twin-track approach of such projects, most projects adopted the disability-specific approach rather than the disability-inclusive approach.

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Furthermore, many of them lasted only a year, or most projects were as small as 0.1 to 0.3 billion won due to the insufficient sustainability of the government's official development assistance for PPP projects.

Based on the analysis of current conditions (above), a direction for developing disability-inclusive international cooperation is proposed below:

<Table 3.1> Disability-related Public-private Partnership Projects of KOICA

(Unit: 1,000 won)

Project Name	Amount	Project Area
2014		
A project to support eyesight recovery in Gazipur, Bangadesh	157,091	Public Health
The program for physically challenged persons' independence in terms of rights and self-reliance in Cambodia	294,818	Education
The education project for basic rehabilitation and vocational rehabilitation of visibly impaired persons residing in Kathmandu, Nepal	66,258	Education
The program for social rehabilitation of individuals with spinal cord injury in Nepal	81,394	Public Administration
Operation of an information education center for the disabled that aims to help disabled ones develop information utilization capabilities and financial self-reliance in Monarangala, Sri Lanka	78,719	Public Administration
Reduction of disabled children's alienation from rehabilitation treatment and improvement of their quality of life in Quang Tri, Vietnam	132,092	Public Health
Creation of environments that reduce the information gap between the disabled and the others in Hanoi, Vietnam	31,394	Public Administration
The project to establish and provide service at the 'Mobile Support Center for the Disabled' in Ho Chi Minh, Vietnam, for facilitation of self-reliance of the disabled	99,327	Public Administration
The project to found and help operate the special education support center under the education office in Lam Dong province, Vietnam	436,344	Education
The computer and physical/art education center for poor children and visibly impaired people in Addis Ababa	55,512	Education
The project to support the disabled in Nkhoma, Malawi	106,382	Public Administration
The project in cooperation with Yonsei Medical Center to prevent blindness in Malawi, Africa	290,695	Public Health
Total	1,830,026	

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<Table 3.2> Disability-related Public-private Partnership Projects of KOICA
(Unit: 1,000 won)

2013		
A project to support eyesight recovery in Gazipur, Bangadesh	189,551	Public Health
The program for physically challenged persons' independence in terms of rights and self-reliance in Cambodia	238,579	Education
The project to provide service at the 'Mobile Support Center for the Disabled' in Ho Chi Minh, Vietnam, for facilitation of self-reliance of the disabled	87,495	Public Administration
The project to support and strengthen the mobile center of assistive devices for disabled women in Vietnam	47,669	Public Administration
Creation of environments that reduce the information gap between the disabled and the others in Hanoi, Vietnam	75,150	Public Administration
The project to found and help operate the special education support center under the education office in Lam Dong province, Vietnam	561,173	Education
Reduction of disabled children's alienation from rehabilitation treatment and improvement of their quality of life in Quang Tri, Vietnam	124,061	Public Health
The project to support the disabled in Nkhoma, Malawi	119,289	Public Administration
The project in cooperation with Yonsei Medical Center to prevent blindness in Malawi, Africa	190,863	Public Health
Total	1,633,830	
2012		
A project to support eyesight recovery in Gazipur, Bangadesh	99,373	Public Health
The program for physically challenged persons' independence in terms of rights and self-reliance in Cambodia	236,603	Public Administration
The project of blindness prevention among children in Cambodia	59,150	Public Health
Reduction of disabled children's alienation from rehabilitation treatment and improvement of their quality of life in Quang Tri, Vietnam	125,375	Public Health
The project to support poor disabled persons' rehabilitation and social integration in Hanoi, Vietnam	96,787	Public Administration
The project in cooperation with Yonsei Medical Center to prevent blindness in Malawi, Africa	283,924	Public Health
Total	901,212	

Data: KOICA statistics restructured (searching date: October 2016).

VI. Conclusion and Suggestion

Korea will take the lead in the Third Asian and Pacific Decade of Disabled Persons. It plays a key role in international development cooperation and draws interests and expectations from the global society. Korea has the commitment to establish specific solutions to facilitate and effectively practice disability-inclusive development cooperation. Accordingly, this study examines the current condition and limitations of official development assistance in the area of disability in Korea. Further, it proposes a direction for advancing official development assistance in the area of disability in line with the changing trend of international development cooperation. In terms of official development assistance to promote public-private partnership strategies, the policy implications for disability-inclusive development cooperation are as below.

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First, PPP projects shall be supported in a diversified manner, including expanded budget allotment and continuous support for years for disability-inclusive development cooperation. It turned out that the scale of budgets alloted to KOICA PPP projects for disability was as small as less than six percent of funding for public-private partnership. Practicing disability-inclusive development cooperation through small-scale projects of 0.1 to 0.3 billion won limits disability-inclusive development cooperation. Such short-term projects are likely to only last for one or two years with no extensions. It is necessary, therefore, to expand disability-related projects in the area of process development assistance. In the area of disability, 'disability' needs to be viewed in the context of social, economic, and political environments of developing countries. Thus, project implementation may require far more time than expected. More attention needs to be paid, therefore, to the scale and practice of public-private partnership projects for disability-inclusive development cooperation.

Second, it is necessary to apply the twin-track approach, which is an effective disability-inclusive development method, to selecting public-private partnership projects. Particularly, the disability-inclusive approach needs to be adopted for such projects. For instance, a PPP project in the area of education that aims to fund schools in developing countries needs to consider the installation of convenient facilities or transportation means for disabled students to have better access to the school. In this manner, the goal of disability-inclusive development can be achieved in substantial consideration of the issue of disability. In existing project proposals, however, there is no specific instruction requiring consideration of cross-cutting issues such as disability. It is not possible, therefore, to practice development cooperation in application of the disability-inclusive approach. KOICA's Public-Private Partnership Office needs to improve the quality of assistance by recommending or obligating parties to consider cross-cutting issues in PPP project proposals so that not only the unique goal of each project but also the goals of cross-cutting issues can be achieved.

Third, it is vital to collaborate with civic organizations and domestic organizations for the disabled to implement PPP projects effectively. Particularly in Korea, the budget allocated for this area is limited; thus, it is necessary to make use of the advantages of relevant civic organizations and large foundations for the disabled. As for large-scale civic organizations whose project cost amounts to 10 billion won, various expertise can be applied to international development cooperation projects from planning an independent assistance program to its substantial implementation. In contrast, civic organizations whose funding is less than 10 billion won are closely related to the local community. It is possible to induce active participation in the development process and to be aware of material problems. This is a significant advantage since it is possible to suggest a solution to overcome a challenge. Therefore, cooperation with various organizations must be sought.

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ORIGINAL ARTICLE

Effects of a Structured 8-week Nordic Walking Exercise Program on Physical Fitness in the Japanese Elderly

Takayuki KAWAMURA [1)] Reiko SUZUKI [2)] Jarmo PERTTUNEN [3)]

1) Faculty of Health Sciences, Tohoku Fukushi University, Japan
2) Proactive Health and Wellbeing Center, Tohoku Fukushi University, Japan
3) Tampere University of Applied Sciences, Finland

ABSTRACT

Although Nordic Walking (NW) is a fast growing form of exercise in Europe. This study aimed to determine how a supervised NW exercise program affects basic fitness and examine its application as a sports activity for supporting the health of elderly. Forty participants were randomly assigned to the NW group (NW: 66±4 years old) or the control group (CO: 68±4 years old). Functional measurements included the sit-and-reach test, timed-up and go test (TUG), knee extensor strength assessment, and incremental shuttle walking test (ISWT). Throughout the ISWT, the heart rate (HR) of each subject was monitored. Static balance was measured with a force platform under four test conditions: normal standing, with eyes open and closed, semi-tandem, and tandem standing with eyes open. These measurements were taken before and after the 8-week NW program. The NW group exercised 60–90 min/session, 3 times/wk. Results showed that NW training had positive effects on the TUG test, flexibility, and knee extensor strength ($p < 0.05$) assessments. In contrast, knee extensor strength was decreased in the CO group throughout the duration of the study ($p < 0.05$). The NW group walked with significantly lower HRs from level 1 (1.8 km/h) to 5 (4.3 km/h) after training ($p < 0.05$). However, there was no significant difference in HRs for the CO group during the ISWT. There were no significant changes between the groups in any of the four platform tests. In conclusion, the 8-week NW program either improved or maintained flexibility, leg strength, and cardiorespiratory endurance with no measurable changes in static balance.

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k-taka@tfu-mail.tfu.ac.jp (Takayuki KAWAMURA; Japan)

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I. Introduction

Life expectancy and retirement age are increasing worldwide, Japan being the fastest aging nation (Statistics Bureau, Japan, 2018). Because of this change, maintenance of mobility has become a vital part of a good quality of life and working capacity. In aging neuromuscular control declines (Delbono, 2003) and muscle mass (Nair, 2005) and cardiorespiratory performance decrease (Sanada, Kuchiki, Miyachi, et al., 2007). These factors promote instability in common daily movements thereby increasing the risk of falls. It is a well-known phenomenon that the improvement of mobility and balance prevents falls and fractures (Kannus, Sievänen, Palvanen, et al., 2005).

Nordic Walking (NW) is a popular and fast growing form of exercise in Europe. Previous studies have demonstrated that NW has both short-term and long-term effects on cardiorespiratory performance. Studies by Porcari, Hendrickson, Walter, et al. (1997) and Church, Earnest & Morss (2002) have found that walking using poles resulted in significant increases in VO_2, caloric expenditure, and heart rate (HR) responses in comparison to walking without poles on a treadmill. Conversely, Schiffer, Knicker, Hoffman, et al. (2006) found that NW resulted in fairly small increases in HR and VO2. The pooling technique (e.g. intensity of pooling) seems to be the reason for inter-individual differences and the degree of improvement in oxygen consumption (Church, Earnest & Morss, 2002). The increase is due to increased muscle activity in the upper body muscle groups (Koizumi, Tsujiuchi, Takeda, et al., 2008).

To the best of our knowledge, there are not many published studies available examining the long-term effects of Nordic Walking. Stoughton (1992) studied muscular and aerobic fitness responses before and after 12 weeks of exerstriding and walking training in sedentary women. In their study, the participants were subdivided into three groups: a walking group, a walking group with poles, and a control group. The maximal aerobic power increased significantly in both exercise groups, which was 8 and 19%, respectively, for each group. Muscular endurance improved by 37% in the Exertrider group and by 14% in the walking group. In contrast, Kukkola-Harjula, Hiilloskorpi, Mänttäri, et al. (2007) identified only moderate increases in peak VO_2 (2.5 ml/min/kg) after 13 weeks of training in 50–60-year-old sedentary women.

The results demonstrated that NW is a suitable exercise method for the elderly and NW may improve functional capacity safely and effectively in this population. However, the knowledge of how NW affects aerobic and functional capacity among the elderly is still lacking. Furthermore, randomized controlled studies are also needed with global participation (e.g. Japan). Thus, the aim of this study was to explore the effects of a structured, 8-week NW exercise program on mobility, functional capacity, and physical conditions in elderly Japanese men and women.

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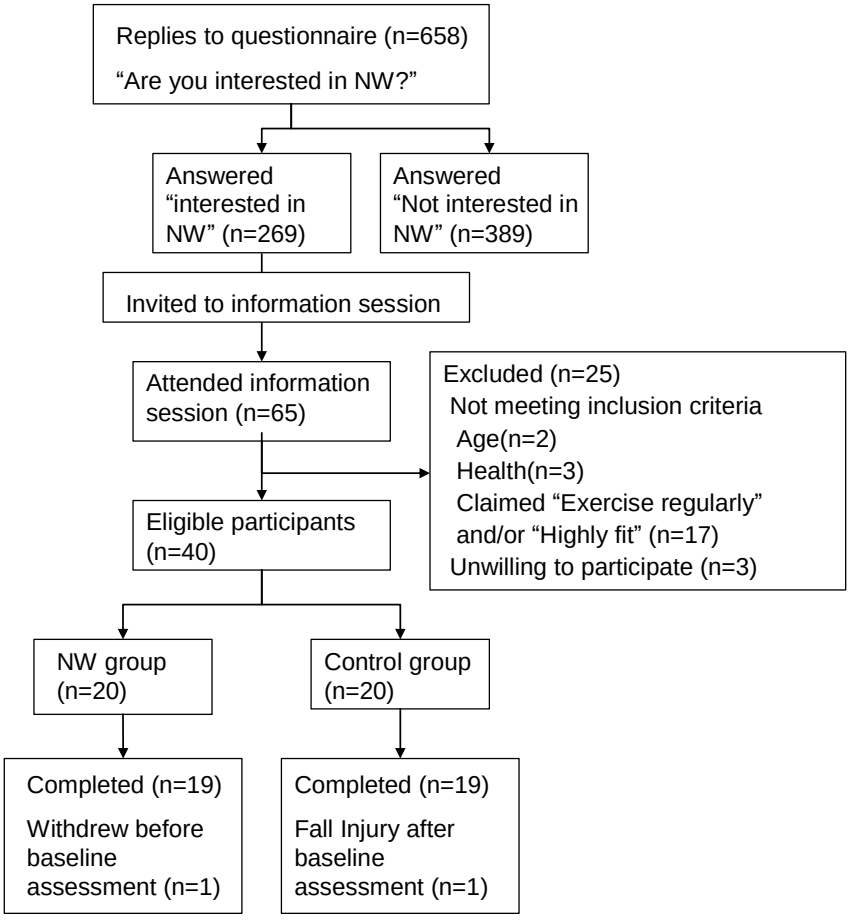
II. Subjects and Methods

1. Subjects and Procedures

Community dwelling elderly were recruited from annual medical checkups in Yamamoto town (Figure 1). A subject group was chosen from an age group ranging in age from 60–70 years. All subjects were able to walk independently (i.e., not dependent on mobility aids) and stand (≥ 1 minute) and walk (≥ 1 km) without any assistance. To prevent potential confounding effects from other exercise programs, volunteers who regularly (≥ 1 day per week) participated in a supervised exercise program were excluded.

The study plan was explained and written informed consent was obtained. Forty subjects were stratified according to age and sex, then the community nurse who was independent of this study randomly assigned the participants to an exercise (n = 20) or control (n = 20) group. Group assignment was revealed following baseline testing. All studies were performed according to a research protocol approved by the Ethical Committee of the Tohoku Fukushi University.



<Figure 1> Flowchart of recruitment and inclusion of study participants.
NW=Nordic walking

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NW poles were provided by Exel Ltd. Each exercise in the NW group was supervised by 2–3 trainers and community volunteers experienced in NW. The trainers were certified as Activity Leaders and/or Basic Instructors by the Japanese Nordic Fitness Association (JNFA). The NW group exercised for about 60 min (5–10 min warm-up, 20 min NW, stretching between sessions, 20 min NW and 5–10 min cool-down), 3 times per week for 8-weeks. Intensity of the NW was based on their rate of perceived exertion (RPE), which did not exceed 13. The walking distance progressed through three stages: the 1st stage, 1.6–2.4 km (1–8 sessions); 2nd stage, 2.4–3.6 km (9–17 sessions), and the 3rd stage, 3.6–4.8 km (18–24 sessions), At the 1st stage of the training program, subjects were provided technical instructions for about 20 minutes after the warm up.

At the 2nd session and 11th session, 800 m walking time, RPE, and HR (Polar Electro, Kempele, Finland) were recorded to assess the physiological intensity of NW. HR was analyzed during the last 400 m. RPE was assessed immediately after completing 800 m of NW.

