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The word ‘Human Services’ is used when someone faces social challenges for ‘help’ or ‘support’ people.

‘Human Services’ is expanding rapidly its area such as field of social welfare, medical, nursing, clinical psychology related mental care, health promotion for aging society, assist family for infant and child care, special supporting education corresponding to vocational education, education support sector corresponding to era of lifelong learning and fluidization of employment corresponding to the area of career development.

Human Services area, if its research methods are scientific, is internationally accepted and greater development is expected by collaborative research which is performed by multinational and multi-profession.

This journal aims to contribute to the progress and development of Asian Human Services.

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ORIGINAL ARTICLE

Male Caregivers Get Coping to Nursing care with Dementia Living at Home

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ABSTRACT

Object: Clarify male caregivers get coping to Nursing care with dementia living at Home.
Patients/Materials and Methods: The subjects were 298 male caregivers. Nursing care burden was assessed using the Zarit Caregiver Burden Scale. Ability to cope with care problems was assessed using the Nursing Care Problems Coping Scale for Male Caregivers for People with Dementia Living at Home. It is clarify that significant correlations between the five coping styles of the NCSM and J-ZBI, long-term care need.
Results: There was a significant correlation ($P < 0.04$) between the point (index) of NCSM and Zarit Caregiver Burden Scale. A positive significant correlation was found in three coping styles. A negative significant correlation was found in one coping style, and no significant correlation in one coping style. There was a significant correlation ($P < 0.04$) between the point (index) of NCSM and Zarit Caregiver Burden Scale. A positive significant correlation was found in the 'Solve the problem' coping style.
Conclusion: Solve the problem style constitution categories are revise, Information gathering, planning, learn from the experience of caring. To focus coping is Male Caregivers Get Coping to Dementia Living at Home. And to reduce the care burden of this style of caregiver, it is important to help how caregivers with this style can be helped. Solve the problem style is effective continue nursing care problems coping style.

＜Key-words＞male caregivers, dementia, coping, period spent providing nursing care.

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I. Introduction

In Japan, the number of older adults with dementia requiring nursing care is increasing. By 2025, this figure is expected to reach more than 7.00 million [1]. With a rapidly aging population and greater life expectancy [2], it is estimated that by 2025, 25% of the population over the age of 65 years will have dementia[3].It has also tried to strengthen public and private efforts to improve care and support for people with dementia and their caregivers. Dementia is a syndrome in which there is deterioration in memory, thinking, behavior and the ability to perform everyday activities[4]. Extra care is required for people with dementia with behavioral and psychological symptoms, which places a burden on caregivers and may damage their psychological health4). In Japan, families with just two or one living accounted for 36.7% of the total number of households in 2010, but this is expected to change because of a change in family structure and an increase in family size [5]. Therefore families with just two or one living accounted for 58.4% of the total number of households in 2035[6].17.0% of the population were unmarried men in their fifties in 2010, but this is expected to increase to 25.2% by 2030. The proportion of unmarried men in their sixties was 9.1% in 2010, but is expected to more than double to 19.8% by 2030. The number of male caregivers of people living at home is increase [7].

Male caregivers have been reported to have health problems and social issues[8]. They suffer from depression[9], tension[10], and dissatisfaction, and their needs are not represented. Male caregivers often do not seek counseling or support from friends or other people[11] and they can easily become isolated from their local community [12]. They are often so devoted to the care they provide that they cannot work or pursue personal interests [13]. The problems that male caregivers face can affect each other, reducing quality of life and affecting psychological condition[14]. Male caregivers often experience problems providing care, and these problems are not effectively managed. It is predicted that male caregivers will be found not to ask friends and family to help solve nursing problems. Male caregivers are also more likely to abuse the person for whom they are providing care [15].

The purpose of this study was to clarify male caregivers get coping to dementia Living at Home. So the relative period spent providing nursing care and coping of care problems male caregivers for people with dementia living at home.

II. Subjects and Methods

1. Subjects and Procedures

The subjects were 762 male caregivers.

Measurements

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We wanted to examine issues of age, relationship with the caregiver, employment situation and period spent providing nursing care. It was thought that support might vary with employment status, so we also asked about whether the person was employed or unemployed.

We ware advanced along a concept framework of Lazarus Coping theory. We used several scales, including the Japanese version of the Zarit Caregiver Burden Scale (J-ZBI)[16], The Care Problems Coping Scale, or Nursing Care Problems Coping for Male Caregivers for People with Dementia Living at Home (NCSM)[17;18;19;20;21].

2. Data Collection

1) J-ZBI: This scale Cronbach's α is 0.93. This scale consists of 22 items, and is a care burden scale that was translated into Japanese by Arai et al. Its reliability and validity have been verified, and it has been used in many previous studies in Japan. Its main focus is the burdens arising from providing care, having to start to provide care, and overall. It uses a five-point Likert-type scale with choices ranging from never = 0, through rarely = 1, sometimes = 2, and quite often = 3 to nearly always = 4.

2) NCSM: This scale Cronbach's α is 0.76. This scale consists of 15 items and five factors. Its main focus is nursing care problems encountered by men caring for someone with dementia at home. The five factors are divided into 'Solve the problem', 'Emotional avoidance', 'Cognitive transformation', 'Careful supervision and waiting' and 'Assistance request' styles of coping.

We also asked about the care recipient's age, diagnosis of dementia and level of certification of long team care need.

3. Statistics analysis

We performed two main statistical analyses:

We looked at the answer distribution compared with the mean and standard deviation that male caregivers of age, relationship with the caregiver, employment situation, period spent providing nursing care and J-ZBI. Add people with dementia of age, diagnosis of dementia, level of certification of long-term care need. We examined correlations between NCSM scores, period spent providing nursing care and the J-ZBI; Peason's correlation coefficient.

All statistical analyses were performed using the Japanese version of SPSS22.0 for Windows. The level of statistical significance was set at 0.05 (two-tailed).

4 Ethical approval

We obtained ethical approval for this study from the ethics committee of Fukuoka University (approval code: 13-7-07). The study conforms to the provisions of the Declaration of Helsinki in 1995 (as revised in Tokyo in 2004). Consent was obtained from hospitals, a care facility, and the Men's Caregiver and Family Association. The purpose of

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the study was explained orally and in writing to the relevant parties. Subjects were informed that their information and data would be treated confidentially. Subjects gave their consent by returning completed questionnaires.

III. Results

1. Subject Characteristics

We received valid responses from 298 people, a response rate of 39.1%. The mean subject age was 70.1 (SD 11.2) years. The care recipient was the caregiver's wife in 190 cases (63.8%), the parent of the caregiver in 103 cases (34.6%), and another relative in four cases (0.2%). Of the respondents, 99 (29.9%) were employed, of whom 43 (14.4%) were farmers, 28 (9.4%) were company employees, and 24 (8.1%) worked in a family-operated business. The mean period spent providing nursing care was 12.0(SD 8.6) years. The J-ZBI of overall care burden mean score was 2.1 (SD 1.2) (see Table 1).

Table 1 . Demographic information of respondents.

Variable		Results (%)
Age	Mean age	70.1 SD 11.2
Relationship with the caregiver	Wife	190 (63.8)
	Parent	103 (34.6)
	Other relative	4 (0.2)
Employment status	Employed	99 (29.9)
	farmer	43 (14.4)
	company employee	28 (9.4)
	family-operated business	24 (8.1)
	Unemployed	104 (34.9)
Period spent providing nursing care.	The mean time（years)	12.0 SD 8.6
J-ZBI*	Mean point score (SD)	2.1 SD 1.2

*Japanese version of the Zarit Caregiver Burden Scale

2. Overview of care recipients

The mean age of the care recipients was 78.1 (SD 9.8) years. In total, 179 (54.6%) had Alzheimer's type dementia, 68 (28.8%) had Lewy body type, 8(2.8%) had front-temporal lobar degeneration. (See Table 2).

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Table 2 Overview of the people with dementia

Variable		Results (%)	
Age	Mean	78.1	SD 9.8
Diagnosis of dementia	Alzheimer's type	179	(54.6)
	Lewy bodies	68	(28.8)
	Frontotemporal lobar degeneration	8	(2.8)
	Cerebrovascular type	9	(2.7)
	Pick type	4	(1.2)
Level of certification of long-term care need	Care support 1 or 2	20	(6.7)
	Care need 1	65	(21.8)
	Care need 2	47	(15.7)
	Care need 3	41	(13.7)
	Care need 4	41	(13.7)
	Care need 5	53	(17.8)
	Not applicable or unspecified	31	(10.4)

Note. Care support is a less intensive level of support required than care need.
The numbers refer to increasing levels of care required.

3. Significant correlations between the five coping styles of the NCSM and J-ZBI.

As 'Solve the problem' coping style and the J-ZBI ware r = 0.26, There was a significant positive correlation. As 'Emotional avoidance style' coping style and the J-ZBI ware r = - 0.31, there was a significant negative correlation. As 'Cognitive transformation style' and the J-ZBI ware r =0.24, there was a significant positive correlation. As 'Careful supervision and waiting style' coping style and the J-ZBI were not significant correlation. As 'Request assistance style and the J-ZBI ware r =0.18, there was a significant positive correlation (See Table 3).

4. Significant correlation between coping style and period spent providing nursing care.

As 'Solve the problem' style and period spent providing nursing care ware r = 0.17, there was a significant positive correlation. As 'Emotional avoidance style' and period spent providing nursing care ware not significant correlation. As 'Cognitive transformation style' and period spent providing nursing care ware significant correlation. As 'Careful supervision and waiting style' and period spent providing nursing care were not significant correlation. As 'Request assistance style' and period spent providing nursing care were not significant correlation (See. Table 3).

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Table 3. **Significant correlations between five coping styles of the NCSM and period spent providing nursing care.**

		J-ZBI	Period spent providing nursing care.
1	**Solve the problem type**		
	I collect information to help with nursing care.		
	I plan for when to do nursing care.	0.26 **	0.17 **
	When nursing care is not successful, I think about the possible caus		
	I think that one can learn from the experience of caring.		
2	**Emotional avoidance type**		
	I think that providing nursing care is not my responsibility.		
	I think that providing nursing care is seen as shameful.		
	I think it is pathetic to provide even this much nursing care.	-0.31 **	n.p
	I become emotional or destroy things.		
	I try not to look as I provide nursing care.		
3	**Cognitive transformation type**		
	Having to provide care has been imposed on me.	0.24 **	n.p
	I will try hard to provide nursing care.		
4	**Careful supervision and waiting type**		
	I will wait until I can provide good nursing care.	n.p	n.p
	I am optimistic that I will improve.		
5	**Assistance request type**		
	I ask for help from neighbors, family and/or relatives.	0.18 **	n.p
	It is a heavy burden to provide nursing care, so I get support from family members and the people around me.		

Peason`s correlation coefficient. **p 0.01
J-ZBI: Japan Zarit Caregiver Burden Scale
NCSM; Nursing Care Problems Coping Scale for Male Caregivers

IV. Discussion

We aimed to clarify the male caregivers get coping to dementia Living at Home. And this study is contribute to male caregivers. This study is relative period spent providing nursing care and coping of care problems male caregivers for people with dementia living at home. The significance of this study is that it focuses only on men, and therefore demonstrates their particular problems providing care. Men may have particular issues in coping with a nursing care problem[7] .When a male caregiver has trouble with providing nursing care, previous studies have shown that they do not tend to ask for external support [22]. They has troubled that go to work or remain at home[23]. However, I have to more evaluation of nursing care problems coping, son or husband, employed caregiver or not, they have emotional supporter[24.25] or not.

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1) Solve the problem style

J-ZBI has a positive correlation with 'solve the problem' style in male caregivers, and this style is also connected with the period spent providing nursing care. Solve the problem style constitution categories are revise, Information gathering, planning, learn from the experience of caring. To focus coping is Male Caregivers Get Coping to Dementia Living at Home. And to reduce the care burden of this style of caregiver, it is important to help how caregivers with this style can be helped. Solve the problem style is effective. Continue nursing care problems coping style[24]. It is same report of Miyasaka[25]that period spent providing nursing care is important to satisfied and continuing caregiver.

2) Emotional avoidance style

This style is negatively correlated with J-ZBI, and this style is a not connected with the period spent providing nursing care. Therefore Emotional avoidance style is not get with a period spent providing nursing care coping. This coping style tend to be a suicide and murder by care providers[26]. This style is a case for formal intervention to safeguard the care recipient.

3) Cognitive transformation style

This style is positive correlated with J-ZBI, and this style is a not connected with the period spent providing nursing care. Cognitive transformation style can invest all their time and energy in providing care, increasing their social isolation to serious levels[31]. Therefore Cognitive transformation style is not get with a period spent providing nursing care coping.

4) Careful supervision and waiting style.

There were no correlations between this style and J-ZBI, period spent providing nursing care. Therefore Careful supervision and waiting style is not get with a period spent providing nursing care coping.

5) Assistance request style.

This style has positive correlations with J-ZBI and this style is not connected with the period spent providing nursing care. These caregivers tend to support[20]. Therefore Assistance request style is not get with a period spent providing nursing care coping. Thus, Solve the problem style is effective continue nursing care problems coping style.

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ORIGINAL ARTICLE

Study on Triage Education for Nursing Students
:Analysis of Their Errors in Triage

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ABSTRACT

START is a system of primary triage performed on casualties at the scene of a mass-casualty incident. START is an acronym for "Simple Triage and Rapid Treatment" by which casualties are sorted into four triage categories. After conducting the triage simulation exercises, the authors realized that some students repeated the same errors despite having completed the triage classes. The purpose of this study is retrospectively to examine some mis-categorized cases to identify causes of triage errors, and thereby inform the future design of courses for triage education.

one hundred and fifteenth fourth-year university nursing students at a university in Kyushu, Japan who completed a two-day disaster nursing course. Nursing students were asked to fill out an answer sheet in the first session (hereafter referred to as "pre-intervention") and again in the second session held a week later (hereafter referred to as "post-intervention"). Many of those were about mis-categorizing "green" casualties as "yellow" and vice versa, which implied that students had difficulty in making triage decisions between the "walking wounded/minor" and "delayed" categories.