For the control group, the community nurses provided phone calls every other week to discuss health-related topics, which were not related to physical exercise. Otherwise, they were asked to continue their usual daily activities. All subjects were asked to refrain from initiating any other new exercise programs, or otherwise consciously changing their activity levels during their participation in the study.

2. Physical Fitness Measurements

After the 8-week NW exercise period, the same measurements were repeated for all subjects. The physical fitness tests included to sit-and-reach test for flexibility, timed-up and go test (TUG) (Podsiadlo & Richardson, 1991) for functional mobility, knee extensor strength for lower extremity strength, and the incremental shuttle walking test (ISWT) (Singh, Morgan, Scott, et al., 1992) for endurance fitness. Flexibility was measured by a sit-and-reach test (Yamamoto, Kawano, Gando, et al., 2009) using a digital flexibility testing device (T.K.K.5112; Takeikiki Co. Ltd, Tokyo, Japan). Isometric knee extensor strength was measured bilaterally using a Musculater GT-50 (OG-giken Co. Ltd., Okayama, Japan). The subjects sat on a specially designed chair secured with straps fastening the trunk and thighs to fix their hip joint at 90 degrees and a knee joint at 70 degrees. The lower leg was tightly strapped to a strain gauge transducer placed just above the ankle. Subjects were asked to exert three-second isometric maximal voluntary contractions against the strain gauge transducer. Two attempts were carried out at three-minute intervals. The real-time force applied to the force transducer was displayed and the peak value was recorded. Peak extension torque was calculated by the multiplication of force with the length of lever arm for each subject. In each of the functional tests, the best of two trials was chosen for analysis.

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In the TUG (Schiffer, Knicker, Hoffman, et al., 2006) assessments, an armchair of comfortable height was used and a distance of 3 m was marked with a line of tape and cone on the floor. The starting position was sitting with hands resting on the arms on their thighs. The participants turned around and walked back to sit down in the chair again. They were instructed to perform the TUG at their normal and maximal speed and they performed one trial before they were timed. The timing of the TUG started when the participant's back came off the back of the chair, and stopped when their buttocks touched the seat of the chair again.

For the ISWT, subjects were instructed to walk between two markers (visible tape on the floor) set 10 m apart in a straight line on the flat surface. Pre-recorded bleeps on a CD were emitted from a CD player. At 1-min intervals the time between each bleep shortened, indicated by a triple bleep, and the number of shuttles increased. The ISWT consisted of a maximum of 12 levels, when subjects failed to achieve the set pace, the number of shuttles they had completed was recorded. Throughout the ISWT, each subject's HR (Polar Electro, Kempele, Finland) was monitored. The test stopped when the subject did not reach the tape at the same time as the bleep by 0.5 m on two consecutive occasions, showed signs of physical injury or distress (as indicated by HR), or no longer wished to continue.

Using the force platform, balance was tested in four different test conditions: (1) normal stand test with eyes open on the balance platform (HUR Labs Oy, Tampere, Finland) with a clearance of 2 cm between the heels, at an angle of 30 degrees between the medial sides of the feet; (2) normal stand test with eyes closed; (3) semi-tandem test with eyes open, the participant placed the heel of one foot along the side of the big toe of the other foot; (4) full tandem test with eyes open, the feet were positioned heel-to-toe along the midline of the platform. The participants performed one trial of each test in the following order (1) to (4) and repeated the trail after a few minutes' rest. We instructed the participants to gaze at a point marker at eye-level at a distance of 2 m and to stand as motionless as possible during all tests. The data sampling rate was set to 50 samples/second, and test duration was 30 seconds for each condition. For data analysis, we used standard posturographic parameters derived from the center-of-pressure (COP), 90% confidence ellipse area (C90A), trace length (TL), sway average velocity (SaV), and standard deviation velocity (StdV). In the analysis of the balance data, the subject's best trial was chosen.

3. Statistical analysis

Data were analyzed using the SPSS statistical software package, version 14.0 (SPSS Inc., Chicago, USA). Comparisons between the two groups were performed using either the Mann-Whitney test or the chi-squire test for nonparametric variables and the independent samples t-test for parametric variables. The training parametric data were

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analyzed by repeated-measures ANOVA with post-hoc test. All data with a $p < 0.05$ confidence level were considered statistically significant.

III. Results

1. Subject Characteristics

One participant from the NW group did not complete the study, and the subject's baseline data were excluded. Attendance at training sessions for the NW group was 90%. There were no statistically significant differences between the NW and control group characteristics at baseline (Tables 1 & 2). No training-related injuries were reported in the NW group.

<Table 1> Characteristics of participants in the Nordic Walking group and the Control group

	NW			CO			
Variable	Mean		SD	Mean		SD	*P*-value
No. participants (Male/Female)	19 (5/14)			19 (5/14)			NS
Age (yr)	66.7	±	4.5	68.0	±	4.6	NS
Height (cm)	152.6	±	6.9	155.3	±	7.4	NS
Weight (kg)	60.4	±	9.7	58.0	±	8.1	NS
BMI ($kg \cdot m^{-2}$)	25.9	±	3.8	24.1	±	2.9	NS
SBP (mmHg)	148	±	20	140	±	17	NS
DBP (mmHg)	86	±	13	82	±	11	NS
HR (bpm)	83	±	14	84	±	13	NS
Hypertension	9			6			NS
Diabetes	3			4			NS
Dyslipidemia	7			6			NS
Heart disease	3			3			NS
Osteoporosis	1			1			NS
Musculoskeletal pain	8			14			NS

Values are expressed as mean and SD. The last column shows the significance values (p) of the differences. Abbreviations: NW=Nordic walking group, CO=Control group, SD=standard deviation, BMI=Body Mass Index, SBP=Systolic Blood Pressure, DBP=Diastolic Blood Pressure, HR=heart rate

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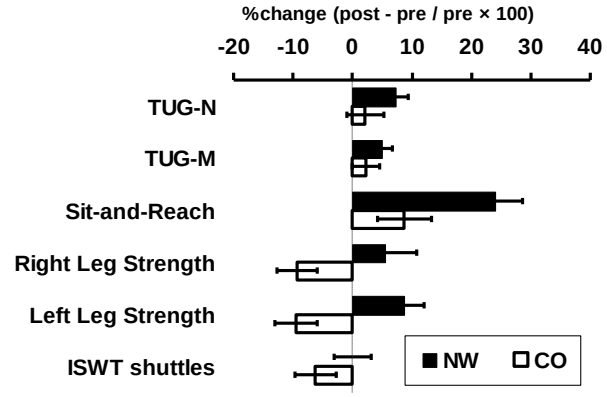
<Table 2> Summary of results-physical fitness tests at baseline in the Nordic Walking group (NW) and the Control group (CO).

Variables		NW Mean		SD	CO Mean		SD	P-value
TUG-N	Sec	8.4	±	0.9	8.1	±	1.1	NS
TUG-M	Sec	6.4	±	0.8	6.1	±	1.1	NS
Sit-and-reach	Cm	27.7	±	7.2	31.3	±	9.0	NS
Leg strength	Right, Nm	80.8	±	23.9	97.5	±	39.2	NS
	Right, Nm/kg	1.34	±	0.37	1.57	±	0.52	NS
	Left, Nm	89.2	±	29.0	110.0	±	36.2	NS
	Left, Nm/kg	1.50	±	0.47	1.69	±	0.48	NS
ISWT	No. of shuttles	45.1	±	10.6	50.2	±	12.3	NS

Values are expressed as mean and SD. The last column shows the significance values (p) of the differences. Abbreviations: TUG-N=timed-up-and go test at normal walking speed, TUG-M=timed-up and go test at maximal walking speed, ISWT=incremental shuttle walking test.

2. Changes observed

Although body weight in the NW was unchanged after the training period, there was a slight but significant increase in the control group ($p < 0.05$). During the 2nd and 11th training sessions, the average HR during the 800 m NW increased from 122±17 bpm (2nd session) to 130±16 bpm (11th training session) at a self-selected comfortable speed. The average walking speed was significantly ($p < 0.05$) faster at the 11th training session (1.46±0.14 m/s) compared to the 2nd session (1.58±0.15 m/s), whereas their RPE was similar for all sessions (2nd: 12.3±1.7 vs. 11th: 11.6 ±1.3).



<Figure 2> Percentage of change in physical fitness scores from baseline to 8 weeks after the Nordic Walking exercise (NW) and control treatment (CO).
TUG-N: timed-up-and go test at normal walking speed.
TUG-M: timed-up and go test at maximal walking speed.
ISWT: incremental shuttle walking test.

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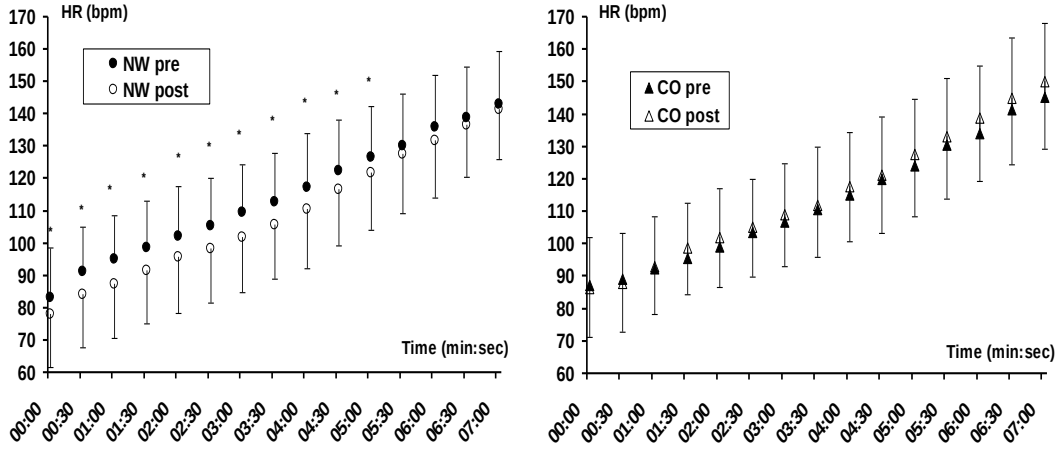
Figure 2 shows the results of the physical fitness test. In the NW group, training had positive effects ($p < 0.05$) on the TUG, flexibility, and knee extension strength (left leg). In contrast, bilateral knee extension strength was decreased in the control group during the same period ($p < 0.05$). There were no statistically significant differences between the first and second ISWT in the number of shuttles completed in the NW group (baseline: 45.1±10.6 shuttles vs. post NW: 44.4±9.7 shuttles). However, the control group performed fewer shuttles in the second test compared to the first test (baseline: 50.2±12.3 shuttles vs. post-Control: 47.1±9.8 shuttles). All subjects achieved more than level 6 (walking speed at level 6: 82 m/min). During the ISWT, the NW group walked with significantly lower HRs from level 1–5 after the 8-week training period ($p < 0.05$). However, there was no difference in HRs in the control group (Figure 3).



<Figure 3> Heart rate (HR) response during the incremental shuttle walk test for the Nordic walking (NW: left graph) and control (CO: right graph) groups at baseline (Pre) and 8 weeks after the intervention period (Post).

The symbols and error bars express mean ± SD. *$p < 0.05$ pre- vs. post-intervention period within the group.

In the force platform measurements (Table 3), all subjects were able to perform four standing positions for 30 s periods. As expected, average higher values were observed for most variables in the tandem stance. TL and SaV were significantly different between the groups in the normal standing condition with only eyes open ($p < 0.05$), however, there were no statistically significant changes between the groups in any of four balance tests.

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<Table 3> Mean and standard deviation (SD) of balance variables on the force platform in the Nordic walking group (NW) and the control group (CO).

COP movement variable		TL (mm)		C90A (mm^2)		StdV (mm/s)		SaV (mm/s)	
(1) Eyes open		Mean	SE	Mean	SE	Mean	SE	Mean	SE
CO	Pre	325.1	17.6	266.4	35.1	6.3	0.3	10.8	0.6
	Post	365.7*	20.3	286.1	45.1	6.8	0.6	12.2*	0.7
NW	Pre	341.9	22.4	242.7	35.0	6.1	0.4	11.4	0.7
	Post	347.1	22.1	236.0	27.1	6.0	0.3	11.6	0.7
(2) Eyes closed									
CO	Pre	450.1	28.1	393.0	60.3	8.7	0.6	15.0	0.9
	Post	445.0	25.2	381.4	69.1	8.2	0.6	14.8	0.8
NW	Pre	450.9	33.0	319.5	38.2	8.0	0.5	15.0	1.1
	Post	476.3	26.8	362.9	50.1	8.3	0.5	15.9	0.9
(3) Semi-tandem									
CO	Pre	494.6	25.4	386.5	53.7	9.0	0.5	16.5	0.8
	Post	467.2	20.9	365.6	56.8	8.7	0.4	15.6	0.7
NW	Pre	491.4	31.7	283.6	32.2	8.5	0.5	16.4	1.1
	Post	499.6	37.3	336.1	39.1	8.7	0.6	16.7	1.2
(4) Tandem									
CO	Pre	595.1	31.3	337.0	27.9	10.7	0.5	19.8	1.0
	Post	652.4	37.4	385.2	49.7	11.7	0.6	21.7	1.2
NW	Pre	650.2	53.6	304.7	31.5	10.8	0.7	21.7	1.8
	Post	672.7	55.7	387.6	83.4	11.1	0.6	22.4	1.9

Outcome variables were: TL = trace length, C90 Area = area of the 90% confidence ellipse, StdV = Standard deviation velocity, SaV = sway average velocity. *$p < 0.05$ pre- vs post-intervention period within group.

IV. Discussion

This study indicates that 8 weeks of the NW program either improved or maintained functional mobility, flexibility, and leg strength with measurable changes in static balance as assessed by the balance platform. As training progressed, NW became a relatively high intensity activity for the elderly.

In older adults, NW or walking with poles seems to have had potential benefits with reduced load to the lower extremities at a controlled walking speed (Strutzenberger, Rasp, Schwameder, 2007) as well as enhanced cardiorespiratory fitness (Stoughton, 1992) Kukkonen−Harjula, Hiilloskorpi, Mänttäri, et al., 2007). However, a recent study showed the lack of a loading effect. Despite its popularity, few studies have assessed the training effects on functional capacity and balance in the elderly. Improvement of the TUG and flexibility produced better results.

Recently, Kukkonen−Harjula, Hiilloskorpi, Mänttäri, et al. (2007) reported that improvement of peak VO_2 was modest (from 26.0 to 28.4 ml/kg/min) in middle-aged (54±3 years old) sedentary women in response to 13 weeks of training, four times per week for 40 minutes per day. They also reported that normal walking, rather than NW improved leg strength assessed by the one leg squat test. Unfortunately, information regarding walking speed, distance, or training environment during the training period was not

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reported in the previous study (Kukkonen–Harjula, Hiilloskorpi, Mänttäri, et al., 2007). We found that NW speed was also significantly faster after the 11th session of training. In addition, isometric knee extensor strength improved after the NW training.

To assess endurance capacity for the elderly in the present study, we used the ISWT. Oxygen uptake has been correlated with distance walked during ISWT in post-myocardial infarction patients and in healthy adults (Woolf-May & Ferrett, 2008). A training effect was observed in the NW group evidence by a decrease in exercise HR at a given submaximal walking speed. After training, however, the number of shuttles achieved at the ISWT did not increase in the NW group. In contrast, there was slight but statistically significant decrease in the number of shuttles in the control group. Although walking with a pole assists subjects to walk faster and widen step length, the shorter heights (range 152–155 cm) of the subjects might have limited their ability to keep up with the speed at higher stages of the ISWT.

Therefore, with a proper poling technique, NW increases the length of steps and promotes walking at a higher speed than walking at normal speed with a reduced subjective perception of fatigue and increased safety of walking with poles (Church, Earnest & Morss, 2002; van Eijkeren FJM, Reijmers RSJ, Kleinveld, et al., 2008) in the elderly. Based on the peak HR during the ISWT, we assessed the individual's training intensity by expressing the 800-m walk HR as a percent of HR reserve (%HRR) at the 2nd and 11th sessions. Although, the RPEs were similar between the sessions (2nd: 12.3±1.7 vs. 11th: 11.6 ±1.3), their walking speed improved significantly from the 2nd to the 11th session. In addition, the %HRR values also increased from 68±15% during the 2nd session to 77±17% during the 11th session. According to the American College of Sports Medicine guidelines, exercise at an intensity equivalent to 60–84% of HRR is considered "hard" or "vigorous" (Woledge, Birtles & Newham, 2005). NW is often viewed favorably as exercise in terms of energy expenditure. However, with regard to the safety of this type of exercise among the elderly, precautions should be taken given the discrepancy between subjective feeling of intensity (RPE) and the physiological basis of intensity (i.e., %HRR). Traditionally, moderate (40–59 %HRR) intensity activities are preferred among older adults, especially for those with chronic diseases. Schiffer, Knicker, Hoffman, et al. (2006) reported that both HR and oxygen consumption responses were similar for NW and jogging at both 6.4 km/h and 7.5 km/h. They also found that based on lactate concentrations, training recommendations derived from walking tests would underestimate NW loads when training intensity was determined using monitoring of HR. Moreover, an increase in walking speed led to a more dynamic walking pattern and simultaneously led to increased ground force in the first part of the stance phase (Strutzenberger, Rasp & Schwameder, 2007) while the load on the knee joint may also increase (Thapa, Gideon, Brockman et al., 1996). Therefore, when introducing NW to previously sedentary elderly individuals, an initial physical activity assessment is

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essential and should include monitoring of exercise intensity using a HR monitor or pulse counting to improve safety.

Our findings provide further evidence for walking and NW as effective forms of exercise that help to maintain or improve endurance capacity. Previous studies, using maximum oxygen treadmill testing in walking programs of greater than 12-week duration, found increases in fitness ranging from 8–30% (Paillard, Lafont, Costes-Salon, et al., 2003; Hardman & Hudson, 1994). In agreement our results, Kukkonen-Harjula et al. (Kukkonen−Harjula, Hiilloskorpi, Mänttäri, et al., 2007) also reported that 13 weeks of NW attenuated the submaximal cardiovascular response and enhanced the peak VO_2 level as much as normal walking.

Eight weeks of NW did not affect balance variables. Walking is an unstable activity and lateral sway during walking is increased in older adults (Woledge, Birtles & Newham, 2005). An increased in COP movement in the force platform balance test was seen in older individuals (Thapa, Gideon, Brockman, et al, 1996; Maki, Holliday & Topper AK, 1994; Era, Schroll, Ytting, et al., 1996) and some prospective studies showed that increased COP movement correlated with risk of falls (Bergland, Jarnlo & Laake, 2003; Bergland & Wyller, 2004; Stela, Smitb, Pluijma et al., 2003). With increasing age, step width increased and step length and stride velocity decreased (Winter, 1991). In agreement with the results of a previous study (Era, Sainio, Koskinen, et al, 2006), tandem stands are challenging for elderly. Tandem standing, in particular, requires muscle strength and endurance to maintain the posture against a narrowed base of support in the medio-lateral direction (Jonsson, Seiger & Hirschfeld, 2005). Reduction of foot impact and support from the poles while walking may be responsible for the lack of changes in the balance variables assessed by the balance platform tests. Furthermore, our subjects were relatively healthy, and their balance was very good even before intervention (Era, Sainio, Koskinen, et al, 2006). Previous studies have shown that both in healthy and active older individuals falls were more often associated with the demands of the activity they engaged in (Hill, Schwarz, Flicker et al., 1999; Bath & Morgan, 1999). Therefore, the engagement in previous physical and sports activities might have contributed to the lack of change observed in the static balance test in our study. Further studies need to assess the impact of prolonged (i.e. 3 months or more [Howe, Rochester, Neil, et al., 2011]) of NW exercise on both static and dynamic balance controls in this population.

In conclusion, a structured 8-week NW exercise program achieved good results in maintaining functional mobility in elderly Japanese men and women. Static balance assessed by the balance platform, however, did not change during the intervention period.

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ORIGINAL ARTICLE

Study of "Individuality" on Nursing Care Job

Kimiko YAMAMOTO[1)] Miwako HIRAKAWA[2)] Chigusa OMORI[1)]
Tomoko Sato[1)] Masami AMANO[1)] Yukiko SATO[1)] Junko OTA[1)]
Saori MATSUZAKI[1)] Yoshiyuki INOUE[3)] Takahito TAKEUCHI[4)]

1) Faculty of Health Sciences Department of Nursing, Kyorin University, Japan
2) Hirosaki University Health and Welfare, Japan
3) Japanese Red Cross Junior College of Akita, Japan
4) International University of Health and Welfare Graduate School, Japan

ABSTRACT

The objective of this research is to clarify how nursing care staff perceive the user's "individuality" based on their shared view in nursing care practices. The survey with paper questionnaire was conducted among 114 nursing care staff who worked at a care giving facility. As a result, 95 (83.3%) commented they had an experience of using the word, "individuality," 22 (19.3%) commented they provided nursing care with "individuality" all the time, and 68 (59.6%) commented sometimes. In addition, we conducted the self-assessment and others-assessment personality test (BigFive short version) among 12 users who were engaged with all 9 nursing care staff in the same team, and then analyzed with Friedman test. As a result, it was clear that nursing care staff had different user perception on four factors, extroversion, openness, sincerity, and harmonicity, whereas they had a common perception on one factor, emotional unstableness. This indicates that it has high potential of providing consistent emotional care; however, it is also considered that they tend to provide care focusing on emotion.

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kimi31ko@ks.kyorin-u.ac.jp（Kimiko YAMAMOTO; Japan）
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I. Introduction

It has been 18 years since the nursing care insurance system was implemented, and the condition surrounding the elderly has changed, such as increases of elderly population, single-person/couple household and dementia. In the social condition change, users expect nursing care staff to provide high quality care.

Considering complexity, diversity, and advancement of nursing care needs, it is essential to properly understand user needs and issues. Team care is critical to support the dignified, independent daily life of users that is a principle of nursing care insurance. It is important that nursing care staff engaging with users need to provide the same nursing care approach as a group. Accordingly, it is fundamental to provide nursing care based on the plan with the right process (assessment→nursing care design→nursing care implementation→monitoring assessment→modification as needed). Furthermore, it is essential to implement nursing process by gathering and sharing information while proposing the care to support a user becoming independent. Within the process, it is important to enhance assessment capability to implement the practice understanding "individuality," and the assessment should include user's emotional/physical condition as well as the relationship with society, such as user's local community.1) When providing service, nursing care staff are required to use the word, "individuality" to respect individual users. In the nursing care service, what does user "individuality" mean? We think the "individuality" is not something "fixed." "Individuality" may be the perceived image from a single aspect. Can others (nursing care staff) truly understand a user's "individuality"? We question whether the individuality perceived by others is the same as the one viewed by oneself. We believe "individuality" should not be determined by others (nursing care staff). To simply describe, the "individuality" is the image perceived by others, and under the condition, nursing care staff use the most vague term "individuality" in their practice – this may lead them to believe the ineffective, unrealistic "elderly care supporting dignity" is an ideal one2). While the word, "individuality" is commonly used in nursing and nursing care practices, we question what it fundamentally means.

The objective of this research is to clarify consistency and discrepancy of perception on user "individuality" among nursing care staff in their shared practices.

Term Definition: To verify the difference on perception of user among nursing care staff in the shared practices and views, the consistent assessment is essential.

Accordingly, the definition of "own personality," the personality attribute employed in psychology is used in this research3), therefore the "individuality" is defined as "consistency seen in the behavior of an individual that can be observed by others and the uniqueness compared to others".

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II. Sample and methodology

1. Research sample

210 nursing care staff engaging with users in the nursing care facility who meet the condition below.

＜User＞

1) Serving 24 hours nursing care
2) Capable of responding to personality test
3) Agrees to respond for the research

＜Nursing care staff＞

1) Working at 24 hours nursing care facility
2) 9 nursing care staff engaging one user and working on the same floor
3) Agrees to respond for the research

Screening rationale: to clarify the perception of "individuality" among nursing care staff who work at the facility capable of engaging with daily life of users for 24 hours. As for users, they should be able to respond to the written questionnaire.

2. Selection of nursing care facility

Among healthcare and nursing facilities for the elderly where offer 24 hours service with users capable of responding personality test in writing, we selected 9 facilities that agreed to the research. While they are arbitrarily selected facilities located in Kanto area, we ensure to select facilities indifferent from other general ones that have not conducted special education or training on our research topic, "individuality."

3. Research method

Self-administered paper questionnaire survey.

4. Period

September 2013 – March 2014.

5. Process to screen respondent

We briefed the research intention to the heads of 4 elderly healthcare facilities, 4 paid elderly nursing homes and 1 low cost elderly nursing home and requested to screen users and nursing care staff who agree to respond for the research.

6. Briefing to respondent

We sent a request letter to cooperate the research to elderly healthcare facilities, paid elderly nursing homes, and low costs elderly nursing home, then visited to brief the research. We then sent/brought a questionnaire to users/nursing care staff who agreed to cooperate. Questionnaires were collected via courier.

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7. Ethical consideration

We conducted the research with the approval of the ethical committee at International University of Health and Welfare. We briefed respondents the objective, method, intention of cooperation, and privacy protection in writing/verbal and got agreement. We also explained that the participation to the research is on a voluntary basis, respondents can quit participating during the research even after the agreement, information will be encoded to be anonymous and will be exclusively used for this research, data will be discarded after publishing the result, and the result will be published.

8. Paper questionnaire

1) Basic attribute

<User> Gender, age, staying period

<Nursing care staff> Gender, age, job type, years of nursing care experience, role at the current facility

2) Research item

<Questionnaire item to nursing care staff>

① What word do you use to express “individuality” in your work?

② Who was it that used the word “individuality” for the first time?

③ Did you learn about “individuality” in your training or a class?

④ In what degree do you provide care considering “user individuality”?

⑤ What type of user you are mostly conscious with on “individuality”
Independent / Need support / Bedridden / Dementia / Others

⑥ Occasion where you are mostly conscious with on “user individuality”
Daily-life support / Medical treatment / Consultation / Casual conversation / Care planning / others

⑦ Which word do you consider to best express “user individuality”?
Personality / Value / Life history / Will / Habit / Others

3) Personality test (BigFive short version)

Among 210 nursing care staff, the team of respondents to be conducted the test was screened. The criteria of the team was 9 staff members or over working on the same floor and engaging 8 same cases or over together. We conducted the personality test to these teams using 29 items of later mentioned BigFive short version to test user personality factors and compare self-assessment and others-assessment by nursing care staff.

Among all respondents, 3 teams were qualified the criteria. Team A was consisted of 9 nursing staff members and engaged with 15 cases. Team B and C were consisted of 10 nursing care staff, and engaged with 8 cases, respectively.

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We conducted the personality test among 29 nursing care staff and 31 users, got valid result from 12 cases, 3 cases and 4 cases from A, B and C teams, respectively. We excluded team B and C from statistical analysis as it did not have enough valid responses.

As a result, we generated 108 personality test data from 12 users and 9 nursing care staff based on the 12 cases for our analysis.

9. Summary of personality test (BigFive short version) on users and nursing staff 29 items of BigFive short version[4] used for the test by Namikawa

While BigFive[5] scale originally developed Wada contains 60 questionnaire items, the short version was developed by Namikawa, Tani, and Wakita to facilitate children and elderlies. BigFive assessment use the characteristics theory using the method to describe human personality by scoring extroversion, emotional unstableness, openness, sincerity, and harmonicity. It use 5-scales, "I agree very much," "I somewhat agree," "can't say either," "I somewhat don't agree," or "I don't agree at all."

10. Analysis approach

We used statistics software, SPSS18.0 for Windows for statistics process. The level of significance was set below 5%.

1) Used simple tabulation, cross tabulation, and correlation analysis for basic attribute and research item.

2) Personality test (BigFive short version)

(1) Simple tabulation of scoring each 5 characteristics attribute factors (user self-assessment and others-assessment by nursing care staff)

(2) Comparative score analysis

To see the score difference between user self-assessment and others-assessment by nursing care staff for each case (n=12) and conducted Friedman test for each 5 factors.

III. Result

1. Respondent summary

1) Basic attribute of nursing care staffs (Table 1)

Distributed a paper questionnaire to 210 nursing care staff who work at elderly facilities, and responses were 126 (60.0% response rate), valid responses were 114 (91.0% valid response rate), consisted of 40 males (35.1%) and 74 females (64.9%). The average age was 37.1±9.7 years old and 42.8±13.5 years old for male and female, respectively. As for role, there were 82 certified care workers (71.9%) and 32 care workers (28.1%).

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Table 1. Basic attribute of nursing care staff

n=114

Gender	Male	Female	Total
Sample size	40 (35.1%)	74 (64.9%)	114 (100%)
Average age	37.1 (SD 9.7)	42.8 (SD13.5)	40.8 (SD 12.4)
Age range	22 - 57	19 - 65	19 - 65
Average experience year	6.3 years (SD 4.7)	8.7 years (SD 6.9)	7.8 years (SD 6.1)
Range of experience year	1-19 years	1-37 years	1-37 years

2. Paper questionnaire result on nursing care staff

1) Use of "individuality"

Among nursing care staff, use of "individuality" was as follows:5 always use it (4.4%), 40 sometimes use it (35.7%), 51 do not use it so much (45.5%) and 16 never use it.

2) Who mentioned "individuality" for the first time?

The first time they heard "individuality" was as follows: 75 from teacher (67.0%), 16 from nursing care staff (14.3%), 11 don't remember (9.8%) 4 from book/TV/Internet (3.6%), 2 from friends/acquaintances (1.8%), and 4 from others (3.6%).

3) Did you learn about "individuality" in the training or class?

35 were taught enough (31.2%), 54 were taught sometimes (48.2%), 21 were not taught so much (18.8%) and 2 were not taught at all (1.8%).

4) How much do you provide the care considering "individuality"?

20 provide the cares considering "individuality" (17.9%), 71 sometimes do (63.4%), 20 do not do so much (17.9%), and 1 do not do at all (0.9%).

5) What kind of user do you mostly concern "individuality"?

In regard to the user that respondents mostly concern "individuality," 41 said dementia (36.6%), 27 said independent elderly (24.1%), 21 said elderly who needs support (18.8%), 9 said bedridden elderly (8.0%), and 14 said others (12.5%).

6) Occasion when mostly concerns "individuality"

In regard to the occasion when mostly concerns "individuality," 79 said daily life support (70.5%), 19 said casual conversation (17.0%), 6 said care planning (5.4%), 2 said consultation (1.8%), and 6 said others (5.4%).