The results of the study showed that most students were likely to answer the triage questions largely based on their perception of visual information (such as video images) rather than on triage criteria.

＜Key-words＞
triage education, nursing students, triage error, triage simulation, visual information

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I. Introduction

START is a system of primary triage performed on casualties at the scene of a mass-casualty incident. START is an acronym for "Simple Triage and Rapid Treatment" by which casualties are sorted into four triage categories. The purpose of using this system is to filter casualties with minor injuries from the remainder, and determine the severity and urgency of a large number of casualties' injuries in a short time(Joan,2014). A university in Japan has been offering courses in disaster medical response, disaster nursing and triage since 2003(Sethuko,2011). From 2004 to 2009 the university invited instructors from Tokyo DMAT (Tokyo Metropolitan Government Disaster Medical Assistance Teams) to provide disaster medical response training for physicians, registered nurses, paramedics, administrators and nursing students. The training consisted of classroom sessions and field training exercises covering such topics as triage, medical care at aid stations and sites littered with rubble, information and communication, and response to extraordinary events including NBC incidents(Kazuyuki,2011; Kazuyuki,2012). A post-training comparative survey to assess the educational impact of the training on registered nurses and nursing students showed the same degree of effects on both groups(Kazuyuki,2011). A follow-up survey of the same groups performed a year later found that the knowledge gained through a field training exercise was far better retained in their memory than that acquired through desktop learning(Kazuyuki,2012).

A number of studies have reported on the effectiveness of simulation education, including field training exercise, both in Japan and abroad(Matthew F, 2007)(Patricia, 2014; Nancy , 2012; Ian, 2015). Although the field training exercise at the above-mentioned university was also proven to be effective, it was difficult for the university to continue to organize a field training exercise for nursing students every year. In an effort to complement desktop learning, the university introduced a triage simulation exercise using video content to allow the students to practice triaging casualties. After conducting the triage simulation exercises, the authors realized that some students repeated the same errors despite having completed the triage classes, and in addition, multiple students gave the same wrong answers to certain questions. The authors had predicted that the students would have difficulty in making triage decisions between the "yellow" and "red" categories most probably because they would be unable fully to understand the levels of severity for those categories. Contrary to that prediction, students' test records indicate that they wavered most between the "green" and "yellow" categories, both before and after the triage classes.

A review of literature relevant to triage found a few articles published in international journals. Leibovici, et al. (1997) conducted a study to identify possible errors in triage by analyzing medical records of victims(Dan,1997). Brannigan, et al. (2006) noted the difficulty in triaging casualties with seemingly minor injuries as some of

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them can deteriorate afterwards, and further pointed out the possibility that triage decisions are not made appropriately (Laura, 2006). Bhalla, et al. (2015) sought to determine the efficacy of START and SALT (Sort, Assess, Life-saving interventions, Treatment and transport) in predicting clinical outcomes(Mary, 2015) and concluded that both systems resulted in many under-triaged patients. The above studies have revealed the difficulty students find in distinguishing patients in the "green" category from those in the "yellow" category. The authors believe that it is important to identify factors behind such difficulty for the future advancement of disaster medical response.

The purpose of this study is retrospectively to examine some mis-categorized cases to identify causes of triage errors.

II. Subjects and Methods

1. Subjects and Procedures

Participants: 115 fourth-year university nursing students at a university in Kyushu, Japan who completed a two-day disaster nursing course

1) From the class of 2012: 66 participants

Valid response rate: 97.0%.

(In 2012, 68 students took the course. Two were eliminated from the study as they missed one of the two days of the course.)

2) From the class of 2013: 49 participants Valid response rate: 96.0%.

(In 2013, 52 students took the course. Three were eliminated from the study as they received triage training in an elective course.)

3) Average age ± standard deviation（SD）

Class of 2012: 21.9 ± 1.28 yrs. Class of 2013: 22.1 ± 1.47 yrs.

In total, 115 students with no prior experience of triage training participated in this study.

2. Data Collection

Nursing students who took the disaster nursing course in 2012 and those who took it in 2013 were asked to fill out an answer sheet in the first session (hereafter referred to as "pre-intervention") and again in the second session held a week later (hereafter referred to as "post-intervention"). The answer sheets were used for data analysis.

1) Instructions in triage classes

In the first session, the instructor briefly explained the concept of START triage, then showed a commercially-available triage simulation video (with case examples) [13] and asked the students to make a triage decision on each case and fill in the answer sheet. The students were then taught in detail about triage. In the second session, held a week later, they spent the first 30 minutes reviewing the previous session, then watched the

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same video, writing their triage decisions on the answer sheet as they had a week before. In both sessions they used the same answer sheet format with a comment box in which they were asked freely to write their impression about their triage exercise or any other comments. The question sheets were collected after each session.

<Course contents>

START triage: "Purpose of triage", "Situations that require triage", "Categories of treatment priority"

How to perform triage: "Color coding for each category - walking wounded/minor (hereafter referred to as 'green'), delayed (hereafter referred to as 'yellow'), immediate (hereafter referred to as 'red') and deceased/expectant (hereafter referred to as 'black')", and "Triage algorithm – ability to walk, spontaneous respiration, respiratory rate, mental state, and radial pulse/capillary refill time (CRT)"

2) Ethical considerations

This study was conducted with ethics committee approval (28-11) from Junshin Gakuen University. The same answer sheet format was used for both pre- and post-intervention tests for ease of comparison. The format included entry fields for age and sex, but no other personal information about the students.

3) Definition of terms

Visual: something that immediately conjures up an image for the viewers

Visual information: images presented through media such as videotape

4) Study components

Age of the participants

Answer data from pre-and post-intervention tests (30-question tests; each correct answer is worth one point; full score is 30)

Free-text comments: challenges they faced in learning triage or any other comments

3. Statistics analysis

1) SPSS Statistics 23 was used as a tool for statistical analysis.

Although age is a basic attribute of the classes of 2012 and 2013, the population of this survey was limited to fourth-year university nursing students and it did not follow a normal distribution. Therefore the Mann-Whitney U test was used to see if there was any variation due to age difference.

As the common type of data extracted from pre- and post-intervention tests are four-choice answers (green, yellow, red and black), the authors predicted that the answers would not be distributed evenly among the choices. Additionally, the population did not follow a normal distribution. Therefore the Wilcoxon signed rank test was used to analyze the data.

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2) Analysis of free text

Content analysis was used as a method to analyze the free-text data written by the participants about challenges they faced in learning triage, or any other comments. As cutting every word out of each sentence would alter the implications of the free-texts, complete sentences were processed as entire units so that all the meaning of a sentence could be extracted. The data were then classified into medium and large categories, and indices were created for the large category. Data analysis was done by three co-authors (two doctoral course students and an associate professor) who have experience in content analysis. The lead author, a graduate school student (a different individual from the co-authors) and a faculty member of a nursing college who holds a Master's degree in nursing calculated the kappa coefficient to measure the inter-rater agreement. The inter-rater agreement about "challenges faced in learning triage and any other comments" was 88.5% in the pre-intervention test, and 87.2% in the post-intervention test.

III. Results

1. Analysis results before education and after education

The absence of significant difference in age as a basic attribute between the classes of 2012 and 2013 implies that they can be regarded as the same population.The average test score out of 30 and standard deviation were 21.98 (±5.76) in the pre-intervention test and 28.47 (±1.79) in the post-intervention test. These results showed a higher rate of correct answers ($p=0.0001$) as well as a significant development of knowledge about triage after the triage classes even though there was a one-week interval between the tests. (Table 1) Analysis of questions the students answered incorrectly in those tests revealed some tendencies. Many of those were about mis-categorizing "green" casualties as "yellow" and vice versa, which implied that students had difficulty in making triage decisions between the "walking wounded/minor" and "delayed" categories. Further analysis found that out of 30 questions, six questions led to certain patterns of incorrect answers. Five out of those six questions led the students to assign a casualty who should have been assigned to the "yellow" category to "green". Four out of those five questions related to "a casualty who walked in supported by someone", and the other was about "a child casualty arriving in his/her parent's arms". These patterns of incorrect answers indicate that the students wavered between the "minor (green)" and "delayed (yellow)" categories. Analysis of the remaining question, which also had a high rate of incorrect answers showed that the students also had difficulty in deciding between "immediate (red)" and "delayed (yellow)" categories. (Table 2)

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2.Analysis result of free description

Some common free-text comments found in the pre-intervention test answer sheets wereabout, in order of frequency, "difficulty in sorting casualties", "specific questions about triage", and "importance of triage", while in the post-intervention test answer sheets, most of them were about "importance of START triage", followed by "difficulty in deciding between 'green' and 'yellow' categories", and "the psychological burden of having to assign a casualty to the 'black' category". What caught the authors' interest was that many of the students who mis-assigned casualties in the "yellow" and "green" categories wrote that "it was difficult to decide between 'green' and 'yellow' categories." These results indicate that the casualties who "walked with someone's assistance" and those who "appeared to be severely injured" confused the students when making triage decisions. (Table 3, 4)

<Table 1>
Rate of correct answers in pre- and post-intervention tests Wilcoxon signed rank test

	mean	Standard deviation	p-value
pre-intervention	21.98	5.76	0.0001
post-intervention	28.47	1.79	

Table 2: Questions with high rate of wrong answers and number of respondents who made each answer choice
*underlined bold figure: number of respondents who made a wrong choice in the post-intervention test

Question number	Correct answer	number of respondents		
		green	yellow	red
4	red	0	**10**	105
18	yellow	**26**	84	5
21	yellow	**26**	87	2
23	yellow	**29**	84	2
24	yellow	**34**	79	2
27	yellow	**36**	77	2

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Table 3: Content analysis of free-text data from pre-intervention test "Challenges faced in triage exercise and any other comments"

"Difficulty in sorting casualties" (data count: 15)
● I found it difficult because I thought the casualty's category may differ depending on the body part affected by fractures or burns.
● A casualty with head contusion might be at risk of developing intracranial hemorrhage. I wondered whether his/her triage category would change at the time of examination and treatment and whether it was right to assign him/her to the "green" category.
● I had difficulty in deciding a category for a casualty with stable vital signs wondering if it might be better to assign him/her to the "red" category.
● Perception of pain may differ due to age or among individuals even for minor injury. It was hard to make triage decisions taking into account such difference and potential impact of shock from injury.
● I wondered whether I should upgrade a casualty in the "green" category with relatively severe injury to the "yellow" category.
● If I tried to base my triage decisions on both the casualty's actual state of injury and complaints, I would be misled into believing that everyone is severely injured.
"Specific questions about triage" (data count: 13)
● When triaging a pregnant woman, to what extent do I need to take the state of the fetus into consideration?
● Is it necessary to consider age as a factor? Is adult triage different from pediatrics?
● I was told to assign casualties who can walk to the "green" category. Does it really mean that their condition would never worsen?
"Importance of triage" (data count: 9)
● It is hard to imagine the feeling of the families of casualties who were assigned to the "black" category thinking that they might have survived otherwise.
● As my decision may mean someone dies, I need to acquire correct knowledge.
● I need to have the ability to anticipate what will happen next and make appropriate decisions.

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Table 4: Content analysis of free-text data from post-intervention test "Challenges faced in triage exercise and any other comments"

"Importance of START triage" (data count: 59)
● Triage is an important system meant to save the greatest number of casualties by prioritizing them for treatment. ● The classes were helpful in learning specific criteria such as "ability to walk". ● I could learn specific procedures of triage after exercising triage based on some case examples. ● Accuracy of triage decisions may be highly variable depending on our knowledge of START triage. ● I could understand that START triage will help us perform triage smoothly and fulfill the significance and purpose of disaster nursing.
"Difficulty in deciding between 'green' and 'yellow' categories" (data count: 7)
● Although by START criterion, a walking-wounded casualty should be assigned to the "green" category, I may become afraid of doing so in a real-world situation. ● It is difficult to determine whether a casualty can or cannot walk with assistance in the START triage system. ● It is difficult to make a triage decision on a casualty who cannot walk unassisted but walked over to the aid station with someone's assistance. ● It makes me feel uneasy because even casualties who seemed to be severely injured are assigned to the "green" category in the START triage system. ● If I tried to base my triage decisions on both the casualty's actual state of injury and complaints, I would be misled into believing that everyone is severely injured.
"Psychological burden of having to assign a casualty to the 'black' category" (data count: 2)
● I imagine performing triage in a real-world situation would be rather hard. Some casualties may ask me to provide care, or there may be situations where treatment from child casualties must be withdrawn. ● When there are a large number of casualties, it may be psychologically challenging to sort some casualties into the "green" and "black" categories in order to save many lives.