7) The word to best express "individuality"

In regard to the term to best express "individuality," 26 said Will (23.2%), 25 said Personality (22.3%), 20 said Value (17.9%), 20 said life History (17.9%), 13 said Habit (11.6%), and 8 said Others (7.1%).

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8) Correlation between the frequency of using "individuality" word and care practice

We calculated rank correlation coefficient of Spearman for the correlation between the frequency of using "individuality" term and care practice. The correlation coefficient was positive at 0.314**(**:p<.001).

9) Correlation between the frequency of using "individuality" word and experience of years in nursing care

We calculated rank correlation coefficient of Spearman for the correlation between the frequency of using "individuality" term and experience of years in nursing care. The correlation coefficient was slightly negative at -0.225* (*:p<. 05).

3. Personality test result on the case engaged by team (BigFive short version)

1) Respondent basic attributes of user self-assessment and others-assessment by nursing care staff (Table 2-1, 2-2)

Valid data of personality test was self-assessment (user oneself) and others evaluation (9 nursing care staff) on 12 user cases engaged by the same team.

Users were 2 males and 10 females, the average age was 82.0±5.5 years old, and the average years in a facility was 6.3±3.1 years. Nursing care staff were 3 males and 6 females, and the average age was 49.7±12.8 years old, and the average year of experience was 9.6±8.4 years.

Table 2-1 Personality test basic attribute of self-assessors (users)

n=12

Gender	Male	Female	Total
Sample size	2 (16.7%)	10 (83.3%)	12 (100%)
Average age	85.0 (SD 1.0)	81.4 (SD 5.8)	82.0 (SD 5.5)
Age range	84 - 86	72 - 94	72 - 94
Average stay	7.5 years (SD2.5)	6.1years (SD 3.1)	6.3 years (SD 3.1)
Range of stay period	5 - 10 years	3 - 13 years	3 - 13 years

Table 2-2 Personality test basic attribute of others-assessors (nursing care staff team)

n=9

Gender	Male	Female	Total
Sample size	3 (33.3%)	6 (66.7%)	9 (100%)
Average age	38.0 (SD13.0)	55.5 (SD7.7)	49.7 (SD 12.8)
Age range	26 - 56	39 - 63	26 - 63
Average experience year	2.3 years (SD1.2)	13.2 years (SD8.2)	9.6 years (SD8.4)
Range of experience year	1 - 4 years	4 - 29 years	1 - 29 years

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2) Comparison of user self-assessment and others-assessment by nursing care staff on 5 personality attribute factors (Table 2-3)

As a result of segmenting 29 items of personality test (BigFive short version) into 5 factors, the average score of self-assessment and others-assessment did not have a big gap. Out of 5 factors, only emotional unstableness showed lower score of others-assessment than self-assessment. On the other hand, 4 factors showed higher score among others-assessment. However, no significant gap was seen on Friedman test.

Extroversion, Openness, Sincerity, and Harmonicity

Table 2-3 Average score of 5 factors of personality test

Personality characteristics	Average score by assessee	
	User self- assessment (12 users)	Others-assessment by staffs (9 nursing care staffs)
Factor 1 Extroversion (out of 25)	16.0±2.6	18.6±1.9
Factor 2 Emotional unstableness (out of 25)	15.0±3.4	14.0±1.9
Factor 3 Openness (out of 30)	19.0±4.0	20.3±2.2
Factor 4 Sincerity (out of 35)	22.4±4.2	25.6±2.6
Factor 5 Harmonicity (out of 35)	19.9±2.5	21.2±2.9

Friedman test, No significant difference for all

(1) Extroversion

The keyword of the first factor, extroversion was related with positive emotional experience, such as warmth/prefer the bonding and relationship with others, self-assertion, active, and seek stimulation, the main semantic content was proactive approach to outside world, interested in people, like to gather, positive thinking, strong intention to improve, seek for excitement and stimulation. The total score was 25. The average score of user self-assessment and others-assessment were 16.0±2.6 points and 18.6±1.9 points, respectively.

(2) Emotional unstableness

The keyword of the second factor, emotional unstableness was anxiety/nervous, hostility/anger, depression/feeling down, overly self-conscious, and impulsive, vulnerable, and the main semantic content was emotional unstableness, restless, tend to think unrealistically, cannot control one's desire and emotion, and not good to deal with stress. The total score was 25. The average score of user self-assessment and others-assessment were 15.0±3.4 points and 14.0±1.9 points, respectively.

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(3) Openness

The keyword of the third factor, Openness was dreaming/imagination, aesthetic/prefer beauty, rich emotional experience, like to change and novelty, wide-range of interests, and flexible value, and the main semantic content is curious to various things, positive to new logic, society and politics, question the existing authority, accept complexity. The total score was 30. The average score of user self-assessment and others-assessment were 19.0±4.0 points and 20.3±2.2 points, respectively.

(4) Sincerity

The keyword of the fourth factor, Sincerity was capability, prefer well-ordered, sincerity, seek achievement, self-discipline, and discretion, and the main semantic content was control desire and impulse, achieve an objective and task, develop a plan and implement, and think well before action. The total score was 35. The average score of user self-assessment and others-assessment were 22.4±4.2 points and 25.6±2.6 points, respectively.

(5) Harmonicity

The keyword of the fifth factor, harmonicity was trust others, honest, altruistic, obey others, modest, and kind, and the main semantic content was social and community-oriented, not interested in hostility and competition, prefer group activity, and being liked by others. The total score was 30. The average score of user self-assessment and others-assessment were 19.9±2.5 points and 21.2±2.9 points, respectively.

3) Evaluation score difference in nursing care staff (Table 2-4)

To understand the perception difference on individual user characteristics among nursing care staff, we have conducted Friedman test for the average score of characteristic factors among 9 nursing care staff engaging 12 users.

As a result, 4 factors, Extroversion, Openness, Sincerity and Harmonicity showed significant differences among nursing care staff, but Emotional unstableness tends to be evaluated lower than user self-assessment and was no significant difference.

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Table 2-4 Difference of others-assessment among 9 nursing care staff in the same team

Nursing care staff	Average score difference between others-assessment by nursing care staff engaged with 12 cases and user self-assessment				
	Extroversion**	Emotional unstableness	Openness***	Sincerity***	Harmonicity***
a	3.1±3.3	-0.4±5.6	-1.4±5.7	1.9±9.9	0.5±8.7
b	5.6±3.5	-1.4±3.3	6.6±3.5	9.9±4.2	7.9±3.8
c	2.7±2.5	-1.6±3.7	-0.5±4.9	2.4±5.7	-1.2±6.1
d	1.7±3.0	-1.9±4.0	0.6±3.1	2.8±4.3	2.4±3.5
e	1.5±2.2	0.2±3.6	1.5±3.7	2.4±6.8	0.8±5.7
f	0.8±3.0	-1.3±3.6	0.7±3.5	1.8±4.2	0.6±2.8
g	3.4±2.8	-0.6±4.3	0.6±4.7	4.0±7.1	2.5±6.0
h	2.7±3.3	-1.1±5.5	2.2±3.5	1.4±5.0	-1.4±5.3
i	2.0±2.6	-0.5±4.6	1.9±4.3	1.9±6.5	-0.7±5.9
Average	2.6±2.9	-1.0±4.2	1.3±4.1	3.2±6.0	1.3±5.3

Average score difference＝(others-assessment by nursing care staff) engaged with 12 cases – average score of {user self-assessment}
Friedman test **: $p<0.01$、***: $p<0.001$

IV. Findings

1. The first person whom nursing care staff heard of using "individuality" and frequency of usage

As for the first person that nursing care staff heard of using "individuality," teacher was highest, and approximately 70% learned it at educational institution. The objective of educating nursing care staff in the textbook of certified care worker education is "care practice supporting user dignity," "support to become independent," "maintain high ethics," and "individual care" which are the basic of interpersonal service, and "nursing care protection," "rehabilitation," "deathwatch" which indicates the expectation of a wide range of nursing care needs and team care [6]. Many nursing care staff seem to learn the importance of care capturing "individuality" at educational institution. As for the frequency of using the word, "individuality" at the nursing care practice, approximately 40% indicated using it whereas 60% not using it. Furthermore, in regard to the correlation between the frequency of using "individuality" and nursing care considering "individuality, those who use the word more frequently tend to provide nursing care with "individuality. It is considered that the nursing care staff who frequently use "individuality" has certain consideration to provide nursing care practice.

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The correlation between the frequency of using the term and years of using "individuality" was weak and negative. Accordingly, it was clear that nursing care staff with less years of experience tend to use "individuality" more frequently. It is considered that they used "individuality" more frequently as it was difficult for them to express concrete care method due to less years of experience.

On the other hand, nursing care staff with more years of experience obtain knowledge and skill based on their care experiences, therefore they can express an accurate word required for users, rather than using vague, elusive term, "individuality."

2. User that nursing care staff is conscious for "individuality"

As for the user that nursing care staff is mostly conscious for "individuality," dementia was highest at 40%, followed by independent user and user needing support at 20%. The essentials of good dementia care, person-centered-care by Tom Kitwood in UK was to value individuality, therefore influences to be conscious for dementia patient[7]. Independent user and user needing support ranked the next, probably because they can communicate their intention to nursing care staff. They consider "individuality" care to respond to their desire communicated by users.

3. Occasion where nursing care staff is conscious for "individuality"

As for the occasion to be conscious for "individuality" in nursing care practice, daily life support rated approximately 70%. Daily life support includes everyday life, moving, eating, excretion, changing clothes, grooming and bathing that has direct physical contact with users. Nursing care is the support user's daily life for 24 hours and individual care is different by user. These supports are not a different skill, but a series of action. A series of action is different by individual user because each user has different needs based on one's habit and desire as well as ability of action. For daily-life support care, staff needs to consider change in physical condition and unpreferred contact by user. Nursing care staff considers a care based on individual users. This should indicate that 70% of nursing care staff focus on the care considering "individuality" during daily-life nursing care practice.

4. Word that nursing care staff use to express "individuality"

The term that nursing care staff mostly use to express "individuality" was "intention," "personality," "value," "life experience," and "habit" in that order, and all showed the same rate. When nursing care staff provides care, "individuality" may be captured differently by each nursing care staff on user's intention, personality, value, life history, and habit, however it is commonly shared to all words. It means that those words are expressed based on the long-life history of each user. It seems that nursing care staff understand they cannot change user's value, interests, and preference even they become the condition needing support. Each user expresses oneself and the way of living

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nurtured in one's accumulated life, such as foods, preference, clothing taste, family relationship, role and position in the society, and financial power. Human can only age as one spent one's life, in other words, user's diversified value, interests and preference show one's individuality and lead to one's presence. There is no clear definition of "individuality," but an attractive, potent word that many want to use. At the same time, it is a convenient term. As there is no clear definition, "individuality" has a definition as many as the number of individuals.

5. Different perception on user "individuality" among nursing care staff

When generally capturing a person, there seems similar impression in the shared environment, such as "easy to talk to," "a little nervous," "short tempered," and "calm relaxed person." Therefore, we do not occasionally confirm about the person, like "I think he is a bad tempered. What do you think about him?"

Similarly, nursing care staff provide care to the same user in the same facility considering to value "individuality" and there is rare occasion to confirm how others perceive the user. However, there were different perception in the personality test (BigFive short version) on the first factor Extroversion, the third factor Openness, the fourth factor Sincerity, and the fifth factor Harmonicity. Also, the second factor Emotional unstableness was commonly perceived by nursing care staff. Followings were the characteristics of 4 factors that had different perceptions among nursing care staff. Behavioral trend of the first factor, Extroversion was sociable, talkative, cheerful, active and proactive. Behavioral trend of the third factor, Openness was talented and creative, advanced, flexible, independent, and beauty-conscious. Behavioral trend of the fourth factor, Sincerity was well-planned, precise and earnest, and self-controlled based on vision. Behavioral trend of the fifth factor, Harmonicity was generous/kind to others and attuned. Every item of four factor characteristics is seen from user's behavior at the occasion of providing care by nursing care staff. Generally, we feel the behavior is "a typical attitude of the person" because it is consistent between the behavior you see and in the past. However, each nursing care staff may feel different on the consistency based on one's value and personality. Accordingly, one of the factor is that nursing care staff look at a user with a different aspect.

It is difficult for one nursing care staff observe all, various behavior of one user during a day. Every nursing care staff observe individual user in an engagement with them and identify the characteristic of an individual. If one user is perceived as "gentle" and "warm," it may be one aspect of the user when contacting the nursing care staff, but not all the aspects, therefore it can be a stereotypical perception. User can be frustrated and less appetite when feeling bad and it changed everyday. With the change, if one starts to upset suddenly and start shouting loud, nursing care staff may change the perception, "I didn't think he was like that" or "I was misunderstanding about him," or one can capture the change as "he has changed." Accordingly, every nursing care staff perceives user with

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fixed image or change the perception, therefore their perception is different. Furthermore, user may behave differently by nursing care staff.

In a daily relationship between individual nursing care staff and user, user behavior is perceived differently. Therefore, it becomes a factor to different perception among nursing care staff.

The characteristics of the second factor, Emotional unstableness was only perceived the same. Emotional unstableness cannot be directly monitored, but can be identified by physical reaction or behavior. Personal, emotional unstableness is not significantly influenced by the action of others, therefore perceived consistent regardless of nursing care staff. Therefore, it was considered that we could provide consistent care for emotion; however, we tend to provide care focused on emotional approach.

To value "individuality," it is essential to capture a user holistically at nursing care. However, it is idealistic theory to capture a user holistically. It is possible to understanding a user partially but not holistically.

V. Conclusion

While there are various approach for "individuality" study, we have researched the perception of "individuality" of an individual user among nursing care staff at nursing care practices based on shared awareness by using personality test (BigFive short version). As a result, it was clear that there were different perception on four factors, Extroversion, Openness, Sincerity, and Harmonicity among nursing care staff. However, they only had a shared perception on one factor, emotional unstableness. From this result, it has high potential to conduct consistent cares for emotion; however, it has a tendency to fall into providing only an emotional approach.

VI. Limitation and challenge of the research

While this research employs BigFive scales and it is not particularly designed for the elderly, we are uncertain if it is the perfect tool to capture personality characteristics of the elderly. We need to develop the scale specifically designed for the elderly and use it for research.

The next step is the interview to nursing care staff to clarify what they value in their practices.

VII. Acknowledgement

We deeply appreciate all of the heads of nursing care facilities, users, and nursing care staff who responded to our questionnaire and provided invaluable data taking their precious time for us.

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We would like to note that this research paper is partially reedited doctoral thesis of University of Health and Welfare data in 2014.

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Services

SHORT PAPER

A Comparison of the Factor Structure of the Self-Harm Antipathy Scale and related Demographic Characteristics between Korea and Japan

Yoshimi AOKI [1)] Eunnam LEE [2)] Harumi KATAYAMA [1)]

1) Hamamatsu University School of Medicine, Japan
2) Dong-A University College of Medicine, Korea

ABSTRACT

The aim of the present study was to compare the factor structures of the Korean and Japanese version of the SHAS and analyze the commonalities and differences of the related social, cultural and education in two countries. Both scales were found to have the same four-factor structure, but the included items differed. The correlation coefficient between suicide and unemployment rates in Korea was 0.83, except for during 1998 to 2001, when both rates suddenly increased. Regarding religion in Korea, about 50% of suicide attempters were nonbelievers, about 30% were Christian, and about 20% were Buddhists. The correlation coefficient between the suicide and unemployment rates in Japan, where about 50% of suicide attempters were Shintoists and about 50% were Buddhists, was 0.89. The commonalities observed in the suicidal social and personal backgrounds may be associated with other commonalities between the Self-Harm Antipathy Scale version of Korea and Japan. The differences observed in religion may be associated with the other differences between the Self-Harm Antipathy Scale version of Korea and Japan.

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mizushi@hama-med.ac.jp (Yoshimi AOKI; Japan)

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I. Introduction

Nurses working in the emergency department are required to respond to patients with an empathetic attitude who have attempted suicide or self-injury (Japan Clinical Paramedic Society, 2009; WHO, 2000). However, currently, nurses often report finding it difficult to respond to and feel somewhat resistant toward such patients (Aoki & Katayama, 2017; Herron, Ticehurst, Appleby et al., 2001; Japan Clinical Paramedic Society, 2009; Mackay & Barrowclough, 2005).

The Self-Harm Antipathy Scale (SHAS) was developed to measure nurses' attitudes and antipathy toward self-injury patients and better grasp the current situation (Patterson, Wittington & Bogg, 2007).

The original SHAS, which was developed in the UK by Patterson, Wittington and Bogg (2007), evaluates the degree of antipathy felt by nurses toward self-injury patients on a 7-point Likert scale. Based on a factor analysis, the original SHAS is composed of 24 items out of a 30-item pool. In addition, a six-factor structure consisting of "Competence appraisal", "Care futility", "Client intent manipulation", "Acceptance and understanding", "Rights and responsibilities", and "Needs function" is used. Cronbach's α coefficient for each factor ranges from 0.52–0.81.

The Korean version of the SHAS (SHAS-K) was translated into Korean by Kwon and Lee (2017) and its reliability and validity have been confirmed. Based on a factor analysis, the SHAS-K is composed of four factors- "Competence Appraisal", "Acceptance and understanding", "Client intent manipulation", and "Care futility"- consisting of 14 items. Cronbach's α coefficient for each factor ranges from 0.54–0.88.

The Japanese version of the SHAS (SHAS-J) was translated into Japanese by Aoki and Katayama (2016), and its reliability and validity have been confirmed. Based on a factor analysis, the SHAS-J is composed of four factors- "Low empathic competence", "Care futility", "Lack of active understanding", and "Ignorance about rights and responsibilities"- consisting of 24 items. Cronbach's α coefficient for each factor ranges from 0.54-0.83.

Although the SHAS-K and SHAS-J have the same number of factors, either the factor names or the composition of the items included in the factors differ. Therefore, comparing the situations of the two countries, which have the highest international suicide rates, to find commonalities and differences could be important for suicide prevention.

The mental health nursing is necessary in the emergency department for patients who self-injury or suicide. Therefore, the aim of the present study was to compare the factor structures of the Korean and Japanese version of the SHAS and analyze the commonalities and differences of the related social, cultural and education in two countries. By these comparisons, the attitude of Korean and Japanese nurses to patients who have attempted suicide or self-injury can be much better understood.

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II. Methods

This study compared the papers written by the authors. The second author obtained information about the present state of suicide in Korea, while the first and third authors obtained information about the present state of suicide in Japan. The collected data were adjusted by the first author, and these data were then compared and examined for commonalities and differences in terms of the factor structures of the SHAS-K and the SHAS-J. The social and personal backgrounds of suicide attempters, and the religious and education backgrounds of their nurses were compared between Korea and Japan.

III. Results

1. Factor structures of the SHAS-K and SHAS-J

"Acceptance and understanding" and "Competence appraisal", which are factors of the SHAS-K, were in agreement with the items included in "Low empathic practice competence", which is a factor of the SHAS-J. "Care futility" and "Client intent manipulation", which are factors of the SHAS-K, were consistent with some of the items included in "Care futility", which is a factor of the SHAS-J. The SHAS-K did not include "Ignorance about rights and responsibilities" and "Lack of active understanding", which are factors of the SHAS-J (Table 1).

2. Suicide and unemployment rates

The correlation coefficient between the suicide and unemployment rates in Korea from 1989 to 2016 was 0.28. However, except for the 4 years between 1998 and 2001, when the suicide and unemployment rates suddenly increased, the correlation coefficient was 0.83 (Figure 1-A). The correlation coefficient between the suicide and unemployment rates in Japan from 1980 to 2016 was 0.89 (Figure 1-B).

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<Table 1> The Difference in factor structures of the original SHAS, SHAS-K and SHAS-J

		ITEM	Factor		
			Original SHAS	SHAS-K	SHAS-J
27	*r*	I find it rewarding to care for self-harming clients		Acceptance and understanding	Low empathic practice competence
26	*r*	I acknowledge self-harming clients' qualities	Competence appraisal		
28	*r*	I can really help self-harming clients			
21	*r*	I feel concern for the self-harming client		Competence appraisal	
23	*r*	I demonstrate warmth and understanding to self-harming clients in my care			
24	*r*	I help self-harming clients feel positive about themselves			
30	*r*	I am highly supportive to clients who self-harm			
20	*r*	I listen fully to self-harming clients' problems and experiences			
19	*r*	A self-harming client deserves the highest standards of care on every occasion			
4		Self-harming clients do not respond to care	Care futility	Care futility	Care futility Care futility
10		There is no way of reducing self-harm behaviours	Care futility	Care futility	
5		When individuals self-harm, it is often to manipulate carers	Client intent manipulation	Client intent manipulation	
6		People who self-harm are typically trying to get even with someone			
15		A self-harming client is a person who is only trying to get attention			
1		People who self-harm are usually trying to get sympathy from others			
7		A self-harming client is a complete waste of time	Care futility		
16		Self-harming clients have only themselves to blame for their situation			
11		People who self-harm lack solid religious convictions	Acceptance and understanding		
22		I feel critical towards self-harming clients			
29		I would feel ashamed if a member of my family engaged in self-harm			
2	*r*	People should be allowed to self-harm in a safe environment	Rights and responsibilities		Ignorance about rights and responsibilities
8	*r*	An individual has the right to self-harm			
9		Self-harm is a serious moral wrongdoing	Care futility		
12	*r*	Self-harm may be a form of reassurance for the individual that they are really alive and human	Needs function		Lack of active understanding
14	*r*	Acts of self-harm are a form of communication to their situation			
17	*r*	For some individuals self-harm can be a way of relieving tension	Acceptance and understanding		
18	*r*	Self-harming clients have a great need for acceptance and understanding			
3	*r*	A rational person can self-harm			
13	*r*	Self-harming individuals can learn new ways of coping			
25		I feel to blame when my clients self-harm			

r: Reversal item

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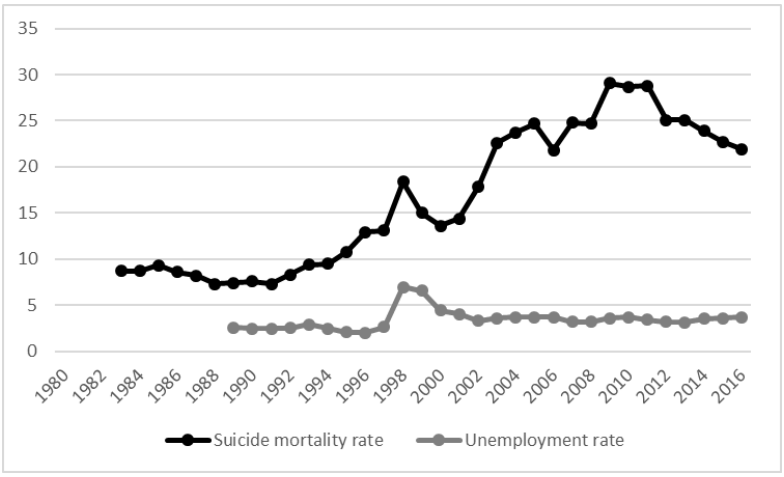
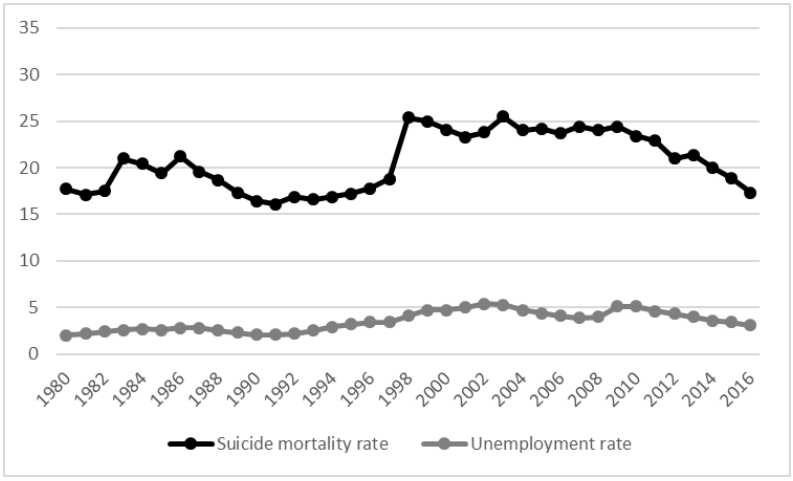
(A)



(B)



<Figure 1> Suicide mortality and unemployment rates in Korea and Japan.

(A) The suicide rate (%) is per 100,000 population and the unemployment rate is per population (%) in Korea.

(B) The suicide rate (%) is per 100,000 population and the unemployment rate is per population (%) in and Japan.

Source of number of suicides and unemployment rate in Korea: Statistics Korea (2017)

Source of number of suicides in Japan: National Police Agency (2017). Ministry of Internal Affairs and Communications Statistics Bureau (2017).

3. Age, gender, and reason for suicide

As of 2016, the highest percentage of individuals attempting suicide in Korea was those aged 50-59 years (20.4%), followed by 40-49 years (19.7%), 30-39 years (14.2%), 60-69

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years (13.6%), and 70-79 years (13.1%).As of 2016 in Japan, the highest percentage of individuals attempting suicide was those aged 40–49 years (17.1%) followed by 50-59 years (16.6%), 60-69 years (16.6%), 70-79 years (13.6%), and 30-39 years (12.9%). The proportion of elderly people (over the age of 60 years) attempting suicide was higher in Japan than in Korea.

Regarding sex, in 2016, 70.6% and 69.4% of those attempting suicide in Korea and Japan, respectively, were men.

In Korea, 61.0% of all suicide attempts were carried out because of psychiatric symptoms according to a survey by the Ministry of Health and Welfare of suicide attempters who visited an emergency room in 2013. In Japan, 49.9% of all suicide attempts were carried out because of health problems according to data from the Suicide Countermeasure Promotion Office of the Ministry of Health, Labour and Welfare in 2016.

4. Religion in Korea and Japan

In terms of religion, in Korea, about 50% of the suicide attempters were nonbelievers, followed by Baptists and Catholics at about 30%. In Japan, about 50% of the suicide attempters were Shintoists and about 50% were Buddhists (Table 2).

<Table.2> Religion distribution of Korean and Japan in 2015

Kinds of Religion	Number
Korea	
Buddhism	7,619,332
Baptist	9,675,761
Catholic	3,890,311
Won Buddhism	84,141
Confucianism	75,703
Chondogy	65,964
Dae Soon Buddhism	41,716
Daejonggyo	3,101
Others	98,135
Non-believer	27,498,715
Japan	
Shinto	89,526,176
Buddhism	88,719,287
Christianity	1,928,079
Various teachings	8,718,964

Source: Statistics Korea (2017). Agency for Cultural Affairs, Government of Japan (2017).

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5. Education of nurses on suicide attempts and self-harm behavior

In Korea, only about 11.6% of nurses have participated in an education program for caring for patients who attempt self-harm (Kwon & Lee, 2017). In Japan, only about 31.5% of nurses have participated in training for caring for suicidal patients (Aoki & Katayama, 2017).

IV. Discussion

1. Factor structure of the SHAS-K and SHAS-J

SHAS-K and SHAS-J both have the same number of four factor structures, but a little different the factor structures. Unlike SHAS-K, SHAS-J has factor s of rights and responsibilities of suicide attempter. Also, client intent manipulation factor of SHAS-K is included in a factor of care futility in SHAS-J. That means that the Japanese nurses recognize that self-injury patients be blamed because they are trying to get attention or sympathy from others. These differences of a factor structure of SHAS-K and SHAS-J could be related the differences in social structure, culture and education between the two countries. The following discussion mentions these three differences. Social and personal backgrounds of suicide are reflecting social structure between the two countries. And religion is related to the culture of the country. Therefore, we will consider the social and personal backgrounds of suicide, the religion and the education below between Korea and Japan.

2. Social and personal backgrounds of suicide

Korea's suicide and unemployment rates both increased after the 1998 Asian currency crisis, the 2008 Korean currency crisis, and the Lehman shock. Since 2012, the Korean government has enacted laws against suicide, and as a result, the current suicide rate in Korea has shown a downward trend. On the other hand, the suicide and unemployment rates in Japan have remained high since 1998 when the bubble burst. However, since the Japanese government enacted basic suicide measures in 2008, the current suicide rate in Japan has also shown a downward trend. In addition, the suicide and unemployment rates in both countries have shown a high correlation, except for the 4 years in which the unemployment rate in Korea suddenly increased. From the above, Korea and Japan both appear to be influenced by their own respective economic situations, suggesting that social backgrounds should be taken into account to strengthen measures for suicide prevention. Most of the suicide attempters in Korean are men of working age (40–60 years), and most of the suicide attempters in Japan are men of a similar age (40–70 years). In addition, the reasons given most frequently for suicide attempts in Korea and Japan were psychiatric symptoms and health problems, respectively. From the above, the personal backgrounds of suicidal people in Korea and Japan were the same: men of working age with mental

and physical problems. Generally, the retirement age in Korea is 60 years, while that in Japan is 65 years. In many cases, those with health problems cannot work, which increases the possibility of unemployment. Therefore, as a measure to prevent suicide in both Korea and Japan, the introduction of a counseling program regarding work for male patients of working age who have health problems is considered necessary.

3. Religion

In Christianity, suicide is an unacceptable offense against life, society, and God (Liegeois & Schrijver, 2017). On the other hand, in Buddhism, suicide can represent the purification of one's life up to the present and restore innocence; it does not prevent the person from going to heaven (Picken, 1979). In Shintoism, death and God are natural nearby feelings, and life and death are regarded as continuous (Hiroi, 2003).

Korea is a country with many Christians compared with other Asian countries. In addition, many nonreligious Korean people are enthusiastic about ancestor worship and legal affairs. By comparison, Japanese people often believe without perceiving their own religion, and often do not recognize the religion they believe. In addition, many Japanese people believe in both Shintoism and Buddhism.

Therefore, in both Korea and Japan, religion is different, as are attitudes toward patients who attempt suicide or self-harm. In Korea, many Christians are against suicide, but many Buddhists hold views that may strengthen suicide orientation; in addition, Korea has a larger percentage of nonbelievers. By contrast, in Japan, there are many Shintoists who do not share the same hatred of death as Buddhists. Therefore, the fact that the SHAS-K did not include "Ignorance about rights and responsibilities" and "Lack of active understanding", which are factors of the SHAS-J, was considered to be associated with religious differences between Korea and Japan.