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Figure 1: Case-based triage questions and correct categories. (○: yes, ×: no)

	Age	Sex	Diagnosis	Triage category	Walk	Breathing	Ventilatory frequency	capillary refilling time	Verbal contact	Heart rate
1	Infant	female	Dead Baby	Black	×	×	0	×	×	0
2	82	male	Cut of 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	Head blow	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	Radius 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	Bone fracture of the nose	Green	○	○	20	○	○	80
15	52	male	Head cut wound	Green	○	○	20	×	○	80
16	23	male	Pelvis bones fracture	Red	×	○	36	○	○	120
17	67	male	Finger joint cutting	Green	○	○	28	○	○	72
18	72	male	Upper part of the body burns	Yellow	×	○	28	○	○	112
19	36	female	Cervical spine sprain	Green	○	○	24	○	○	78
20	71	male	Eye puncture wound	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	Breaking water of the pregnant woman	Yellow	×	○	24	○	○	64
25	21	female	Left wrist bone fracture	Green	○	○	25	○	○	82
26	35	female	Sticks wound by the glass	Green	○	○	29	○	○	104
27	2	male	Right forearm second-degree burn	Yellow	×	○	28	○	○	92
28	51	female	Back of the head blow	Green	○	○	22	○	○	86
29	10	male	Wrist burns	Green	○	○	27	○	○	94
30	78	male	Intraoral injury	Green	○	○	24	○	○	74

black tag : Apnea group (death)　　red tag : Top priority treatment group

yellow tag : Standby treatment group　　green tag : Retention group (mild group)

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IV. Discussion

The average score of the post-intervention test (held a week later) provided a confirmation that the students' knowledge of triage had increased. As the participants were fourth-year university nursing students, the authors had predicted that their prior education in nursing would help them develop their knowledge of triage quickly. However, despite completing the triage classes, many students gave the same wrong answers to the questions they had answered incorrectly in the pre-intervention test, and many of those wrong choices related to the "yellow" category. The results of free-text analysis indicated the influence of visual information on the students' triage decisions. The triage simulation video used in the exercise contained some quite realistic depictions of injuries such as facial burns and open fractures which gave the impression that the casualties had suffered severe injuries. The key point of observation needed to assign a casualty to the "green" category is the ability to walk. However, the visual information from the video may have made the students wonder if it was right to assign the casualty to "green" category, worrying that his/her condition might take a sudden turn afterwards. It is also possible that their imagination held them back from making appropriate decisions. Moreover, "walking" means both walking unassisted and walking with assistance, but according to START triage criterion, unless the casualty is walking unassisted, he/she should be assigned to the "yellow" category. Some of the questions may have misled the students. One such question was about a casualty whose condition was stated in the question sheet as being "able to walk with assistance", but about whom the video clip gave the impression that he/she was walking unassisted but accompanied by someone. As the video image seemed more realistic, the students possibly relied mainly on the visual information in categorizing this casualty. It is conceivable that the students' perception of such video images is the cause of their hesitation in making triage decisions even when the casualty's condition is clearly stated, as for instance, "able to walk with assistance". Teaching triage by showing video content which depicts close to real-world scenarios can be difficult. However, allowing the students to make errors and send feedback will provide an opportunity to identify the cause of such errors(Laura, 2006)(Cynthia L, 2016) . Therefore, it is reasonable to assume that video-based simulation exercises can improve student learning.

In mass casualty incidents, over-triage is often accepted on the basis that it is better to err on the side of medical safety. But when under-triage occurs, a casualty who can wait but needs medical attention is assigned a lower treatment priority and this creates the risk of overlooking a casualty whose condition could deteriorate at any moment. If the assessment of "ability to walk", a criterion for determining between the "yellow" and "green" categories is confusing to students, it is important to take a focused approach in preparing them so that they will always adhere to the criterion under all circumstances. The results of the study showed that most students were likely to answer the triage

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questions largely based on their perception of visual information (such as video images) rather than on triage criteria. The authors believe that it is necessary to make the students aware of the need to adhere to the criteria in order to triage casualties appropriately, bearing in mind that their decisions are likely to waver in the face of visual information(Dan, 1997).

A casualty's complaints may also be a factor which makes triage decision difficult. Casualties' complaints of pain or suffering seemed to have caused the students to believe that those casualties were severely injured. There were several free-text comments that support this observation such as "by the appearance and complaints of the casualties, I was misled into believing that everyone was severely injured." It is said that in real-world mass casualty incidents, casualties who complain frequently are less likely to have severe injuries, while quiet casualties who cannot verbalize their pain are more likely to be suffering from severe injuries. Therefore, it is also important to remind students of the need to pay attention to this phenomenon when they perform triage.

There were fewer incorrect answers to questions regarding triage decisions around the "yellow" and "red" categories. A probable reason is that although both categories are for casualties with severe injuries, the criteria for "red" such as loss of consciousness and two-second or more of capillary fill time are clear and easily understood both visually and numerically. Although START is an important triage system, it is nothing more than a primary triage that only determines the severity of an illness or injury. Primary triage is followed by secondary triage, in which casualties are categorized for the levels of severity, and priorities of immediate medical treatment and transport to medical institutions. If the students are told about this process in detail beforehand and understand that casualties can be re-triaged in this recurrent process, they will be able to make more accurate triage decisions based on the casualty's current condition without worrying about potential deterioration afterwards, and it may help improve their skills in START triage.

This study found that when learning about triage criteria and using simulation video, students can place undue weight on the visual information even if the casualty's condition is clearly stated. This can lead to incorrect triage decisions. This finding has some important implications for START triage education in the future. The authors believe that it is necessary to make practical use of triage criteria and visual teaching resources while explaining in detail that relying solely on visual information would lead to incorrect triage decisions.

Ⅴ. Conclusion

Despite having learned about triage criteria, students were still greatly confused in making triage decisions even on cases of minor injury when visual information was realistic and gave an impression

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of severe injury. It also became clear that the triage criteria "walking" and "walking with assistance", was an area of common mis-categorization and that casualties' complaints about their pain and suffering were misleading to the students.

Limitations of this study

As the number of participants of this study is limited to 115, interpretation of its results requires circumspection. At this stage, the university can offer only video-based simulation exercises despite being aware that a more physically engaging learning experience is better in terms of students' memory retention. It is also a limitation of this study.

Future Challenges

As this study suggested the possibility of errors or confusion in triage decisions caused by visual information, future triage training should include and adhere to the basics of performing triage according to triage criteria before relying on visual information. The course content will continue to be revised, and the educational outcome thereof will be evaluated in order to help improve the quality of triage education. Currently, triage classes are offered only to fourth-year university nursing students. The authors plan in future to study and discuss whether decision-making and assessment abilities in triage are different between fourth-year students and first-year students with no knowledge of triage.

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ORIGINAL ARTICLE

The Role of Surgical Nurse in International Disaster Response (IDR) in Japan
: Recognition of the Medical Workers with Experience in IDR

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ABSTRACT

Objective: With regard to medical doctors and nurses who had participated in international disaster response(IDR), the purposes of the study were as follows:①To identify the factors related to recognition of the need for "surgical nursing practice" in IDR provided by Japan ②To clarify the role of Surgical Nurse in future IDR.

Method: The survey was conducted between June 20, 2016 and July 31, 2016 targeting medical professionals (doctors and nurses) with experience in IDR. We distributed self-report questionnaires to authors and coauthors of academic papers that described studies examining IDR and been published within the preceding 5 years.

Results: We received responses from 54 of the 110 participants (recovery rate: 49.1%). Data for 51 subjects (valid response rate: 94.4%) were ultimately analyzed. "Organization (Governmental Organization [GO] group and Nongovernmental Organizations [NGO] group) at the time of dispatch" differed significantly recognition of the need for "surgical nursing practice" in IDR.

Discussion: "Organization at the time of dispatch;" was the main factor related to recognition of the need for "surgical nursing practice" in IDR. GO group recognized that the role of Surgical Nurse in IDR was not only nursing care through the perioperative period but also disaster nursing care to perform a wide variety of activities will be required in the provision of medical support following international disasters. NGO group recognized the importance of nursing care during operations as the role of Surgical Nurse in IDR.

＜Key-words＞
surgical nurse, disaster relief, international disaster response, natural disasters

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I. Introduction

Natural disasters, which occur in various parts of the world, exert a serious impact on society, economies, and the global environment. In 2015, nine of the top ten countries with disaster victims were low- and middle-income countries and accounted for 69.9% of all such countries (Guha-Sapir, Hoyois & Below, 2015). Because most disasters occur in low- and middle-income countries, in which economic and social infrastructure is underdeveloped, victims do not receive sufficient relief at a local level and require support from other countries. Regarding disaster support in medicine, medical support teams from various countries are dispatched to affected countries. However, there are no unified standards for this support, and it is managed inefficiently and has been unable to provide sufficient assistance thus far (World Health Organization [WHO], 2013). In an effort to address these issues at an international level, the WHO created new standards in 2013. These standards aim to improve the quality of surgical treatment provided in conjunction with other types of medical support during the month following the occurrence of a disaster (WHO, 2013). In accordance with these standards, medical teams dispatched from overseas are classified into the following four categories according to their abilities: (1) outpatient emergency care, (2) inpatient surgical emergency care, (3) inpatient referral care, and (4) additional specialized care (Norton, von Schreeb, Aitken et al., 2013). According to this classification, medical teams that are appropriate for a given situation are dispatched to disaster areas.

When disasters occur outside Japan, the Japan Medical Team for Disaster Relief (JMTDR), which is a Governmental Organization (GO), and the Self-Defense Force are dispatched if requested by the affected countries. Medical teams from Nongovernmental Organizations (NGO) also provide support in disaster-affected areas. During the medical support activity that followed the earthquake in Nepal in 2015, the JMTDR dispatched a new functional expansion team, which was capable of providing hospitalization and surgery, and expanded the quality and range of disaster aid and medical care. In addition to performing this surgical function, the JMTDR dispatched surgical nurses for the first time. The typical role of surgical nursing practice in Japan is to provide expert knowledge and skills that facilitate surgery and ensure patient safety during the perioperative period (Japanese Association for Operative Medicine, 2013).

Research examining international emergency medical assistance has been conducted in Japan since the 1990s. Although some studies clarified the role of nurses in medical activities without surgical functions, no studies have examined surgical nursing practice, and most previous research has involved analyses and reports regarding activity content. Ukai (2013) posited that most research has involved reports and analysis because IDR are conducted when disasters occur, activity is infrequent, and events differ. Therefore, studies tend to be limited to the presentation of empirical reports, because collecting data from research subjects is a difficult process, and

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individuals are unlikely to report repeated experiences (Ukai, 2013). However, to ensure high specificity for short-term international emergency medical assistance that requires effective results, it is important to look beyond activity reports and discover legal qualities via quantitative analysis, which leads to future activity.

Outside Japan, many developed countries are actively engaged in activities with surgical functions, and numerous reports regarding surgery-related activity content have been published. However, as in Japan, no studies have examined surgical nursing practice in IDR.

Under the leadership of the WHO, the number of medical activities that focus on improving the quality of surgical treatment in international emergency medical assistance is expected to increase. The provision of activities associated with surgical functions for surgical nurses has just begun in Japan's international emergency medical assistance, and training for surgical nurses has become a challenge. Therefore, the current study sought to clarify surgical nurses' role in association with surgical functions. Determination of the role recognized as necessary by working medical practitioners could lead to efficient and effective activities.

The results are expected to provide important foundational data via for the expansion of surgical functions in future international emergency medical assistance, and they could be included in education and training for surgical nurses and contribute to personnel training.

1. Research Purpose

With regard to medical doctors and nurses who had participated in IDR, the purposes of the study were as follows:

1. To identify the factors related to recognition of the need for "surgical nursing practice" in IDR provided by Japan
2. To clarify the role of Surgical Nurse in future IDR

2. Definitions of Terms

1. IDR (International Disaster Response) refer to medical support provided in areas affected by large-scale disasters outside Japan.
2. GO (Governmental Organization) are organizations under the jurisdiction of a government involved in the execution of international medical activities.
3. NGO (Nongovernmental Organizations) are private organizations that conduct international medical activities and are managed independently of the government.

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II. Subjects and Methods

1. Study Design

A cross-sectional quantitative study was conducted using a self-administered questionnaire survey.

2. Survey Details

The survey collected data regarding basic attributes (age, sex, occupation, number of years' experience in occupation, number of dispatches, year of dispatch, duration of dispatch, and dispatching organization) and performed or supported experience in surgical procedures at the time of dispatch.

The following questions were measured using a five-point scale (1 = unnecessary, 2 = somewhat unnecessary, 3 = neither necessary nor unnecessary, 4 = somewhat necessary, 5 = necessary):

1. The need for "surgical nursing practice" in IDR
2. The role of Surgical Nurse recognized as necessary for IDR

Subjects' responses to 24 items based on the Practical Guidelines for Operative Medicine, which were produced by the Japanese Association for Operative Medicine, were measured to examine surgical nurses' perceived responsibility for domestic surgical management (Japanese Association for Operative Medicine, 2013).

We also included six items pertaining to roles necessary for general nurses in IDR, which represented roles for nurses who do not undertake surgical functions in IDR, based on previous studies (Furukawa, Shinchi, Fukuyama et al., 2007; Fukuyama, Koichi Shinchi, Toyoka Shinchi et al., 2007).

Five items pertaining to roles other than those described above were established according to the opinions of one doctor, one emergency specialist, two disaster medicine experts, and one surgical nurse with experience in IDR.

3. Survey Methods

1) Subjects

In total, 110 medical professionals (doctors and nurses) with experience in IDR were invited to participate.

2) Data Collection Methods

We distributed self-report questionnaires to authors and coauthors of academic papers that described studies examining IDR and been published within the preceding 5 years. The questionnaires were sent to their affiliation addresses via mail. Respondents returned the completed surveys via mail.

3) Data Collection Period

June 20, 2016 to July 31, 2016

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4. Analytical Methods

Fundamental statistics were calculated for all items. Shapiro-Wilk normality was assessed during analysis, and age and years of experience were normally distributed, while all others items were not. Mann-Whitney's U test was used to determine the difference between variables with non-normal distributions. All analyses were performed using JMP Pro 12 statistical analysis software. The significance level was set at $p < .05$, and 95% confidence intervals were calculated.

5. Ethical Considerations

This study was approved by the ethics committee at the institution with which the authors were affiliated. Subjects received a form containing an explanation regarding the study purpose and assurance that participation was voluntary, subjects would not be disadvantaged if they declined to participate, the study would be anonymous and would not contain identifying information, and their data would be used only for academic purposes. This form was distributed with the questionnaire, and return of the questionnaire implied consent.