4. Education

In a previous study, attitudes and education geared toward patients who attempt self-harm interact, and thus training, supervision, and support for nurses caring for such patients is needed (Conlon & O'Tuathail, 2012). In both Korea and Japan, many of nurses have not participated in practical educational programs for patients who attempt self-harm or suicide. In a previous study, many nurses in Japan reported finding it difficult to understand how to assist suicide attempters or provide proper care (Aoki & Katayama, 2017). In addition, a survey of nursing students in Korea conducted using the Q-strategy showed that educational programs based on the subjectivity of attitudes toward patients who attempt suicide was needed (Cho, Lee, & Park, 2017).

Therefore, training nurses for caring of patients who attempt self-harm or suicide is needed in both Korea and Japan. An educational program for promoting care therefore needs to be developed in consideration of diverse factors such as experience, culture, and religion and the subjectivity of nurses.

5. Limitation

This study is a study based on limited the tool and the environment, and there are limits to using the results. The nurse's attitude toward self - injured patients has a large personal factor so the results of this study may not be relevant.

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SHORT PAPER

Issues of Specific Educational Curriculum Development for Resource Rooms and Special Needs Classes in Japanese High Schools

Mitsuyo SHIMOJO[1)] Haruna TERUYA[2)] Aiko KOHARA[2)]
Changwan HAN [2)]

1) Okinawa Prefectural Tomishiro Minami Senior High School, Japan
2) Faculty of Education, University of the Ryukyus, Japan

ABSTRACT

The objective of this study was to clarify the issues related to the establishment of School with Resource Rooms and special needs classes and the specific education curriculum development issues in high schools. For this purpose, using Scale C³, data will be collected from the perspective of career education in high schools, and issues based on data will be clarified. Comparison of self-assessment and teacher-assessment there was a discrepancy in some scores` average scores. There was a large gap in scores between self -assessment and evaluation by others in the scores of "mental and physical health ". In addition, there was a difference between the scores of "Information expression" and "information processing". In the results of the average area score of items in the Scale C³, the categories with a low average area score were "decision-making" (3.48) and "carrier design" (3.53) in the evaluation by teacher-assessment. In this study, there were differences in what teachers and students perceived to be needs. Without a curriculum tailored to the needs of students, no teaching effect or educational results can be expected. The Scale C³ used in this study can be used for education curriculum development in the future, since it is possible to grasp the needs from the perspective of career education.

＜Key-words＞
resource room in high school, special needs education classroom, curriculum, career education

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Corresponding author: hancw917@gmail.com (Changwan HAN; Japan)
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I. Introduction

In 2016, the Ordinance for Enforcement of the School Education Act were partially amended to stipulate that "special curricula should be established" in high schools. This has enabled the establishment of school with resource rooms in high schools, which were unable to make a particular education curriculum development. This is partly due to an increase in students with special needs in upper secondary schools. According to the number of cases for consideration for "students with disabilities" in public high school entrance examinations in FY2014, the number has been increasing since 2012, and in 2014, the number of cases increased by 101 compared to the previous fiscal year (Ministry of Education, Culture, Sports, Science and Technology; MEXT, 2016). However, among the "students with disabilities" in this survey, PDD (Pervasive Developmental Disorders), ADHD (Attention-Deficit/Hyperactivity Disorder: ADHD; hereafter, ADHD), and ASD (Autism Spectrum Disorder: ASD; hereafter, ASD) have not been determined based on a diagnosis by a doctor or mental health professional, and therefore some students have not been formally diagnosed. As diagnoses are expected to continue increasing, it is possible that special needs classrooms will be established in addition to School with resource rooms in the future due to changing legislation. In doing so, we need to consider students with special needs` education curriculum development.

Although legislation has been enacted, specific education curriculum development remains challenging. Specific education curriculum development may be provided by the School with resource rooms in elementary and junior high schools or by the education curriculum development of special needs classrooms. Currently, elementary and junior high schools are organized in accordance with the Courses of Study for Elementary and Junior High Schools. Specialized curricula may be utilized (Ordinance for Enforcement of the School Education Act, Article 138) where particularly needed. However, in actual education curriculum development, most schools are responsible for teacher of special needs classrooms (Sato & Urano, 2017). There is also the problem that teachers with low levels of expertise must be used because of the low percentage of educators with special support licenses. The same issues may arise in upper secondary schools in the future.

Practical examples of the implementation of special curricula in upper secondary schools include communication skills, stress management, and career education focusing on self-reliance activities, in addition to the content of the regular Courses of Study in High Schools (MEXT, 2017). In particular, the content of career education is indispensable for high school students in terms of fostering their ability to transition to contributing members of society after graduation. In addition, the practice of self-reliance activities is similar to that of "basic and general-purpose abilities" in career education. "basic and general-purpose abilities" consists of "human relationship formation skill", "self-understanding and self-management skill", "basic skill of respond to tasks" and "career planning skill" (Central Council for Education, 2011). This suggests that career

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education is an important factor in organizing special curricula in upper secondary schools.

This study aimed to clarify the issues related to the establishment of school with resource rooms and special needs classrooms and the specific education curriculum development issues in high schools. For this purpose, data will be collected from the perspective of career education in high schools, and issues based on data will be clarified.

II. Methods

1. Subjects and Procedures

The survey was completed by 158 students in the first year of a high school in Okinawa Prefecture and also the HR teachers' assessment data of 158 students in charge of the class. The data were collected by mail between July and September 2018. A total of 158 data accomplished questionnaires were collected among the 158 that had been distributed, but of these, only 145 questionnaires (students) and 157 questionnaires (teachers) could be analyzed because of the incomplete responses of the others.

After receiving a request for participation from the principal, the students who were able to participate and their HR teachers completed the questionnaire. Students completed the self-assessment scale (high school version) and teachers completed the scale for assessment others while observing the students' school life.

2. Scale for Coordinate Contiguous Career (Scale C³)

Scale C³ was developed as a tool for evaluating and providing continuous support for the career development of high school students into working people (Han, Numadate, Goy, et al., 2018). Currently, scales for self-assessment and others are being developed. Self-assessment scales (for high school students) are highly reliable (Teruya,Yano, Shimojo et al., 2018).

The Scale C³ consists of two domains: "personality" and "career." "Personality" includes five sub-domains: “mental and physical health”, “inattention”, “hyperactivity/impulsivity”, “adherence”, and “self-esteem”. In the domain of "career", there are four sub-domains: "human relationship formation skill," " self-understanding and self-management skill," " basic skill of respond to tasks," and " career planning skill." Within the "human relationship formation skill" sub-domains, there domain additional sub-domains of " appreciating diversity," "communication skills," "social skills," and " self-understanding and self-management skill ", which is further broken down into the sub-domains of " understanding one's role," " self-motivation," " stress tolerance," and " basic skill of respond to tasks " that are " information acquisition," " information expression," " information processing," and " career planning skill " that are " decision-making " and " carrier design." The total number of items included in all sub-domains is 92.

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Assessments were performed using five choices: "1 = very good", "2 = slightly correct", "3 = neither", "4 = not very good", and "5 = almost none". The score is summed for each sub-domain, and the lower the domain score, the higher the need for that domain.

3. Analytical method

After determining the actual status of students with special needs extrapolated from each domain, the issues of establishing special needs classrooms are discussed. Students with special needs is extrapolated from the scores of self-assessment and others' assessment. The calculation method is "(mean score) - (2standard deviation; SD)" based on the calculation criteria for the cut-off value of IN-Child Record (Han, Yano, Kohara et al., 2017).

In addition, issues in the curriculum will be examined from the perspective of career education from domains with low scores from self-assessment and assessment of others and domain with high scores. With regard to domain in which there is a large gap between self-assessment and the assessment of others, education curriculum development issues will be examined from the perspective of career education.

III. Results

1. Analysis of the situation of students with high special needs

The actual status of students with special needs differs in "information expression," "information processing," and "decision-making." There was also a difference between self-assessment and teacher-assessment by others in terms of "communication skill " and "self-motivation." In terms of "communication skills," 10 (6.4%) teacher-assessment were found to be in high demand, compared to 4 (2.8%) on a self-assessment basis. In addition, 9 students (6.2%) answered "self-motivation" while 13 (8.3%) answered "self-motivation" for teacher entry. This suggests that although the students themselves feel there is a need, there is a discrepancy between the students' perceptions and the teachers' perceptions.

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<Table 1> Number of students with special needs

Domains	Sub-domains	Special needs students n(%)	
		Self-assessment (n=145)	Teacher-assessment (n=157)
	Total score	4(2.8)	2(1.3)
Personality	Mental and physical health	3(2.1)	2(1.3)
	Inattention	10(6.9)	4(2.5)
	Hyperactivity/impulsivity	10(6.9)	11(7)
	Adherence	3(2.1)	2(1.3)
	Self-esteem	4(2.8)	3(1.9)
Career	Appreciating diversity	8(5.5)	10(6.4)
	Communication skill	4(2.8)	10(6.4)
	Social skill	5(3.4)	8(5.1)
	Understanding one's role	4(2.8)	2(1.3)
	Self-motivation	9(6.2)	13(8.3)
	Stress tolerance	4(2.8)	3(1.9)
	Information acquisition	7(4.8)	8(5.1)
	Information expression	7(4.8)	0(0)
	Information processing	14(9.7)	0(0)
	Decision-making	8(5.5)	0(0)
	Carrier design	9(6.2)	4(2.5)

When there is a need for both the domain of "inattention" and "hyperactivity/impulsivity", attention deficit/ hyperactivity disorder (ADHD) tendencies are indicated (Han, Kohara, Yano et al., 2017). In addition, when there is a need for both "adherence" and "communication skill" domains, there is a tendency for autism spectrum disorder (ASD). Three students (2.1%) had a tendency towards ADHD, and two (1.3%) had a tendency to self-assessment. In addition, the ASD tendency was 0 (0%) for self-assessment and 1 (0.6%) for Teacher-assessment by others (Table 2).

<Table 2> Number of ADHD or ASD trend students

Tendency	Special needs students n (%)	
	Self-assessment (n=145)	Teacher-assessment (n=157)
ADHD tendency ("Inattention" and "Hyperactivity/impulsivity")	3(2.1)	2(1.3)
ASD tendency ("Adherence" and "Communication skill")	0(0.0)	1(0.6)

2. Comparing domain score of the Scale C[3]

Table 3 shows the mean scores for the self-assessment and the other party's teacher-assessment domains and the average item scores in the domain of students with special needs.

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1) Comparison of each domain

Comparison of self-assessment and teacher-assessment by others revealed that there was a discrepancy in some domains average scores. The domains were "mental and physical health" (10.04), "adherence" (5.89) and "information expression" (6.37). self-assessment scores are lower in these three domains. The student felt that there is a need, but this suggests that there is a difference between the student's perception and the teacher's perception.

2) Comparison of the average item score in the domain

In the domain of self-assessment, the high score of items were "social skill" (4.11) and "hyperactivity/impulsivity" (4.09). The region with the lowest score was "adherence" (3.18). From this, it can be seen that students felt there is a need in the domain of "adherence."

Looking at the average score of items in the other party's teacher-assessment domain, the domains with the lowest scores were "decision-making" (3.48) and "career design" (3.53). These two domains are sub-domains of "career planning skill". In other words, teachers felt there is a need for students' career planning skills. Therefore, we found that there were issues related to career planning skills development.

IV. Discussion

This study aimed to clarify the issues related to the establishment of School with resource rooms and special needs classrooms and the specific education curriculum development issues in high schools.

In the analysis of the actual state of students with special needs, there was a large gap in scores between self-assessment and teacher-assessment in the domains of "Mental and physical health". In other words, it appears that students are more aware of the need for "Mental and physical health" than teachers. "Mental and physical health" is characterized by a variety of social problems such as depression (Han, Numadate, Goya et al., 2018). Also, since about 2% of students show a tendency towards ADHD, it is expected that the number of students in the emotional and behavioral class will increase when a special needs class is established in high schools. Education curriculum development will require programs that address mental and physical health trends and ADHD characteristics.

In addition, there was a difference between the domains of "Information expression" and "Information processing." In the domain of "Information expression", 14 students (9.7%) were self-assessed by students with special needs and 0 students (0%) by teacher-assessment. In addition, 7 students (4.8%) self-assessment and 0 students (0%) teacher-assessment were included in the "Information expression" field. This domain is included in the sub-domain of "Basic skill of respond to tasks". "Basic skill of respond to

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tasks" refers to the basic abilities needed to deal with issues such as schooling and work (Han, Numadate, Goya et al., 2018). In other words, the domains of "information processing" and "information expression" are the basic domains of learning. With regard to the basics, although students feel there is a need, teachers may feel there is no need. There are many cases in which students' self-reliance, such as self-reliance activities, is included in the special education curriculum development of high schools. However, acquiring basic academic abilities is considered to be the foundation of future career development. When organizing special curricula in upper secondary schools, it is also necessary to make efforts to improve basic academic ability.

<Table 3> Differences average domain score

Domains	Sub-domains (Sub-domains average score)	Self-assessment (n=145)	Teacher-assessment (n=157)	score difference
Personality	Mental and physical health	42.15 (3.52)	52.57 (4.41)	**10.04** (0.9)
	Inattention	27.24 (3.37)	27.25 (3.89)	0.01 (0.5)
	Hyperactivity/impulsivity	24.52 (4.09)	27.24 (4.54)	2.72 (0.45)
	Adherence	19.10 (3.18)	24.99 (4.17)	**5.89** (0.98)
	Self-esteem	17.99 (3.60)	20.69 (4.14)	2.70 (0.54)
Career	Appreciating diversity	15.46 (3.86)	16.02 (4.01)	0.56 (0.14)
	Communication skill	26.74 (3.73)	31.01 (4.43)	4.27 (0.69)
	Social skill	20.56 (4.11)	20.97 (4.19)	0.41 (0.08)
	Understanding one's own role	11.04 (3.68)	11.25 (3.75)	0.21 (0.07)
	Self-motivation	10.14 (3.38)	10.82 (3.61)	0.68 (0.23)
	Stress tolerance	10.48 (3.49)	11.44 (3.81)	0.96 (0.32)
	Information acquisition	41.61 (3.82)	43.76 (4.38)	2.15 (0.55)
	Information expression	26.79 (3.83)	33.16 (4.69)	**6.37** (0.87)
	Information processing	28.08 (4.01)	26.00 (3.72)	2.08 (0.30)
	Decision-making	10.43 (3.48)	10.43 (3.48)	0.00 (0.00)
	Career design	15.12 (3.78)	14.13 (3.53)	0.99 (0.25)

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In the results of the average domain score of items in the Scale C[3], the domain with a low average item score were "decision-making" (3.48) and "carrier design" (3.53) in teacher-assessment. Both are sub-domains of "career planning skill", "career planning skill" is the ability to choose and utilize various information on how to live, and to make decisions and plans on one's own, thereby forming a career (Han, Numadate, Goya et al., 2018). This suggests that teachers feel there is a need for students' career planning skills.

The results of this study revealed that "basic skill of respond to tasks" and "Career planning skill" domains of special need for high schools and are issues of education curriculum development. According to the results of the nationwide survey, the percentage of elementary schools giving guidance on "basic skill of respond to tasks" and "career planning skill", and junior high schools and senior high schools on "basic skill of respond to tasks" was low (National Institute for Educational Policy Research, 2013). Therefore, it can be seen that the practice of "basic skill of respond to tasks" and "career planning skill" is still lacking at present. In the future, assistance in these domains will be needed, as this domain will become an issue in the implementation of special education curriculum development in high schools.