III. Results

Of the 110 medical professionals to whom surveys were sent, 54 returned completed questionnaires (recovery rate: 49.1%). One individual without disaster dispatch experience, one individual who was not a medical worker, and one individual whose questionnaire was incomplete were excluded from the study; therefore, data for 51 subjects (valid response rate: 94.4%) were ultimately analyzed.

1. Overview of Subjects

1) Basic Attributes

Subjects' basic characteristics are shown in Table 1. Of the 51 subjects, 74.5% were men, and 25.5% were women. Their ages ranged from 28 to 68 years (median: 43.0 years, interquartile range [IQR]: 38–52 years). With respect to profession, 68.6% were physicians and 31.4% were nurses, and the nurses included a midwife. Numbers of years' experience ranged from 5 to 46 years (median: 19 years, IQR: 14–27 years).

Numbers of dispatches ranged from 1 to 30 (median: 2, IQR: 1–3). Of the dispatching organizations, 68.6% were GOs and 31.4% were NGOs. Years of dispatch fell between 1998 and 2015: with 7.8%, 11.8%, 5.9%, and 74.5% of dispatches recorded in 1998, 2000–2005, 2006–2010, and 2011–2015, respectively. Dispatch durations ranged from 7 to 150 days, with 80.4%, 5.9%, and 13.7% lasting ≤14 days, 15–28 days, and ≥29 days, respectively. With respect to experience of surgical treatment at the time of dispatch, 70.6% of subjects were experienced, and 29.4% lacked experience.

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<Table 1> Subjects' basic characteristics (N = 51)

Item	Group	n	%	Median (IQR)	Range
Sex	Male	38	74.5		
	Female	13	25.5		
Age (years)				43 (38–52)	28–68
	28–39	17	33.3		
	40–49	19	37.2		
	50–59	12	23.5		
	≥60	3	5.9		
Occupation	Physician	35	68.6		
	Nurse	16	31.4		
Work experience (years)				19 (14–27)	5–46
	5–10	7	13.7		
	11–15	11	21.6		
	16–20	14	27.5		
	21–30	15	29.4		
	≥31	4	7.8		
Number of dispatches				2 (1–3)	1–30
	1	21	41.1		
	2	8	15.7		
	3	11	21.6		
	≥4	11	21.6		
Dispatching organization	GO	35	68.6		
	NGO	16	31.4		
Year of Dispatch	1998	4	7.8		
	2000–2005	6	11.8		
	2006–2010	3	5.9		
	2011–2015	38	74.5		
Duration of dispatch (days)				14.0	7–150
	≤14	41	80.4		
	15–28	3	5.9		
	≥28	7	13.7		
Surgical experience during dispatch	Yes	36	70.6		
	No	15	29.4		

IQR = interquartile range; GO = governmental organization;
NGO = nongovernmental organization

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2) The need for "surgical nursing practice in IDR

With respect to recognition of the need for surgical nursing practice in IDR, scores ranged from 1 to 5 (median: 4, IQR: 3–5), and the proportion of subjects whose responses were “somewhat necessary” or “necessary” was 72.5% (Table 2).

<Table 2> Recognition of the need for surgical nursing practice in IDR (N = 51)

Grouping	n	%	Median (IQR)
			4 (3–5)
1. Unnecessary	1	2.1	
2. Somewhat unnecessary	4	7.8	
3. Neither necessary nor unnecessary	9	17.6	
4. Somewhat necessary	15	29.4	
5. Necessary	22	43.1	

IQR = interquartile range

2. Factors Related to Recognition of the Need for Surgical Nursing Practice in IDR

1) Recognition of the Need for Surgical Nursing Practice and Correlations Between Basic Attributes

Subjects were divided into two groups according to their median scores for age (median: 43 years), years of experience (median: 19), number of dispatches (median: 2), and dispatch duration (median: 14 days). In addition, years of dispatch were divided into two groups based on the 2013 introduction of uniform WHO standards, and statistical tests were performed. The results showed that dispatching organizations differed significantly between the two groups (Table 3).

<Table 3> Recognition of the need for surgical nursing practice and their relationships with basic attributes (N = 51)

Item	Group	n	%	Need for surgical nursing practice p-value
Sex	Male	38	74.5	.676
	Female	13	25.5	
Age (years)	28–43	26	51.0	.389
	44–68	25	49.0	
Occupation	Physician	35	68.6	.206
	Nurse	16	31.4	
Work experience (years)	5–19	25	49.0	.235
	20–46	26	51.0	

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Number of dispatches	1 2–30	21 30	41.2 58.8	.096
Year of Dispatch	1998–2012 2013–2015	17 34	33.3 66.7	.595
Dispatch duration (days)	7–14 15–150	41 10	80.4 19.6	.371
Type of dispatch organization	GO NGO	35 16	68.6 31.4	**.030***
Surgical experience at the time of dispatch	Yes No	36 15	70.6 29.4	.293

GO = governmental organization; NGO = nongovernmental organization

2) Recognition of the Need for Surgical Nursing Practice in Each Organization at the Time of Dispatch

The proportions of subjects who were affiliated with GOs and NGOs were 77.1% and 68.8%, respectively, and they provided responses of "somewhat necessary" or "necessary" (Table 4).

<Table 4>Proportion of organizations that recognized a need for surgical nursing practice

	GO group (n = 35)		NGO group (n = 16)	
	n	%	n	%
1. Unnecessary	0	0.0	1	6.2
2. Somewhat unnecessary	1	2.9	3	18.8
3. Neither necessary nor unnecessary	7	20.0	1	6.2
4. Somewhat necessary	7	20.0	8	50.0
5. Necessary	20	57.1	3	18.8

GO = governmental organization; NGO = nongovernmental organization

3. Role of Surgical Nursing Practices Recognized as Necessary for IDR

Cronbach's α for this item was 0.95, and the mean score (± SD) was 4.25 ± 1.15. Subjects who exhibited high levels of recognition of the need for surgical nursing practice were assigned to the GO group, and those who exhibited low levels of recognition of the need for surgical nursing practice were assigned to the NGO group. Mean scores for organizations for which a significant difference was observed at the time of dispatch are shown in Table 5.

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<Table 5> Role of surgical nursing practices recognized as necessary during IDR

		GO group (n = 35) Mean ± SD	NGO group (n = 16) Mean ± SD
Roles based on the Practical Guidelines for Operative Medicine			
1)	Preparation of instruments used for surgery, necessary items	5.00 ± 0.00	4.69 ± 0.87
2)	Confirming instrument count and condition to prevent leaving materials in patient body	5.00 ± 0.00	4.50 ± 0.89
3)	Introduction to anesthesia ·assistance during awakening	4.97 ± 0.18	4.31 ± 1.08
4)	Preparation of surgical nursing record	4.97 ± 0.18	4.31 ± 1.01
5)	Instrument delivery to the operator in Clean area	4.97 ± 0.18	4.56 ± 0.89
6)	Provision of reliable sterilization in cleanliness areas	4.97 ± 0.18	4.58 ± 1.26
7)	Prevention of residual materials in the body	4.97 ± 0.18	4.19 ± 1.05
8)	Managing patient temperature Response to sudden changes	4.94 ± 0.25	4.38 ± 0.89
9)	Prevention of skin disorders and neuropathy due to surgical posture	4.94 ± 0.25	4.38 ± 0.89
10)	Preventing falls and injuries	4.90 ± 0.31	4.56 ± 0.81
11)	Preparation of operating room instruments	4.87 ± 0.34	4.44 ± 0.89
12)	Preventing falls and injuries	4.87 ± 0.34	4.44 ± 0.89
13)	Assistance during anesthetization	4.84 ± 0.37	4.13 ± 1.09
14)	Placement in the operating room	4.81 ± 0.59	4.31 ± 0.95
15)	Surgical nursing care plan and practice	4.77 ± 0.56	4.13 ± 1.09
16)	Psychological support for patients	4.74 ± 0.63	4.31 ± 0.95
17)	Temperature adjustment in the operating room	4.55 ± 0.72	4.06 ± 1.00
18)	Consideration for ambient sounds during surgery	4.48 ± 0.81	4.00 ± 1.32
19)	Continuing nursing (handover to local medical personnel)	4.48 ± 0.85	4.13 ± 1.20
20)	Patient visits before and after surgery (including listening to medical history)	4.29 ± 0.90	3.81 ± 1.10
21)	Management of excised specimens	3.71 ± 1.13	2.88 ± 1.54
22)	Management of implants to be transplanted	2.97 ± 1.56	2.94 ± 1.57
23)	Supporting endoscopic surgery in clean zones	2.74 ± 1.65	1.88 ± 1.36
24)	Providing endoscopic surgery	2.42 ± 1.50	1.81 ± 1.38
Necessary duties of general nurses in IDR			
25)	Internal arrangement (placement of devices in consideration of flow lines)	4.52 ± 0.77	3.75 ± 1.29
26)	Management of medical equipment	4.26 ± 1.06	3.88 ± 1.02
27)	Supporting Outpatient Medical Treatment	4.16 ± 1.11	3.94 ± 1.12
28)	Management of medical waste	4.16 ± 1.04	3.82 ± 1.13
29)	Reception triage	4.10 ± 1.03	3.81 ± 1.05
30)	Health management of team members	3.94 ± 1.15	3.69 ± 1.30
Other roles			
31)	Infection control	4.63 ± 0.60	4.06 ± 1.24
32)	Coordinating duties between multiple specialties	4.52 ± 0.77	4.13 ± 1.02
33)	Postoperative patient care	4.52 ± 0.77	3.56 ± 1.15
34)	Supporting surgeries in clean zones	4.42 ± 0.92	4.00 ± 1.32
35)	Procurement of medical equipment	3.42 ± 1.20	3.63 ± 1.15

GO = governmental organization; NGO = nongovernmental organization;
SD = standard deviation
Cronbach's α 95%

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1) Items Related to the Practical Guidelines for Operative Medicine

In the NGO group, although the mean score did not reach 4.0 (somewhat necessary), the "patients' visits before and after surgery (including listening to medical history)" item was recognized as necessary in the GO group. In both the GO and NGO groups, items for which mean scores did not reach 4.0 (somewhat necessary), showing low levels of recognition of need, were as follows: "able to provide endoscopic surgery," "able to support endoscopic surgeries in clean areas," "management of implants to be placed in the body," and "management of excised implants."

2) Necessary Roles for General Nurses in IDR

In the NGO group, mean scores did not reach 4.0 (somewhat necessary); however, the "assistance providing outpatient treatment," "reception triage," "internal placement (placement of devices in consideration of flow lines)," "management of medical devices," and "management of medical waste" items were recognized as necessary in the GO group.

In both the GO and NGO groups, the mean score for the "health management by team members" item did not reach 4.0 (somewhat necessary), indicating low levels of recognition of need.

3) Other Items

The "patient care in postoperative hospital room" item was recognized as necessary in the GO group; however, the mean score for the item did not reach 4.0 (somewhat necessary) in the NGO group. In addition, mean scores for the "procurement of medical equipment" item did not reach 4.0 (somewhat necessary) in either the GO or NGO group, indicating low levels of recognition of need for the item.

IV. Discussion

1. Recognition and Related Factors Affecting Surgical Nursing Practice in IDR

The results showed that 72.5% of individuals experienced in IDR recognized the need for surgical nursing practice. As with surgical functions, the need for surgical nursing practice was recognized by organizations at the time of dispatch. The demand for surgical nursing practice is expected to increase as the WHO implements activities that focus on improving the quality of surgical treatment.

2. The Role of Surgical Nurse in IDR

The results regarding the items based on the Practical Guidelines for Operative Medicine indicated that the special role of surgical nursing practice in IDR was almost identical to nurses' everyday duties in Japan. For example, the items for which both the GO and NGO groups showed low levels of recognition of need included "providing endoscopic surgery," "management of implants to be placed in the body," "management of excised specimens," and "supporting endoscopic surgeries in clean areas." Much of the

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surgery performed by medical support teams in disaster zones includes trauma surgery, such as orthopedic surgery for traumatic injuries; debridement; and sutures (Read, Holian, Moller et al., 2016; Chu, Stokes, Trelles et al., 2011; Rajpura, Boutros, Khan et al., 2010; Wong, Razek, Elsharkawi et al., 2015). Therefore, we believe that endoscopic surgery was of low priority and was not recognized as necessary in emergency disaster medical support activities. With respect to implantation operations, specialized teams of orthopedic surgeons perform open reduction and internal and external fixation procedures (Rajpura, Boutros, Khan et al., 2010). Moreover, the JMTDR provided orthopedic surgery to support activities following the Nepal earthquake. Therefore, it is possible that the need for implant management, including the management of specimens, will increase in the future.

The NGO group exhibited low recognition of the need for "patient visits before and after surgery (including listening to medical history)," but the item was considered necessary by the GO group. In addition, the results regarding "postoperative patient care" were similar to those for other items, and the GO group's level of recognition of need for this item was significantly higher relative to that of the NGO group. This is considered one of the roles of Surgical Nurse in IDR, in addition to the typical duties of Japanese Surgical Nurses, during the perioperative period.

In addition, the items for which the recognition of need were highest in the GO group included "assistance for outpatients," "reception triage," "placement of devices (placement of devices in consideration of flow lines)," "management of medical devices," and "management of medical waste." In previous studies, these tasks were identified as duties necessary for nurses in ordinary IDR that did not involve surgical functions (Furukawa, Shinchi, Fukuyama et al., 2007; Fukuyama, Koichi Shinchi, Toyoka Shinchi et al., 2007). Specifically, our results suggest that there is a need for surgical nursing practice to fulfill general nursing duties in IDR.

Items for which recognition of need was low in both the GO and NGO groups included "health management by team members" and "procurement of medical equipment." It is likely that these tasks are performed by medical coordinators in the teams and are not undertaken within Surgical Nurse.

In the future, surgical functions will be expected to play an important role in IDR, and the specialized skills involved in surgical nursing practice will be required to administer treatment efficiently. In addition, roles that are learned in normal surgical nursing practice in Japan were also required for the provision of IDR. This result could be an important source of experience for nurses who support surgical nursing practice in future international emergency relief activities.