The limitation of this study was that the data collection was only from first year of high school in Okinawa prefecture. There are major differences in scholastic ability and actual conditions of student among high schools. Despite the limitations of the study, structured tools were used to capture the needs of all students and teachers. It was a meaningful study in terms of understanding the needs from the point of view of career education. In this study, the data were insufficient to allow statistical differences in the results to be addressed. In the future, it is necessary to increase the number of schools and state statistical differences, and it is necessary to consider the curriculum in depth.

The principal is responsible for specific education curriculum development and is primarily responsible for special needs classrooms and school with resource rooms. In this study, there were differences in what teachers and students perceived to be needs. Without a curriculum tailored to the needs of students, no teaching effect or educational results can be expected. Therefore, it is necessary to ascertain the needs using scientific tools. The Scale C[3] used in this study can be used for education curriculum development in the future, since it is possible to grasp the needs from the perspective of career education.

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REVIEW ARTICLE

Importance of Physical Activity and $\dot{V}O_2$max:

Five Major Determinants of $\dot{V}O_2$max

Masahiro KOHZUKI[1)] Chaeyoon CHO[1)] Ryo TAKAHASHI[1)]
Taku HARADA[1)]

1) Graduate School of Medicine, Tohoku University, Japan

ABSTRACT

Cardiorespiratory fitness (CRF) is defined as the ability of the circulatory and respiratory systems to supply oxygen during sustained physical activity and is usually expressed as maximal oxygen uptake ($\dot{V}O_2$max) during maximal exercise testing. There are five major determinants of $\dot{V}O_2$max: functions of the heart, lung, kidney, muscle, and blood (hemoglobin). Cardiac output, pulmonary diffusion capacity, oxygen-carrying capacity, renal function, and other peripheral limitations like muscle diffusion capacity, mitochondrial enzymes, and capillary density are all examples of $\dot{V}O_2$max determinants. $\dot{V}O_2$max, measured by cardiopulmonary exercise testing, provides what is probably the most sensitive assessment of the effect of new therapy on the function of any diseased organ system whose major function is to couple pulmonary gas exchange to cellular respiration. For example, it is important to determine whether new medical, surgical, and rehabilitative procedures can effectively intervene to improve the gas transport capability of a diseased organ system.

<Key-words>
physical activity, physical inactivity, $\dot{V}O_2$max, rehabilitation

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kohzuki@med.tohoku.ac.jp (Masahiro KOHZUKI; Japan)
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I. Physical inactivity (PI)

Physical inactivity (PI), which is associated with increased morbidity, loss of health-related quality of life, and substantial healthcare expenditure, is estimated to be the fourth leading cause of death worldwide (Medibank Private, 2007; Martin, Beelerb, Szucsb et.al., 2001; Katzmarzyk, Janssen, 2004; Chenoweth, Leutzinger, 2008; Zelle, Klaassen, Van, et al., 2017). It is an established risk factor for the development of common noncommunicable diseases (NCD) (World Health Organization, 2010), with approximately 6–10% of all deaths from NCD attributable to PI (Kohl, Craig, Lambert, et al.,2012). Approximately one-third of the global population does not engage in the minimum weekly amount of physical activity (PA) recommended by the WHO, which is 150 min of moderate-intensity aerobic PA throughout the week, at least 75 min of vigorous-intensity aerobic PA throughout the week, or an equivalent combination of moderate- and vigorous-intensity activity (Zelle, Klaassen, Van et al., 2017; World Health Organization, 2010; Kohl, Craig, Lambert et al.,2012).

The association between PI and poor outcomes is also established for patients with cardiac disease, pulmonary disease, and chronic kidney disease (Cacciatore, Amarelli, Ferrara et al., 2018; Waschki, Kirsten, Holz et al., 2011; Beddhu, Baird, Zitterkoph et al., 2009). Patients with cardiac disease, pulmonary disease, or renal disease typically engage in a lower level of PA than does the general population, which can induce a catabolic state including reduced neuromuscular functioning, reduced exercise tolerance, and reduced cardiorespiratory fitness (CRF).

II. Cardiorespiratory fitness (CRF) and $\dot{V}O_2max$

CRF is an important consideration, in addition to PA, as it is a strong predictor of mortality (Sieverdes, Sui, Lee et al., 2010; Blair, Kohl, Paffenbarger et al., 1989); low CRF presents a particularly high risk of death compared to other common risk factors, such as diabetes, high cholesterol, or hypertension (Blair, Sallis, Hutber et al., 2012). CRF is defined as the ability of the circulatory and respiratory systems to supply oxygen during sustained PA and is usually expressed as maximal oxygen uptake ($\dot{V}O_2max$) during maximal exercise testing (Caspersen, Powell, Christenson et al.,1985). In 2016, the American Heart Association published a scientific statement (Ross, Blair, Arena et al., 2016) recommending that CRF, quantifiable as $\dot{V}O_2max$, be regularly assessed and utilized as a clinical vital sign. This statement was based on the mounting evidence that lower CRF levels are associated with high risk of cardiovascular disease, all-cause mortality, and mortality rates stemming from various types of cancers.

$\dot{V}O_2max$ is expressed either as an absolute rate in, for example, liters of oxygen per minute (L/min) or as a relative rate in, for example, milliliters of oxygen per kilogram of

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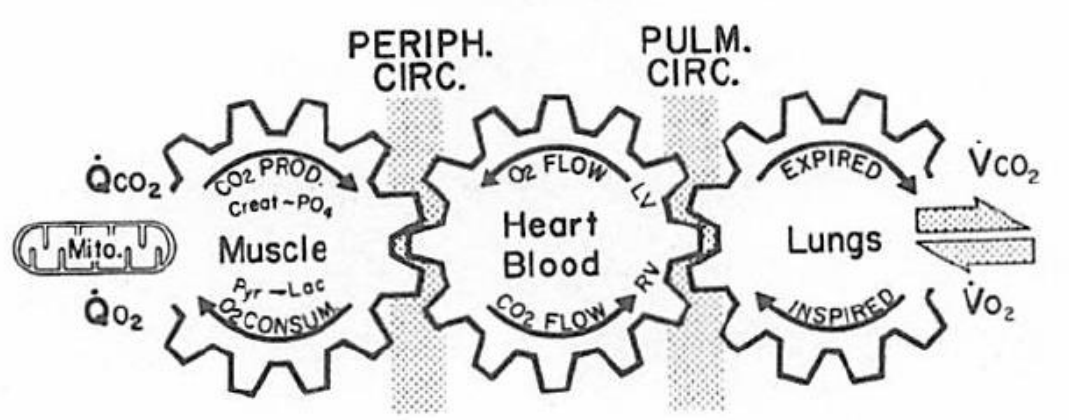
body mass per minute (e.g., mL/ (kg · min)). The latter expression is often used to compare the performance of endurance athletes and patients.

III. Major determinants for $\dot{V}O_2max$

Wasserman showed gas transport mechanisms for coupling cellular (internal) to pulmonary (external) respiration (Figure 1) (Wasserman, 1999).



(Wasserman, 1999)

<Figure 1> Gas transport mechanisms for coupling cellular to pulmonary respiration
$\dot{Q}CO_2$; minute newly produced CO_2, $\dot{Q}O_2$; minute O_2 utilization
$\dot{V}CO_2$; minute CO_2 output, $\dot{V}O_2$; minute O_2 taken up from the alveoli.

The gears represent the functional interdependence of the physiological components of the system. The large increase in O_2 utilization by the muscles ($\dot{Q}O_2$) is achieved by the increased extraction of O_2 from the blood perfusing the muscles, the dilatation of selected peripheral vascular beds, an increase in cardiac output (stroke volume and heart rate), an increase in pulmonary blood flow by recruitment and vasodilatation of pulmonary blood vessels, and finally, an increase in ventilation. O_2 is taken up ($\dot{V}O_2$) from the alveoli in proportion to the pulmonary blood flow and degree of O_2 desaturation of hemoglobin in the pulmonary capillary blood.

Recent findings suggest that metabolic acidosis in chronic kidney disease (CKD) patients promotes muscle protein wasting and protein-energy wasting (PEW) by increasing protein degradation (Caso & Garlick, 2005) and reducing protein synthesis (Bailey, Wang & England,1996). As a result, muscle mass maintenance is impaired in CKD patients with altered protein turnover rates (Mitch, 1997). Adding to sarcopenia, metabolic acidosis, protein-energy wasting, angiotensin II, and myostatin overexpression in uremia contribute to muscle wasting etiology in CKD (Fahal, 2014). Moreover, the drug erythropoietin (EPO) can boost $\dot{V}O_2max$ significantly in both humans and other mammals (Kolb, 2010). Therefore, Kohzuki suggested that there are five major

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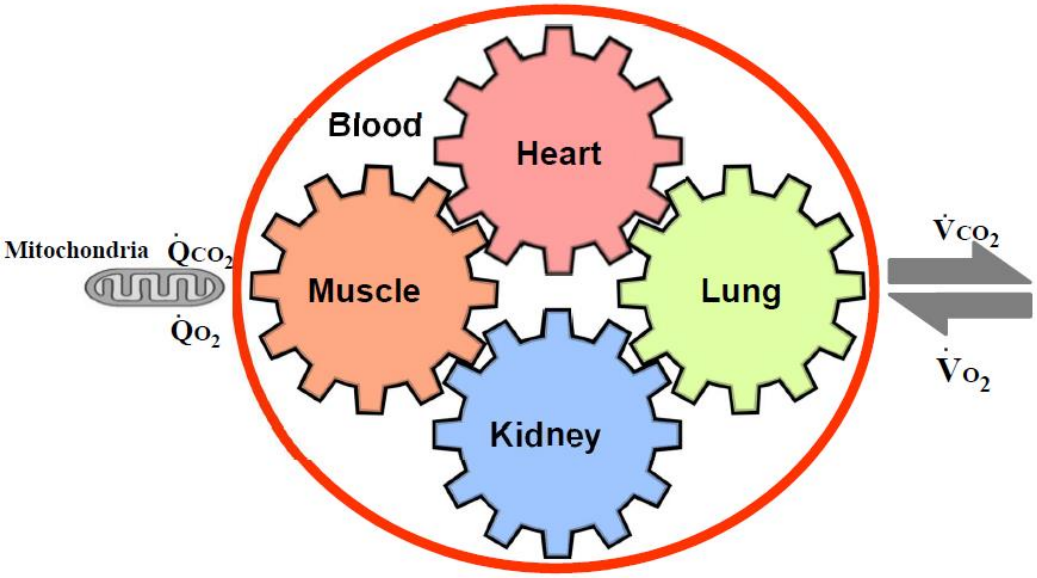
determinants for $\dot{V}O_2max$: functions of the heart, lung, kidney, muscle, and blood (Figure 2) (Kohzuki, 2018).



(Kohzuki, 2018)

<Figure 2> Gas transport mechanisms for coupling cellular to pulmonary respiration: five major determinants for $\dot{V}O_2max$

$\dot{Q}CO_2$; minute newly produced CO_2, $\dot{Q}O_2$; minute O_2 utilization

$\dot{V}CO_2$; minute CO_2 output, $\dot{V}O_2$; minute O_2 taken up from the alveoli.

Cardiac output, pulmonary diffusion capacity, oxygen-carrying capacity, renal function, and other peripheral limitations like muscle diffusion capacity, mitochondrial enzymes, and capillary density are all examples of $\dot{V}O_2max$ determinants.

IV. Factors limiting exercise

Symptoms that stop people from performing exercise are fatigue, dyspnea, angina, or claudication (Wasserman, 1999).

The exact mechanisms of fatigue remain a topic of debate. Because lactic acidosis accompanies an increased rate of anaerobic ATP production, it is tempting to attribute fatigue to the intracellular consequences of exercise lactic acidosis. Low cellular pH, increased inorganic phosphate, impaired calcium release from the sarcoplasmic reticulum, and decreased ATP levels have also been proposed as mediators of fatigue (Wasserman, 1999).

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Dyspnea is a common abnormal consequence of exercise. It occurs in patients with relatively ineffective ventilation, such as in patients with a high fraction of the breath which is physiological dead space (low gas exchange efficiency), and in those with hypoxemia, metabolic acidosis, or impaired ventilatory mechanics. Sedentary subjects usually experience fatigue rather than dyspnea as their limiting symptom during exercise involving large muscle groups. Because of the reduction in maximal ventilatory capacity with aging, elderly people may experience exertional dyspnea at maximum exercise rather than fatigue (Wasserman, 1999).

Pain in the chest or other related areas is the most common symptom of patients with coronary artery disease. This reflects an inadequate O_2 supply to the myocardium relative to the myocardial O_2 demand. Reducing the O_2 demand by decreasing myocardial work or increasing myocardial O_2 supply can eliminate angina. Reducing O_2 demand, however, may necessitate a reduced maximal work capacity. That is, the patient may be forced to trade a less active lifestyle for anginal relief (Wasserman, 1999).

Claudication occurs because of an O_2 supply/demand imbalance in the muscles of the exercising extremity. Because walking at a normal pace requires approximately 20-fold increase in O_2 utilization by the muscles of locomotion, the ability to increase blood flow to the lower extremities is critically important to be able to walk without pain. If atherosclerotic changes in the conducting vessels to the lower extremity limit the increase in leg blood flow, an O_2 supply/demand imbalance will result (Wasserman, 1999).

V. Exercise testing

As super-aged society has come, the number of persons with multimorbidity and multiple disabilities (MMD) (Kohzuki, 2014) and their needs of rehabilitation have increased rapidly more than expected (Kohzuki, 2014). Exercise testing offers the investigator the unique opportunity to study simultaneously the cellular, cardiovascular, and ventilatory systems' responses under conditions of precisely controlled metabolic stress. Exercise testing with appropriate gas exchange measurements can also serve to grade the adequacy of cardiorespiratory function. For example, exercise testing might not only distinguish between lung and cardiovascular disease, but also it may be used to distinguish one cardiovascular disease from another as the cause of exercise limitation. For instance, coronary artery disease, chronic heart failure, and peripheral vascular disease may be distinguished by the pattern of abnormal gas exchange response to exercise (Wasserman, 1997).

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VI. Conclusions

There are five major determinants for $\dot{V}O_2max$, such as functions of the heart, lung, kidney, muscle, and blood (hemoglobin). Cardiac output, pulmonary diffusion capacity, oxygen-carrying capacity, renal function, and other peripheral limitations like muscle diffusion capacity, mitochondrial enzymes, and capillary density are all examples of $\dot{V}O_2max$ determinants. $\dot{V}O_2max$, measured by cardiopulmonary exercise testing, provides what is probably the most sensitive assessment of the effect of new therapy on the function of any diseased organ system whose major function is to couple pulmonary gas exchange to cellular respiration. For example, it is important to determine whether new medical, surgical, and rehabilitative procedures can effectively intervene to improve the gas transport capability of a diseased organ system.

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REVIEW ARTICLE

Importance of Physical Exercise in Oldest-old Adults:
A Literature Review Study

Chaeyoon CHO [1)] Chaewon LEE [1)] Masahiro KOHZUKI [1)]

1) Graduate School of Medicine, Tohoku University, Japan

ABSTRACT

Oldest-old adults aged ≥85 years are more vulnerable to frailty, chronic diseases, and disabilities; therefore, concerns about their healthcare are increasing. Prevention of physical and mental disability is a key objective for successful ageing in these adults. We aim to review the literature investigating the importance of exercise in oldest-old adults. Moreover, our major goal is to present the effectiveness of exercise designed to improve physical function in oldest-old adults. An effective exercise protocol for oldest-old adults is characterized by an intervention period of 24 weeks, intervention frequency of 2 or 3 times per week, and intensity of reserve heart rate ranging from 40 to 60%. Although exercise intervention had a uniformly positive impact on physical function, regular physical exercise seemed to be more beneficial in oldest-old adults. Further studies are necessary to investigate the systematic review in physical exercise and oldest-old adults.