Many surgical nurses have the potential for active participation in IDR. We are acutely aware that the surgical nursing practice specialty is required in activities to support disaster victims, and we hope that it will be utilized as a new human resource in international emergency medical assistance.

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V. Study Limitations and Future Research Topics

It was difficult to recruit the subjects for the study, and the study sample was small. It is therefore possible that bias occurred in the dispatching organizations and related medical field, and the results should be interpreted with caution. In addition, few subjects had experience of surgical functions in IDR, and our assessment was performed with this in mind. Future research should include larger samples, and the role of Surgical Nurse should be based on experience.

VI. Conclusion

The results showed the following regarding individuals experienced in IDR: (1) 72.5% of experienced subjects recognized the need for "surgical nursing practice" in IDR; (2) "organization at the time of dispatch;" was the main factor related to recognition of the need for "surgical nursing practice;" and (3) GO group recognized that the role of Surgical Nurse in IDR was not only nursing care through the perioperative period but also disaster nursing care to perform a wide variety of activities will be required in the provision of medical support following international disasters. NGO group recognized the importance of nursing care during operations as the role of Surgical Nurse in IDR.

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ORIGINAL ARTICLE

Individual Evaluation of the Visual Functions of Children with Severe Motor and Intellectual Disabilities using the Heart Rate Index

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ABSTRACT

Children with severe motor and intellectual disabilities (hereinafter, "children with SMID") produce only slight movements in response to surrounding influences, and it is difficult to evaluate their remaining sensory functions through behavioral observation alone. In this study, we focused on a first-grade Junior high-school student (hereinafter, "Student A") with concurrent visual (light perception only) and hearing (complete deafness) disabilities in addition to severe motor and intellectual disabilities, who was attending a "Special Needs Education School for the Physically Challenged", and we evaluated the student's sensory functions using the heart rate index. As a result, an orienting response, where the presentation of visual light and color stimuli coincides with a transient reduction in heart rate, was found to be highly reproducible, which suggests that the student perceives visual stimuli. Similarly, in response to facial stimuli, Student A's heart rate response to familiar and unfamiliar faces differed, with the heart rate decreasing in response to unfamiliar faces, and increasing in response to familiar faces. Based on this, it seems likely that Student A differentiates faces, and that his heart rate response differs depending on his affinity for the face. While Student A's visual functionality was previously diagnosed by a physician as light perception only, the results of this study suggest that Student A may retain the visual functionality to differentiate and recognize people.

<Keywords>
severe motor and intellectual disabilities (SMID), heart-rate fluctuation, visual function evaluation

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I. Introduction

At special needs education schools for the physically challenged attended by children with motor disabilities of the limbs or trunk, the severity, concurrence, and diversification of disabilities have increased in recent years. Due to technological advances in neo-natal and critical care medicine and improved and expanded medical support, even children with severe motor and intellectual disabilities (hereinafter, "children with SMID") whose lives used to be in danger can now lead normal lives (Ooe & Kawasumi, 2014). Hence, Special Needs Education Schools for the Physically Challenged have many more children with severe and multiple disabilities on their registers than other types of special needs schools in Japan (Ministry of Education, Culture, Sports, Science and Technology (MEXT), 2015).

Many children with SMID have a severe motor disability. As a result, their voluntary movement is poor, and they produce only slight movements in response to surrounding influences. While teaching staff attempt to provide encouragement with a focus on what they believe to be the remaining sensory functions, it is difficult to correctly determine whether or not movements that seem to be responsive are in fact voluntary. Hence, the question of how to ascertain the remaining sensory function, interest, and concern of children with SMID is a crucial challenge within education for the physically challenged, and a way of objectively evaluating these kinds of sensory function, interest, and concern is needed.

Physiological indices are a means of detecting bodily responses to external influences, to evaluate various sensory functions and psychological states without relying on language or movement. Hence, they have also garnered attention as a method of evaluating the sensory function, interest, and concern of children with SMID. According to a study by Ooba & Era (2002) that examined research trends in the developmental evaluation of children with SMID, physiological indices such as the heart rate and brain waves were used in 29 out of 78 articles (37%). The heart rate in particular is simpler to measure than other methods, imposes little stress on the child, and was used in many prior studies to evaluate the sensory function, interest, and concern of children with SMID (e.g., Ooe, 2012; Kawasumi, Sato, Okazawa, et al., 2008).

In these prior studies, to evaluate sensory functions, interest, and concern, the "orienting response" where the heart rate drops temporarily after presenting a stimulus, and the "expectancy response," where the heart rate increases after presenting a stimulus, were used as indicators. According to Kitajima and colleagues (Kitajima, Koike, Katada, et al., 1993), the orienting response reflects the perception of a stimulus, and is applied to the evaluation of whether or not there is sensory reception of the stimulus. However, the expectancy response is thought to reflect active attention to, for example, the calling of one's name, and is applied to the evaluation of whether or not there is interest in or concern about the stimulus. In light of this, since examining the phases of

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heart rate fluctuation is effective in evaluating the sensory function, interest, and concern of children with SMID, and because measurement is simple, we presume that they can also be applied to scenarios of educating children with SMID.

In this study, we hence focused on the case of a first-grade Junior high-school student at a Special Needs Education School for the Physically Challenged (hereinafter, "Student A") who had concurrent visual (light perception only) and hearing (complete deafness) disabilities and was diagnosed with severe motor and intellectual disabilities, and we evaluated the student's sensory functions using the heart rate as an indicator.

Student A's lessons proceeded on the basis of the medical diagnosis that he visually perceives light only. However, according to his homeroom teacher and his guardians, when shown teaching materials and when a guardian's face came close, he was seen to make what appeared to be voluntary responses such as blinking, and was thought to potentially possess a certain level of visual function. Children with cerebral palsy often have concurrent central visual disorder, but according to previous studies, this "rarely means no vision whatsoever," and "relatively good color vision (particularly reds and yellows)" has also been reported (Swift, Davidson & Weems, 2008). There are some children with SMID who attend Special Needs Education Schools for the Physically Challenged who, based on the daily behavioral observations of their caregivers, are "thought to be able to see a little," and it is thought there may be instances where slight visual function remains that cannot be evaluated accurately owing to motor impairment.

Therefore, in this study, we aimed to clarify Student A's visual functions, and used the heart rate as an indicator in the evaluation of his color perception and facial recognition abilities.

II. Subjects and Methods

1. Subject

The subject was Student A (male), a first-grade Junior high-school student at a Special Needs Education School for the Physically Challenged. Student A was 12 years of age, and he had been diagnosed by a physician as having severe motor and intellectual disabilities, as well as concurrent visual (light perception only) and hearing (complete deafness) disabilities. Student A was primarily receiving scheduling and instruction in school subjects on an educational program instead of independent activities. He was also receiving regular medical care from nurses, guardians, and teachers in accordance with his primary physician's directions, such as artificial respiratory management, oral cavity and nasal cavity sputum aspiration, internal sputum aspiration via endotracheal catheter, and intubated feeding via gastrostomy.

According to Yokochi's classification (Ryouiku Society on Severe Motor and Intellectual Disabilities, 2014), Student A was A1-C (locomotive function: unable to turn over;

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intellectual development: unable to comprehend language; no significant eyelid movement). We also implemented the MEPA-R (Movement Education and Therapy Program Assessment – Revised) (Kobayashi, 2005), under which the developmental stages of three fields and six domains of a child's motor and sensory fields (posture, mobility, skill), linguistic fields (receptive language and expressive language), and sociality field (interpersonal relations) are evaluated over a 72-month period. The results yielded a development level of 0 years of age in all fields and domains.

2. Measurement device

We used the HOT-1000 manufactured by Hitachi High-Technologies Corporation (Tokyo, Japan) (Figure 1). By placing a headset-shaped holder on the front of the head, this device can detect changes in cerebral blood flow and heart rate to a tenth of a second from the reflection of near infrared light (light with a wavelength of approximately 800 nm) emitted from the scalp. This device also enables measurement from a tablet, and, by tapping the screen at the time of presenting a stimulus, the analyst can record the timing of that presentation. In this study, we used the changes in heart rate measured by the HOT-1000 device as the index of visual function evaluation.

<Figure 1> The heart rate measurement device used in this study.

3. Measurement procedures

The measurements in this study were taken at Student A's home and in a classroom at the Special Needs Education School for the Physically Challenged.

In this study, based on the physician's diagnosis of light perception, to confirm that it was possible to evaluate light perception using the heart rate, we firstly examined changes in the heart rate induced by light stimuli. Furthermore, based on the physician's diagnosis of visual functionality as "light perception only," to evaluate whether there were other remaining visual functions that had previously been considered perceptually impaired, the subject was presented with color perception and facial stimuli, and changes in the heart rate in response to these stimuli were examined (Table 1).

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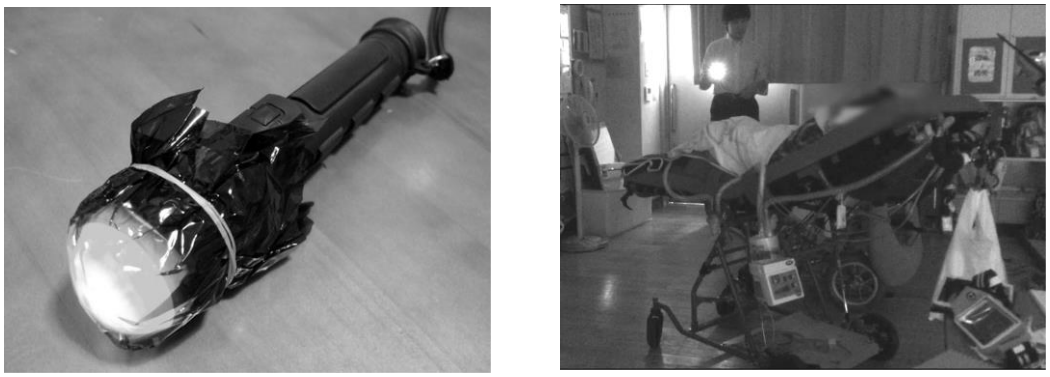
<Table 1> The evaluation of Student A's sensory functions and objective thereof.

Sensory function	Stimulus	Objective
Light perception	Photo stimuli	To check whether the visual function of light perception, (diagnosed by a physician) could be evaluated with the heart rate index.
Color perception	Color stimuli	To use the heart rate index to evaluate whether there is any remaining visual function of color perception (not diagnosed by a physician).
Facial recognition	Facial stimuli (unfamiliar/ familiar)	To use the heart rate index to evaluate whether there is any remaining visual function related to facial recognition (not diagnosed by a physician).

As the method of presenting the photo stimuli, in this study, we utilized lights created by covering a flashlight with red, blue, yellow, and green-colored cellophane (Figure 2, left). We turned off the lights to darken the room, and presented each of the colored lights on Student A's face from around two meters away for 10 seconds (Figure 2, right). The intervals between shining the lights on his face were around 20 seconds, and when the stimulus was presented, the analyst recorded the timing by tapping the screen of the tablet used for measurement.



<Figure 2> Sensory function evaluation of photo stimuli.
Right: Presenting the light to Student A. Left: The flashlight used for photo stimuli.

After confirming that the visual function of light perception only as diagnosed by a physician could be evaluated by measuring the heart rate changes corresponding to the light perception, we evaluated the student's color vision, which was previously thought to be perceptually impaired. For the color stimuli, we used a picture book called the "Darumasanga" (Kagakui, 2007) that depicts a red character (Daruma), to evaluate visual function related to the perception of colors in a setting where the picture book was read to the subject. The picture book was read to Student A by his former homeroom teacher, who presented the book around 20 cm before Student A's eyes as she read it

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aloud. When the scenes in the picture book changed and the red-colored character appeared, the measuring screen was tapped to record the timing.

Furthermore, to examine Student A's interest in people and his communication potential, we conducted a visual evaluation of his perception and recognition of people's faces, which were previously considered impaired. The facial stimuli were set up so that the faces of a stranger (an unfamiliar face), Student A's former homeroom teacher, and his mother and father would be shown in a sequence at around 20 cm before Student A's eyes. When the face was shown in front of Student A's eyes, the analyst would tap the measuring screen and record the timing.

4. Data processing

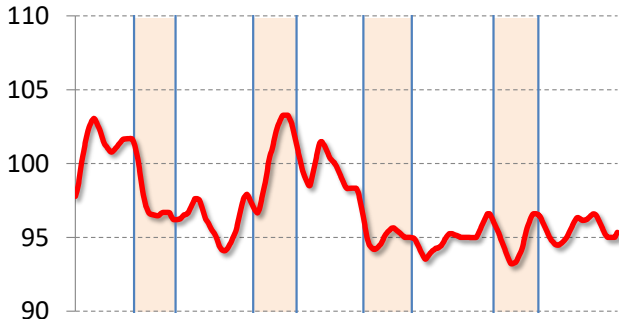
In the analysis of the results, a transient decrease in heart rate immediately after the presentation of each sensory stimuli was determined to be an orienting response, and a transient increase in heart rate immediately after the presentation was determined to be an expectancy response (a continually increasing heart rate after presenting the stimuli), and these responses were further investigated.

To assess the magnitude of heart rate changes elicited by various sensory stimuli, the average heart rates, 3 seconds before and 10 seconds after stimulus presentation, were calculated for each trial. Then, the average heart rate 3 seconds before stimulus presentation was subtracted from the average heart rate 10 seconds after stimulus presentation, to obtain the difference.

III. Results

1. Changes in heart rate associated with the presentation of photo stimuli

The changes in heart rate associated with the presentation of the photo stimuli are shown in Figure 3. When the photo stimulus was presented ten times using the light covered by the colored tape, Student A's heart rate decreased significantly immediately after the presentation 8 out of 10 times (80%).



<Figure 3> Changes in Student A's heart rate associated with the presentation of photo stimuli.(Broken line: Heart rate, Vertical line: Presentation of stimuli)

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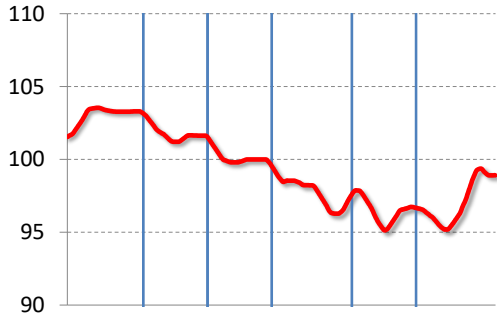
2. Changes in heart rate associated with the presentation of color stimuli

The changes in heart rate during the reading of the picture book are shown in Figure 4. When the book's red character (Daruma) appears, he is repeatedly depicted as falling over, and in this study we measured the change in heart rate while the five scenes in the picture book were read. The result was that when the picture book's scenes changed and the red character was presented, the heart rate was confirmed to decrease significantly 5 out of 5 times (100%) immediately after the character was presented.



<Figure 4> Changes in Student A's heart rate associated with the presentation of color stimuli. (Broken line: Heart rate, Vertical line: Presentation of stimuli)

3. Changes in heart rate associated with the presentation of facial stimuli

As it was suggested that student A perceives the red character, we inferred that he retains more visual functionality than previously thought. Hence, to reveal his potential for communication utilizing visual function, we measured changes in Student A's heart rate when the faces of strangers and familiar people such as his mother, father, and former homeroom teacher appeared before his eyes.

The result was that when the stranger's face was shown before Student A's eyes, student A's heart rate immediately decreased significantly 2 out of 2 times (100%) (Figure 5, top left). However, when the face of student A's former homeroom teacher was shown in what was the first occasion of their meeting in around a year, Student A's heart rate immediately increased slightly 2 out of 2 times (100%) (Figure 5, top right). Furthermore, when we measured the change in heart rate on the appearance of Student A's mother and father with whom he has the most regular contact (Figure 5, lower right), his heart rate was confirmed to immediately increase suddenly thereafter 2 out of 2 times (100%). The amount of change at around the time the familiar/unfamiliar faces appeared is summarized in Table 2. Contact with the student was most frequent with his mother and father, followed by his former homeroom teacher, and then the unfamiliar face, and, although his heart rate decreased on seeing the unfamiliar face, with the familiar faces we observed a trend whereby his heart rate increased with the frequency of contact.

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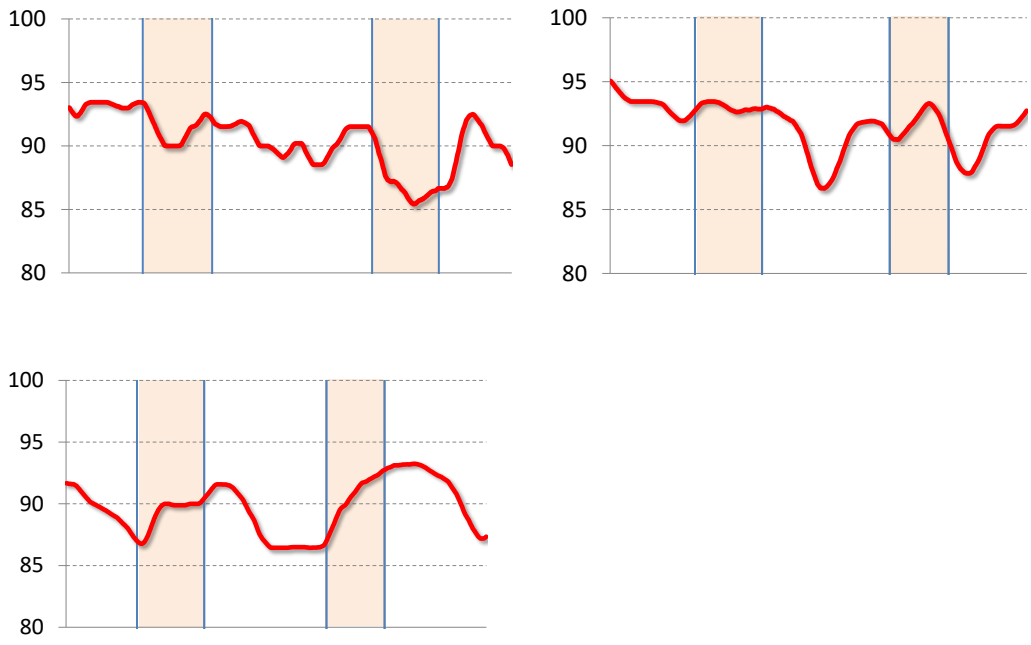

<Figure 5> Changes in Student A's heart rate associated with the presentation of facial stimuli. (Broken line: Heart rate. Vertical line: Start/end of stimuli)

<Table 2> Changes in Student A's heart rate around the time of presentation of the facial stimuli.

		Familiar face	
	Unfamiliar face	Former homeroom teacher	Mother and father
1st	-3.42	0.77	3.38
2nd	-5.72	2.41	6.22

4. Heart Rate Changes After Various Sensory Stimuli

To assess the magnitude of heart rate changes elicited by various sensory stimuli, the differences between the heart rates before and after stimulus presentation were obtained (Table 3). The results revealed that the heart rate among the child subjects decreased by an average of -1.53/min after presentation of light stimuli, and -1.07/min after presentation of color stimuli. Furthermore, regarding face stimuli consisting of strangers' faces, the heart rate after stimulus presentation decreased dramatically, compared to other visual stimuli, by an average of -2.83/min.

On the other hand, regarding familiar faces, after the child subjects were shown their previous homeroom teachers' faces, the average heart rate increased by +0.59/min after presentation of face stimuli. After they were shown their parents' faces, the change was even more remarkable, with the average heart rate increasing by +2.53/min after stimulus presentation.

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<Table 3> Changes in Heart Rate (/min) Before and After Stimulus Presentation During Each Trial (/min)

		1st trial	2nd trial	3rd trial	4th trial	5th trial	AVERGE
Photo stimuli		-4.11	+2.73	-2.82	-1.93	—	-1.53
Color stimuli		-1.47	-1.47	-1.59	-0.26	-0.54	-1.07
Facial stimuli	Unfamiliar	-2.21	-3.46	—	—	—	-2.83
	Familiar (teacher)	+0.90	+0.29	—	—	—	+0.59
	Familiar (parents)	+1.13	+3.92	—	—	—	+2.53

IV. Discussion

In this study, using the indicator of heart rate, we evaluated the visual functions of Student A, a child with SMID and concurrent severe motor and intellectual disabilities. The transient reduction in Student A's heart rate that was associated with the presentation of the photo stimuli had a high reproducibility of 8 out of 10 times, which, also based on the timing of the start of the change, was likely to be an orienting response. This suggests that Student A is capable of perceiving photo stimuli. The physician also diagnosed Student A as having a concurrent visual impairment of light perception only and it seems likely that his remaining visual functions are evaluable using the heart rate as an indicator.

It was previously thought that Student A's color perception was impaired, based on the physician's diagnosis of light perception only. However, the daily observations of the homeroom teacher and his guardians also reported a slight eyelid response to characters containing color. Hence, considering that other visual functions may remain, a change in heart rate was also detected while a picture book depicting a red Daruma character was read. As a result, when the red character was presented before the student's eyes, his heart rate decreased immediately afterwards, and this heart rate decrease that seems likely to be an orienting response was confirmed to be highly reproducible. Therefore, it seems likely that Student A perceived the red character, and detected the changes in the scenes. This suggests that Student A retains greater visual function than expected, and we thus hoped that this remaining function, which was difficult to evaluate with prior methods, could be demonstrated using the heart rate.

Accordingly, in order to examine Student A's potential for interpersonal communication, in an attempt to confirm whether or not he is capable of perceiving and

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recognizing faces – the foundation of communication – we also examined the changes in heart rate when Student A saw an unfamiliar face and the faces of his former homeroom teacher, mother, and father that he knew well. When he was shown the face of a stranger, his heart rate decreased, and the amplitude change was more significant than with the photo or phono stimuli. Furthermore, the heart rate decrease was also of high reproducibility, and is thus likely to be a response of perception and of orientation towards the stranger's face.

So how does the heart rate change with a face that Student A knows well? In this study we detected the heart rate when Student A was shown the face of his former home room teacher, who had interacted with him daily at school until a year earlier, and when Student A was shown the faces of his father and mother who he sees every day. When the faces of the former homeroom teacher and the student's parents appeared before Student A's eyes, his heart rate increased significantly, and the phases of the change differed from the changes when other sensory stimuli or the stranger's face were presented. The increase in heart rate when Student A saw faces he knew well likely correlates with affinity, and the heart rate increased significantly more when seeing the face of his mother and father who he sees every day, than when seeing the face of his former home room teacher, who he had not seen in a year.

A heart rate increase of this kind immediately after Student A saw a very familiar face is likely to be an expectancy response. According to Kitajima and colleagues (Kitajima, Koike, Katada, et al., 1993), expectancy responses can be considered to reflect active attention towards a stimulus, and they point out that expectancy responses appear when a pleasant emotion arises in particular. In this study, the heart rate increase that was viewed as an orienting response from Student A was limited to when he saw the faces of his mother and father and former homeroom teacher with whom he had interacted on a daily basis, and based on this, since good relationships had been created through daily interactions with Student A, it was inferred that an expectancy response appeared that coincided with a pleasant emotion upon seeing the faces of his mother and father and former homeroom teacher.

To date, other evaluations of the remaining sensory functions of children with SMID have been conducted using the heart rate index (e.g. Sasahara, 2010; Kawasumi, Sato, Okazawa, et al., 2008; Mizuta, Katagiri & Ishikawa, 1999). Many of these prior studies primarily evaluated the tactile, olfactory, and auditory senses, and few have attempted to evaluate visual function (e.g., Sasahara, 2010). This study, albeit a single case report, suggests the potential of utilizing the heart rate to evaluate visual function; in the future, we will need to accumulate findings from other children with SMID to verify its usability.

Depending on the presence or absence of remaining sensory functions and the interest or concern on the part of the student, the method of presenting teaching materials and communication support differ greatly. The results of this study suggested that even for children with SMID such as Student A, who have severe motor impairments and for

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whom evaluation based on behavioral responses is problematic, it may be possible to utilize physiological indices to evaluate interest and concerns through their remaining sensory functions and pleasant emotions. Based on these findings, we suggest it might be beneficial to use physiological indices appropriately in a school education setting in order to understand the actual condition of children with SMID and evaluate their learning. We hope that the fragment of this student's hidden reality that was revealed in this study can serve as a helpful clue in providing individually tailored and effective educational assistance.

Acknowledgment

We are sincerely grateful to the subject, Student A, and his guardians, and everyone at the institution concerned for their kind cooperation during this study. This study was implemented after providing a verbal explanation of the details of the study and handling of personal information to Student A's guardians and obtaining their written consent.

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ORIGINAL ARTICLE

Objective and Subjective Evaluation of Neurofeedback Trainings in Healthy Individuals

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ABSTRACT

Neurofeedback training aims to teach self-regulation through signals derived from neural activity. In children with attention-deficit hyperactivity disorder, neurofeedback generally focuses on increasing the power of either the beta1 (15–18 Hz) or the sensory motor rhythm (12–15 Hz), while decreasing the power of other frequency bands. The purpose of this study was to evaluate the efficacy of objective and subjective measures for assessing the effects of neurofeedback training in healthy adults. We evaluated the effects of eight sessions of beta1 and sensory motor rhythm neurofeedback training in healthy adults using objective measures (i.e., event-related potential components during a flanker task) and subjective measures (i.e., Student Behavior Checklist). Sixteen adults were divided into beta1 and sensory motor rhythm training groups. An event-related potential component, N2, was enhanced at post-training compared with pre-training periods. Moreover, we observed enhanced N2 in the beta1 group, suggesting that improved attentional function influenced the N2 component. Conversely, we found no differences in the Student Behavior Checklist between the pre- and post-training periods for either group. These findings demonstrate that subjective measures were not sufficient to uncover the effects of eight neurofeedback training sessions. Thus, we suggest that objective measures, such as event-related potential components, be used to evaluate the effects of neurofeedback training.

＜Key-words＞
Neurofeedback training, attention deficit hyperactive disorder, Biofeedback

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I. Introduction

In neurofeedback (NF) training, the trainee learns the acquisition of self-control over certain brain activity patterns via feedback about their own neural signals, for instance, via electroencephalograms (EEGs). In previous studies, NF training has been found to improve behavioral problems (Lubar, Swartwood, Swartwood, et al., 1995), mental state (Gruzelier, 2014), and epilepsy (Sterman & Egner, 2006). NF training has been especially effective for improving behavioral problems in individuals with attention-deficit hyperactive disorder (ADHD) (Gevensleben, Albrecht, Schlamp, et al., 2009; Lubar, Swartwood, Swartwood, et al., 1995; Wangler Gevensleben, Albrecht, et al., 2011).

ADHD is characterized by persistent symptoms, which include inattention, hyperactivity, and impulsivity (American Psychiatric Association, 2013). Compared with children with typical development, children with ADHD exhibit low EEG beta (and alpha) activity (Barry, Clarke & Johnstone, 2003). Thus, one NF method for treating children with ADHD aims to enhance beta activities (Gevensleben, Albrecht, Schlamp, et al., 2009; Wangler Gevensleben, Albrecht, et al., 2011). There are two types of beta-focused NF training, classified by frequency band: sensory motor rhythm (SMR: 12–15 Hz) training and beta1 (15–18 Hz) training (Monastra, Lynn, Linden, et al., 2005). Egner & Gruzelier (2004) reported that SMR and beta1 training had different positive effects on behavioral problems: beta1 training targeted inattention, whereas SMR training affected impulsivity/hyperactivity.