＜Key-words＞
intervention, oldest-old adults, physical exercise, physical performance.

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Corresponding author: kohzuki@med.tohoku.ac.jp (Masahiro KOHZUKI; Japan)

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I. Super-Aged Society: older population.

The World Health Organization (WHO) defined an "aging society" as one in which more than 7% of the population is 65 years or older, an "aged society" as a society in which more than 14%, and a "super-aged society" as a society in which more than 21% (Tahara, 2016). Since 2013, Japan has been a super-aged society in which more than 25% of the population is 65 years or older (Tahara, 2016; Arai, Ouchi, Toba et al., 2015).

In Japan, the population dynamics in the last half century (1950s to 2010s) show drastic changes. In the 1950s, the older adult population occupied merely 5% of the total population, and the life expectancy was only approximately 60 years. In contrast, since 2017, Japan has been a super-aged society in which more than 28% of the older adult population (Arai, Ouchi, Toba et al., 2015; Suzuki, 2018).

As of 2017, the total Japanese population was 126.7 million, which included 35.2 million people aged ≥65 years (27.7%) and 17.5 million people aged ≥75 years (13.8%). Henceforth, the oldest-old (aged ≥85 years) and old-old (aged ≥75 years) population will increase rapidly compared with the young-old population (aged 65–74 years) in Japan (Suzuki, 2018). In other words, 1 in 4 Japanese individuals is an older adult. The population of Japan is predicted to continue to grow in the future (Suzuki, 2018). In addition, the 2017 statistics revealed an average life expectancy of approximately 87 and 81 years in women and men, respectively.

Older age has been shown to be a risk factor for age-related decline in specific areas, physical decline predisposes to loss of independence, poor quality of life, and hospitalization (Arai, Iinuma, Takayama et al., 2010; La Grow, Yeung, Towers et al., 2013). Particularly, oldest-old adults aged ≥85 years are more vulnerable to chronic diseases and disabilities; therefore, concerns about their healthcare are increasing (Ansai, Aurichio, Gonçalves et al., 2016). Moreover, prevention of physical and mental disability is a key factor for successful ageing in oldest-old adults (Ansai, Aurichio, Gonçalves et al., 2016; Orr, de Vos, Singh et al., 2006)

II. Geriatric Syndrome: "Frailty" and "Frail"

Frailty is the term used to indicate a geriatric syndrome characterized by reduced homeostatic reserves, which exposes the individual to an increased risk of negative health-related events, such as falls, disability, hospitalizations, and mortality (Rodríguez-Mañas, Féart, Mann et al., 2012; Clegg, Young, Iliffe et al., 2013). Different operational definitions have been proposed for capturing frailty status, with each one focusing on specific aspects of the syndrome and detecting slightly different risk profiles (Cesari, Landi, Vellas et al., 2014). The terms frailty and frail are often used in the literature without clear criteria; there is not yet a consensus on a standardized and valid method for clinical screening of frailty. The most well-known definition is the frailty

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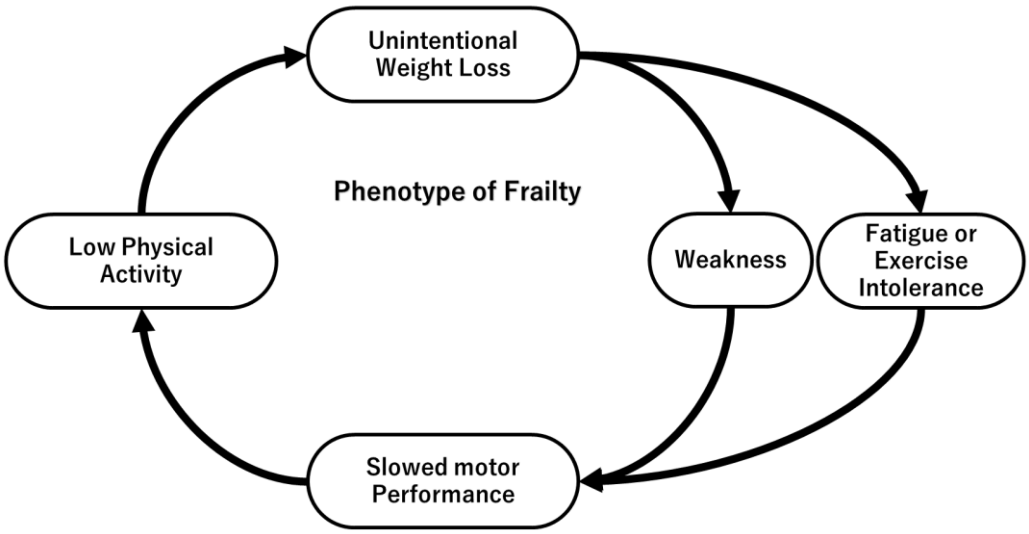
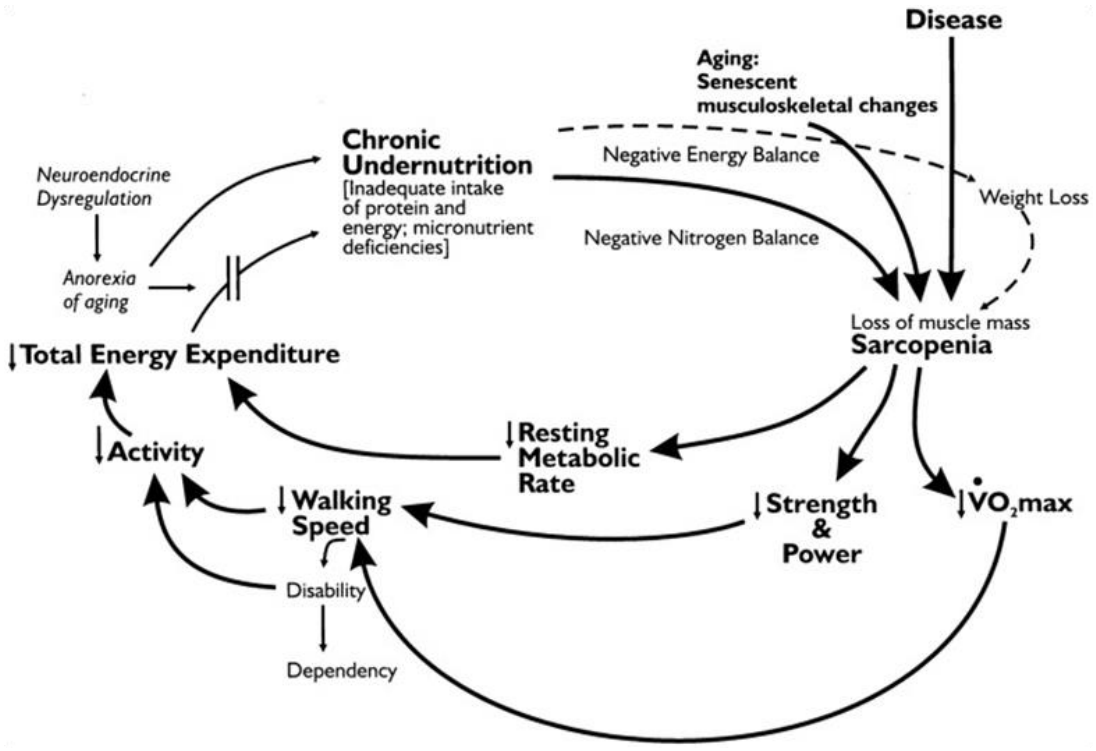
phenotype described by Fried et al (Fried, Tangen, Walston et al., 2001; Fried, Xue, Cappola et al., 2009)



(Adapted from Fried LP, et al. J Geronrol A Biol Sci Med Sci. 2009;
Liu CK, et al. Cli Geriatr Med. 2011)

<Figure 1> Component frailty



(Adapted from Fried LP et al, . J Gerontol A viol Sci Med Sci. 2001.
Negm AM, et al. Pilot Feasibility Study. 2018)

<Figure 2> Frailty Cycle

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Fried et al. characterized frailty as unintentional weight loss (≥ 4.5 kg in the past year), weakness, fatigue or exercise intolerance, slowed motor performance, and low physical activity in individuals (Fig 1). Older adults were considered pre-frail if they had 1 or 2 of these characteristics; they were considered frail if they demonstrated at least 3 of these characteristics (Fried, Xue, Cappola et al., 2009; Liu & Fielding et al., 2011).

In addition, the cycle of frailty model proposed by Fried et al in 2001 (Fig. 2) identified key elements of frailty (Fried, Tangen, Walston et al., 2001; Negm, Kennedy, Ioannidis et al., 2018). The core elements of the frailty cycle incorporated the main frailty markers, including age-associated physical declines in activity, strength, balance, and walking speed (Liu & Fielding et al., 2011). The proposed intervention components aimed to improve all frailty markers of the frailty cycle (Fig 2).

Pre-frail oldest-old adults have an increased risk of falls, hip fractures, and disability as well as of becoming subsequently more frail than young-old adults (Woods, LaCroix, Gray et al., 2005; Shirooka, Nishiguchi, Fukutani et al., 2017). Therefore, maintaining a non-frail and healthy status is important for prevention of various adverse outcomes. This prevention requires exercise interventions plus the treatment of disability aimed at reducing the risks of complications in older adults.

III. Physical Exercise in oldest-old adults: literature review

In recent years, increased physical exercise and exercise intervention have been proposed as preventive strategies for frailty and its adverse outcomes, as they can target 4 of the frailty criteria. This literature review aims to investigate the effect of exercise interventions on improving physical function in oldest-old adults (Ansai, Aurichio, Gonçalves et al., 2016; Cho, Han, Sung et al., 2017; Kapan, Winzer, Haider et al., 2017). Three studies published between 2016 to 2017 were included in the review. Two studies were randomized control trials (RCTs) and one were nonrandomized control trials (NRCTs).

Table 1 presents the characteristics and summary of the exercise interventions. The researched studies encompassed a sample population of 59 oldest-old adults, with a mean age of 84.3±3.7 years. Exercise time of three studies, ranging from 16(Ansai, Aurichio, Gonçalves et al., 2016), 24(Kapan, Winzer, Haider et al., 2017) to 48h (Cho, Han, Sung et al., 2017) over 16 to 24 weeks reported statistically significant improvements in physical function; strength and balance.

One of the 3 studies used multicomponent exercise with aerobic, strength, and balance exercises (Ansai, Aurichio, Gonçalves et al., 2016). One study included aerobic exercise (Cho, Han, Sung et al., 2017) and one included strength exercise (Kapan, Winzer, Haider et al., 2017). Two of the studies used an ergometer machine for aerobic exercise (Ansai, Aurichio, Gonçalves et al., 2016; Cho, Han, Sung et al., 2017). Two studies used the following strength exercises: (1) exercise intensity ranging from 14 to 17 on the Borg

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conventional scale; progression was carried out by increasing to 15 repetitions and an incremental load of 1 kg (Ansai, Aurichio, Gonçalves et al., 2016) and (2) exercise performed in two sets, with 12-15 repetitions until muscular exhaustion (Kapan, Winzer, Haider et al., 2017).

<Table 1> Summary of study details for papers included in literature review

Study	Participants and Intervention	Exercise Intensity	Outcomes and Findings
Ansai, Aurichio, Gonçalves et al., (2016)	RCTs n=23, community-dwelling healthy. Age, mean±SD: 82.6±2.6 Multicomponent Exercise (60min/session, 1time/week,4-month) 1) 5 min of warm-up 2) 13 min of aerobic exercise 3) 15-20 min of strength exercise 4)10 min of balance exercise. 5) 5 min of cool-down	Aerobic exercise: ranged 60 to 85% reserve heart rate. Strength exercise: ranged from 14 to 17 on the borg scale. Balance exercise: Dynamic and static weight transfer, Walking on a line.	Outcomes 1)Muscle strength: sit-to-stand 2) Balance: one-leg standing 3) dual task: TUG 4) Falls Findings Significant increase in muscle strength and balance, no significant dual task and Falls.
Cho, Han, Sung et al., (2017)	NRCTs n= 10, community-dwelling healthy. Age, mean±SD: 85.2±2.4 Aerobic Exercise (40min/session, 3time/week,6-month) 1) 5 min of stretching(warm-up) 2) 30 min of aerobic 3) 5 min of stretching(cool-down)	Aerobic Exercise: ranged from 40 to 60% reserve heart rate. Borg scale of 11(light) to13(Somewhat hard).	Outcomes 1)SPPB: 3test balance, gait speed, lower strength. 2) QOL: SF-12 Findings Significant increase in SPPB total score, balance, lower strength, SF-12. No significant gait speeds
Kapan, Winzer, Haider et al. (2017)	RCTs n= 26, pre-frail. Age, mean±SD: 84.0±6.0 Physical Exercise (60min/session, 2time/week,3-month) 1)5 min of warm-up 2) 50 min of six strength exercise 3) 5 min of cool-down	Six strength exercise: ranged 12 to 15 repetitions.	Outcomes 1) SPPB, 2)handgrip strength, 3) PASE 4) WHOQoL Findings Significant increase in SPPB total score, PASE total score, no significant handgrip strength and WHOQoL.

Note: NRCTs; nonrandomized control trial. PASE; Physical Activity Scale for the Elderly, RCTs; randomized control trial. SPPB; Short physical Performance Battery, TUG; Timed Up and Go test. WHOQoL; World Health Organization Quality of Life, SF-12; 12-Item Short-Form Health Survey.

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Table 1 also presents the outcomes and significance values of the 3 included studies. All studies reported statistically significant effects of physical function, such as muscle strength, lower body strength, and balance (Ansai, Aurichio, Gonçalves et al., 2016; Cho, Han, Sung et al., 2017; Kapan, Winzer, Haider et al., 2017). Moreover, one study showed a significant on health-related quality of life (Cho, Han, Sung et al., 2017). Multicomponent and aerobic exercises appeared to have the greatest impact. These studies have shown that physical exercise in oldest-old adults protects against the diverse components of frailty by increasing muscle strength and balance.

IV. Conclusion

In a literature review of the importance of exercise interventions for the frailty and frail in oldest-old adults. It was found that even though the participants were oldest-old and frail, the exercise adherence was high with no adverse events, supporting that exercise was safe and feasible (Ansai, Aurichio, Gonçalves et al., 2016; Cho, Han, Sung et al., 2017; Kapan, Winzer, Haider et al., 2017).

An effective exercise protocol for oldest-old adults is characterized by an intervention period of 24weeks over, an intervention frequency of two or three times per week, intensity of ranged from 40 to 60% reserve heart rate. Although exercise intervention uniformly had a positive impact on physical function, regular physical exercise seemed to be more beneficial in oldest-old adults.

In conclusion, Regular exercise intervention in physical and mental function is a key point for successful ageing in oldest-old adults. However, this study is literature review, further studies are necessary to investigate the systematic review in physical exercise and oldest-old adults.

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Faculty of Education, University of the Ryukyus, 1 Senbaru, Nishihara, Nakagami, Okinawa, Japan
FAX: +81-098-895-8420 E-mail: ashs201091@gmail.com
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