ADHD is considered as a dimension rather than a category. Nonclinical individuals who have some problems relative to ADHD symptoms cannot be on medication. Thus, it is expected that application of NF trainings will be one of ways for nonclinical individuals. Evaluations of the efficacy of NF training in children often involve assessments by caregivers (e.g., parent-rated questionnaires) (Linden, Habib & Radojevic, 1996; Lubar, Swartwood, Swartwood, et al., 1995). However, adults receiving treatment often do not have a close relationship with another adult who can conduct an evaluation. Thus, we considered that a subjective assessment via a self-rated questionnaire might be useful for evaluating NF training in nonclinical adults. The effects of beta1 and SMR training have previously been found to improve behavior problems in healthy adults (Egner & Gruzelier, 2004). In this study, we examined whether assessments with objective and subjective measures uncovered the effects of beta1 and SMR training in healthy adults.

II. Methods

1. Participants

Eighteen healthy adults were assigned to SMR and beta1 groups. Two participants left the study prior to completion because they were too busy with college. They reported

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to have no history of neurological and/or psychiatric disorder. The two groups were matched according to age and sex (three male and five female participants, SMR: 23.38 ± 2.39 years, beta1: 24.63 ± 5.45 years).

2. Protocol

This study comprised eight NF training sessions (SMR or beta1) based on previous studies (Egner & Gruzelier, 2004), and pre- and post-training assessments. Participants attended one or two sessions per week. Pre- and post-training assessments were conducted within 1 week before the start and after the end of the NF sessions.

3. NF training

NF training sessions were conducted using ProComp Infiniti (Thought Technology Inc., Montreal, QC, Canada). During the sessions, EEG was recorded from Cz with the left and right earlobes as reference and ground channels, respectively. We asked participants to increase the power of a given frequency band (SMR: 12–15 Hz or Beta1: 15–18 Hz) and to decrease the theta (4–7 Hz) and high beta (22–30 Hz) bands. The participants performed three tasks in a session. For all three tasks, the amplitude of each frequency band was represented online as a bar that changed in size. Task-specific audio-visual feedback was given in all three tasks (i.e., types of pictures, size of a movie clip, and movement of a boat game; EEG Suite, Thought Technology Inc., Montreal, QC, Canada). The three tasks took approximately 15 min to complete.

4. Pre- and Post-assessment

1) Objective measure

As an objective measure, we administered a flanker task during EEG recording. In the flanker task (Eriksen & Eriksen, 1979), stimuli of five arrows are classified into compatible stimuli (i.e., <<<<< and >>>>>) or incompatible stimuli (i.e., >><>> and <<><<) according to the relationship between the central arrow and the surrounding arrows. The participants were required to use their thumb to press a button corresponding to the direction of the central arrow. Each stimulus was presented on a PC monitor for 100 ms and the stimulus onset asynchrony was set between 2000 and 2500 ms (step = 100 ms). Left and right responses were equally required in a block. Twenty-four compatible stimuli and 36 incompatible stimuli were randomly assigned into a block, and there were 16 blocks in each assessment. The task was performed using STIM2 software (NeuroScan Inc., Victoria, Australia).

EEG and electrooculograms (EOGs) were recorded from 29 scalp electrodes (Fz, FCz, Cz, CPz, Pz, Fp1, Fp2, F7, F3, F4, F8, FC5, FC1, FC2, FC6, T7, C3, C4, T8, CP5, CP1, CP2, CP6, P7, P3, P4, P8, O1, O2), as well as at positions above and below the left eye, and at the outer canthi of both eyes, using easycaps (EASYCAP Inc., Woerthsee-Etterschlag, Germany) and NUAMPS (NeuroScan Inc., Victoria, Australia).

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We used the average of the left and right earlobes as a recording reference, and AFz was set as the ground electrode. The data were sampled at 500 Hz (0.1–80 Hz band-pass filtered). The electrode impedance was less than 5 KΩ. EEG signals were low-pass filtered offline at 50 Hz. EEGs were segmented into stimulus-locked epochs (i.e., −100 to 1000 ms triggered by the stimulus onset) and response-locked epochs (i.e., ±600 ms triggered by the button press). Stimulus-locked epochs were baseline corrected using the period 100-ms pre-stimulus, and response-locked epochs were baseline-corrected using the period 200-ms pre-stimulus. Gratton's ocular collection was applied to the epochs (Gratton, Coles & Donchin, 1983), and epochs containing ±50 μV were automatically rejected. We separately averaged the epochs according to compatibility (compatible and incompatible) and correctness (correct and incorrect), and the event-related potentials (ERPs) were re-referenced to the common average reference. We evaluated the stimulus-locked ERPs in trials where participants correctly responded and the response-locked ERPs for trials containing incompatible stimuli. The ERP analyses were conducted using MATLAB R2013b and EEGLAB v13.5.4b (Delorme & Makeig, 2004).

Behavioral measures (i.e., correct response times: correct RTs and incorrect response rates) and ERP components (N2, P3, and error-related negativity: ERN) were used for statistical analysis (Wild-Wall, Oades, Schmidt-Wessels, et al., 2009). For the stimulus-locked ERPs, N2 was identified as the negative peak between 200 and 350 ms at Fz, and P3 was identified as the positive peak between 200 and 500 ms at Pz. For the response-locked ERPs, ERN was identified as the negative peak during the period 200 ms after a response was made.

2) Subjective measure

We used the Student Behavior Checklist (SBC) as a subjective measure (Davis, Cheung, Takahashi, et al., 2011). The SBC is a self-rated questionnaire that comprises 18 items based on ADHD symptoms, as outlined in the DSM-5. According to a previous study, the two-factor model with inattention (nine items) and impulsivity/hyperactivity (nine items) as factors was an acceptable fit for Japanese and American samples (Davis, Cheung, Takahashi, et al., 2011). We used the sum of the items in each factor for statistical analyses.

III. Results

1. Behavioral measures

Table 1 shows the mean correct RTs and incorrect response rates for the compatible and incompatible stimuli at the pre- and post-training measurements in both groups. We performed analyses of variance (ANOVAs) on the correct RTs and incorrect response rates with group (beta1 and SMR), period (pre-training and post-training), and compatibility (compatible and incompatible) as factors. We found significant main effects

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of compatibility on both correct RTs ($F(1,14) = 77.45$, $p = .000$) and incorrect response rates ($F(1,14) = 56.01$, $p = .000$), indicating that incompatible stimuli produced longer correct RTs and higher incorrect response rates compared with compatible stimuli. We did not find any significant main effects or interactions with respect to the behavioral measures ($p > .05$).

<Table 1>Means (SDs) of correct response time and incorrect response rates.

		compatible		incompatible	
		pre	post	pre	post
correct response time (ms)	β1	334.05 (23.20)	343.12 (22.34)	374.99 (21.35)	383.64 (32.49)
	SMR	322.34 (22.11)	317.73 (17.62)	368.46 (41.25)	363.75 (42.55)
incorrect response rate (%)	β1	1.68 (1.35)	1.57 (0.63)	13.88 (8.46)	11.99 (4.94)
	SMR	1.94 (2.36)	2.13 (1.69)	11.07 (8.11)	12.67 (7.84)

2. ERP components

Figure 1 shows pre- and post-training grand average stimulus-locked ERP waveforms at Fz and Pz for compatible and incompatible stimuli in both groups. We performed ANOVAs with group, period, and compatibility as factors on the N2 and P3 amplitudes and latencies. We found a significant main effect of period on N2 amplitude ($F(1,14) = 5.17$, $p = .04$), indicating that post-training N2 amplitudes were larger compared with pre-training amplitudes. We could not find any other main effects or interactions with respect to N2 amplitudes and latencies ($p > .10$). Regarding P3, we found a significant main effect of compatibility on P3 latencies ($F(1,14) = 10.85$, $p = .005$), indicating P3 latencies were longer for incompatible stimuli than compatible stimuli. We could not find any other significant main effects or interactions ($p > .10$).

A visual inspection revealed a change in N2 in the beta1 group compared with the SMR group, although the interaction between group and period was not statistically significant. We conducted ANOVAs with compatibility and period as factors for each group. We found a significant main effect of period in the beta1 group ($F(1,7) = 7.27$, $p = .03$), whereas the main effect of period was not significant in the SMR group ($F(1,7) = 0.64$, $p = .45$). Thus, the observed change in N2 appeared to be restricted to the beta1 group.

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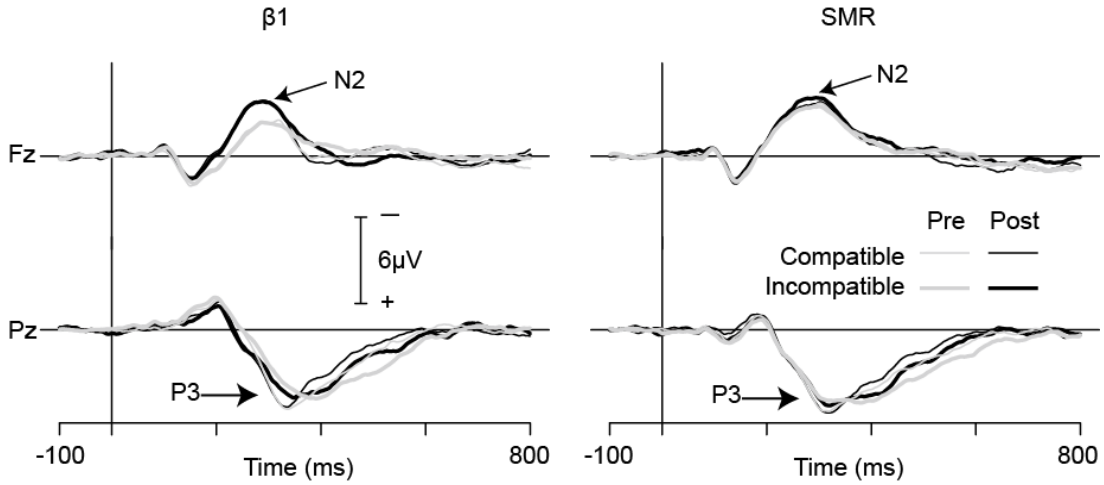
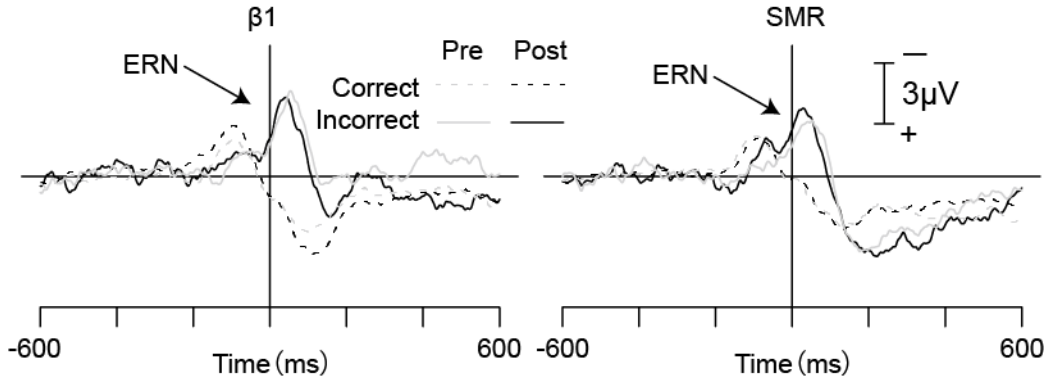


<Figure 1> Grand average stimulus-locked event-related brain potential waveforms on Fz and Pz.

Figure 2 shows pre- and post-training grand average response-locked ERP waveforms at FCz for correct and incorrect responses in both groups. The negative ERP component (i.e., ERN) was enhanced during the 100 ms after incorrect responses only. We performed an ANOVA for ERN amplitude with group and period as factors for incorrect responses. We did not find any significant main effects or an interaction ($p > .10$).



<Figure 2> Grand average response-locked event-related potential waveforms on FCz.

3. Subjective assessment

Table 1 shows the mean scores of inattention and hyperactivity/impulsivity at the pre- and post-training periods in the SMR and beta1 groups. We did not observe any differences in inattention or hyperactivity/impulsivity scores between the pre- and post-training periods in either group. This observation was statistically confirmed by an ANOVA with group and period as factors, which did not reveal any significant main effects or an interaction ($p > .10$).

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<Table 2> Mean scores (SDs) on the Student Behavior Checklist (SBC).

	inattention		hyperactivity/ impulsivity	
	Pre	post	pre	post
β1	6.88 (4.62)	6.75 (5.12)	5.88 (5.35)	5.63 (5.29)
SMR	11.13 (5.95)	9.88 (5.88)	5.88 (5.82)	6.00 (5.89)

IV. Discussion

We used objective and subjective measures to examine the effects of NF training in adults with TD. With regard to objective measures, N2 was clearly enhanced at the post-training compared with the pre-training period in the beta1 group. In the flanker task, the N2 amplitude is known to represent the degree to which cognitive control is needed, e.g., the degree of conflict (Yeung, Botvinick & Cohen, 2004). However, we did not find a significant interaction between period and compatibility. Thus, the observed enhancement of the N2 after NF training might not be related to cognitive control. Egner & Gruzelier (2004) suggested that beta1 training improves attentional skills. Thus, it is possible that the information processing associated with the N2 was enhanced by improved attentional ability. As in a previous study (Egner & Gruzelier, 2004), we were able use an objective measure to define the effects of NF training in adults.

When we used subjective measures, we did not find any effects of NF training in adults (i.e., each factor of SBC). It is possible that eight NF training sessions were insufficient to produce an effect. In addition, our participants did not have complaints about ADHD symptoms. Thus, participants may not have noticed improvements related to NF training. Awareness about the effect of NF training might motivate individuals to participate in NF training. Therefore, we suggest that objective assessments be administered quickly after training, and that trainers inform trainees of the results of the assessment.

Although our measures did not reveal a clear effect of SMR training, beta1 and SMR training have been found to differently improve behaviors associated with ADHD symptoms (Egner & Gruzelier, 2004), SMR training has also been found to have a positive effect on mood (Gruzelier, 2014). Thus, our measures may not have captured the effects of SMR training. A larger study sample with a greater number of NF sessions may help to resolve this issue.

This study has several limitations. Firstly, our sample size was small, which reduced statistical powers. Next, in visual inspection (Figure 1), N2 amplitudes of the

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pre-training period were larger in SMR than beta1 groups, although the difference was not statistically significant. It was possible that some of SMR group had sufficiently large N2 amplitudes; thus, their N2 might be not enhanced by the SMR training. Finally, in the start of this study, we tried to uncover the effect of NF trainings using the difference between beta1 and SMR trainings, in order to negate practice and placebo effects. However, we could not find the significant interaction on N2 amplitude between group and period. Thus, our results did not fully negate the practice and placebo effects on N2 amplitudes. Typically, the placebo effect is considered to be stronger on subjective measures than objective measures. Although the practice effect is also associated with behavioral data and other ERP components, these measures were not different between the pre- and post-training periods. Therefore, we believed the possibility that the difference of N2 amplitude between pre- and post-trainings was associated with the effect of the beta1 training.

In summary, we examined the efficacy of objective and subjective measures in assessing the effect of NF training on adults with TD. Although NF training changed our objective measure, we found no differences in subjective measures between the pre- and post-training periods. These results may indicate the possibility that objective measures more sensitively capture the effects of a small number of NF training sessions than subjective measures. Thus, we suggest that assessments with objective measures be conducted shortly after NF training. This may draw more attention to subtle improvements and increase patient motivation to participate in NF training.

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ORIGINAL ARTICLE

Life Satisfaction and Social Capital of the Chinese Elderly

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ABSTRACT

As the elderly population in China is expected to rise to 300 million by 2025, the life satisfaction of the elderly is of great interest among Chinese researchers. This study tries to examine whether the social capital of the elderly has effects on their life satisfaction, and, if it has, which components of social capital between the structural component and the cognitive component have more effects on the elderly in Chengdu, China. The results of multiple regression analysis on the life satisfaction of the elderly show that only the health status of the elderly is statistically significant. On the contrary, social capital has several statistically significant factors on their life satisfaction. Among the structural component of social capital, informal participation, formal participation, and formal social networks are statistically significant on the life satisfaction of the elderly. Among the cognitive factors of the social capital, norms of reciprocity and interpersonal trust are statistically significant factors. The cognitive component factors may not be easily changed by social interventions such as social services. In other words, providing social services would not improve the elderly's levels of norms of reciprocity or interpersonal trust since these factors are cognitive. On the contrary, the structural component factors of social capital could be improved by social service programs. Therefore, the government and the society need to provide various social service programs to improve participation levels of the Chinese elderly.

＜Key-words＞
the chinese elderly, life satisfaction, social capital, norms of reciprocity, participation, social services

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I. Introduction

The Chinese population aged 60 years and over was approximately 222 million in 2015, which accounted for 16.1% of the total population, and is expected to exceed 243 million by the end of 2020, and 300 million by the year of 2025 (NWCA, 2013; Zhang, 2015). The aging phenomenon in China is particularly evident recently in southwestern China, including Chengdu. In addition, the elderly population increased gradually. The elderly in Chengdu was approximately 2.6 million in 2015, accounting for 21.2% of the total population of Chengdu (NWCA, 2016).

As the elderly population is aging rapidly, the life satisfaction of the elderly is of great interest among Chinese researchers. Life satisfaction is one of the most well-known constructs in gerontology (Mannell and Dupuis, 1996). Moreover, life satisfaction has been considered as an important factor in successful aging and as an indicator of efficacy in the old age (Freund and Baltes, 1998).

Increased risks for losses in health and income in old age suggest that old people may have lower levels of life satisfaction than young people. Liu (2005) found the decline in the health of the elderly could lead to a variety of diseases which might result in a sharper decline in health. According to Tan (2016), the elderly might experience feelings of loneliness, helplessness, anxiety and other negative emotions as results of declining income and social status after their retirement. These problems would reduce their life satisfaction. Gwozdz and Sousa (2010) found that the lowest absolute levels of life satisfaction were recorded for the eldest members. On the contrary, Pinquart and Sorensen (2000) found that older adults' life satisfaction was not lower than younger adults'.

Then, what kind of factors affect the life satisfaction levels of the elderly in China? Cleary, individual characteristics such as gender, age, educational level, health status, marital status, and whether or not living with children have impacts on their life satisfaction. Borg et al. (2006) observed gender and age had an impact on the life satisfaction of old people; women had lower life satisfaction than men, and older people had lower life satisfaction than younger people. Litwin and Shiovitz (2011) observed that educational levels were associated with the life satisfaction of the elderly. In other words, the higher their educational levels were, the higher their life satisfaction levels were. Health status seems to play an important role in their life satisfaction, also. Han et al. (2013) observed there was a relationship between health status and the life satisfaction of the elderly. Stephan et al. (2011) and Gwozdz and Sousa (2010) also reported that health status was a predictor of life satisfaction of the elderly.

In addition, being married or living alone was associated with life satisfaction (Belvis et al., 2008). However, marital status might have different effects for older men and women (Chipperfield and Havens, 2001). Gabriel and Bowling (2004) insisted that having a good relationship with children enhanced the life satisfaction of the elderly. Lin

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et al. (1999) and Shen et al. (2011) also found that living with their children has been associated with the life satisfaction of the elderly in South Korea. On the contrary, Chyi and Mao (2012) found that the Chinese elderly living with their own children reduced their elderly's happiness.

Financial situations may have influences on the elderly's life satisfaction. According to Senik (2004) and Inal et al. (2007), income had positive effects on their life satisfaction. The elderly with lower income had significantly lower life satisfaction than those with moderate/high income. Those with higher income were happier and more satisfied with their life (Kaliterna et al., 2007).

In addition to income, the subjective economic status may also influence the life satisfaction of the elderly. Hsu (2010) reported subjective economic status was associated with life satisfaction based on four waves of a survey of health and living status of the elderly in Taiwan. Also, Hu et al. (2005) study showed that subjective low economic status increased psychological distress. Specifically, subjective economic status has been shown to be associated with depression and life satisfaction of the elderly.

Social capital has been also proved to be effective factors on the life satisfaction the elderly (Gwozdz and Sousa, 2010; Angelini and Cavapozzi, 2012; Lim and Putnam, 2010; Norstrand and Xu, 2012; Kim and Harris, 2013; Cramm et al., 2013). There is a growing body of literature examining the life satisfaction of the elderly in context of social capital recently in China (Chen and Silverstein, 2000; Silverstein et al., 2006). Chen et al. (2009) even insisted that social capital had the most significant explanatory power for life satisfaction of the elderly.

Though social capital has become an important factor for the elderly's life satisfaction, there are many definitions and a wide range of measures about social capital (Stephens, 2008). Defining social capital, some emphasized social relationships among groups of people (Onyx and Bullen, 2000). Following Putnam's influential work (1995), social capital is defined in terms of the trust, social networks and norms of reciprocity (Ferlander, 2007).

Most conceptualizations of social capital include both structural and cognitive aspects (Yamaoka, 2008). The former includes social networks and social participation, which focuses on structural and more objective aspects of social capital, while the latter includes trust, social rule, and norms of reciprocity, which focuses on the less tangible side of social capital (Bain and Hicks, 1998).

Social networks provide frequent interaction with neighbors (Gray, 2009), which may lead to influencing the life satisfaction of the elderly. Grundy and Sloggett (2003) reported strong social networks had positive effects of on the psychological health of the elderly. Participation is also related to the life satisfaction of the elderly. Gabriel and Bowling (2004) found that participation, such as attending educational programs or volunteering, not only brought enjoyment to the elderly but also improved their life satisfaction. Park and Connon (2012) and Lee et al. (2014) also found that the elderly's

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participation, especially in leisure activities, significantly improved their life satisfaction.

Trust, one of the cognitive components of social capital, is also associated with life satisfaction of the elderly. It includes social trust in unspecific people as well as special trust in acquaintances or formal institutions (Paldam, 2000). Wenger et al. (2001) showed that the elderly had trusted in and depended mainly on family members for their personal care whilst the elderly had trust in friends and neighbors to talk to when feeling depressed.

Other perceived social capital, such as social rule, has effects on life satisfaction (Lin and Peek, 1999; Lin et al., 1999). The Chinese elderly, Kim et al. (2015) found, also showed higher life satisfaction when they tended to follow the social rule.

Norms of reciprocity have been also proved to have an influence on the life satisfaction of the elderly in South Korea (Lin, 2009). Chen and Yang (2016) also found that reciprocity in parent-child exchange was related to the life satisfaction of the elderly. This study tries to examine whether the social capital of the elderly has effects on their life satisfaction, and, if it has, which components of social capital between the structural component and the cognitive component have more effects in Chengdu, China.

II. Research Methods

A survey was conducted for respondents who were aged 60 years and over without severe physical conditions in 15 communities of Jinjiang, Wuhou, Qingyang, Chenghua, and Jinniu administrative districts in Chengdu, China from December 20, 2016, to January 25, 2017.[1] Thus, 300 were sampled, and among them, 297 respondents returned their questionnaires.

A dependent variable of this study is the elderly's life satisfaction, which is measured by Cui (1986)'s scale for the life satisfaction of the elderly. The scale consists of 20 items which examine respondents' past, present, and future life situation. Levels of life satisfaction were calculated as averages of 20 items. It is a 5-point Likert scale (1 = "very unsatisfied"; 2 = "unsatisfied"; 3 = "fair"; 4 = "satisfied"; 5 = "very satisfied"). The reliability in this study was good with Cronbach's $\alpha = 0.821$.

A key independent variable is social capital, which consists of structural components and cognitive components. The former includes informal social networks, formal social networks, informal participation, and formal participation, while the latter includes interpersonal trust, public trust, social rule, and norms of reciprocity.

Informal social networks were evaluated with the following 6 questions (Lin, 2009;

[1] The respondents were sampled through the following procedure. First, each community in the administrative districts was numbered 1 to 100 according to its English spelling, and 15 communities were selected. Second, 20 people aged 60 years and over were randomly selected in each selected community.

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Jiang, 2015). "How many children give you money or gifts?" "How many relatives give you money or gifts?" "How many times have you contacted with your children for a month?" "How many times have you contacted with your relatives for a month?" "How many friends or neighbors can help you when you are in trouble?" "How many neighbors are willing to invite you to eat or help you?" The scale of informal social networks had a high reliability with Cronbach's α = 0.824.

Formal social networks were measured with following two questions (Lin, 2009; Jiang, 2015): "How many kinds of collective activities have you participated in?" and "How many times did you meet with your collective activities members for a month?" The scale of formal social networks had a relatively low reliability with Cronbach's α = 0.603.

Informal participation was measured with the following 2 questions (Lin, 2009; Jiang, 2015; Cheng, 2016): "Do you get together, go shopping or travel with your family?" and "Do you get together, go shopping or travel with your friends?" The scale of informal participation had a low reliability with Cronbach's α = 0.531.

Formal participation was measured with the following three questions (Lin, 2009; Jiang, 2015; Cheng, 2016): "Do you participate in collective activities held by the community?" "Do you attend community vote?" "Do you raise questions with your community? The scale of formal participation had a medium-range reliability with Cronbach's α = 0.690. Both measures for informal and formal participation are 5-point Likert scale: 1 = never, 2 = seldom, 3 = sometimes, 4 = usually, and 5 = all the time.

Interpersonal trust, one factor of the cognitive component, was evaluated with 5 items of family' trust, relatives' trust, friends' trust, neighbors' trust and strangers' trust (Lin, 2009; Jin, 2012). The scale of interpersonal trust had a relatively high reliability with Cronbach α = 0.700.

Public trust was evaluated with these 8 items of trust in: residents committee, educational institutions, medical institutions, local government, State Council, Public Security Bureau, mass media and Ministry of Justice (Lin, 2009; Jin, 2012). The scale of public trust had a high reliability with Cronbach α = 0.837. Both scales for interpersonal and public trust were 5-point Likert scales: 1 = completely distrust, 2 = distrust, 3 = fair, 4 = trust, 5 = completely trust.

The social rule, another factor of the cognitive component, was measured with the following three questions (Lin, 2009; Jin, 2012): "Do you obey traffic regulations, queue up, and do not make noise and smoke in public places?" "Do you pay attention not to bring trouble to others?" "Will you call the police or report to relevant departments if you find security risks in the community?" The scale of the social rule had a medium-range reliability with Cronbach's α = 0.618.

Norms of reciprocity were evaluated with the following four questions: "Do you believe that someone who receives help from you will help you when you are in trouble?" "Will you help others who have helped you when they are in trouble?" "Have you been helped by someone else?" "Have you helped others?" Both scales of social rule and norms

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of reciprocity are 5-point Likert scale: 1 = never, 2 = seldom, 3 = sometimes, 4 = usually, and 5 = all the time. The scale of norms of reciprocity was reliable with Cronbach's α = 0.678.

Socio-demographic variables and economic variables included as control variables were: gender, age, educational level, health status, marital status, whether living with children, individual monthly income, and subjective economic status.

III. Results and Discussion

1. Individual Characteristics of respondents

As Table 1 shows, there are more women (55.9%) than men (44.1%) of the total respondents. The respondents are grouped into three age brackets; 60-69 years 36.7%, 70-79 years 45.1%, and 80 years and older 18.2%. Educational levels of the Chinese elderly are generally low: 59.6% of them with middle school education or lower. Only 40.4% of them had educational achievements with high school or more. Low educational levels for the elderly are very natural since China focused on agricultural development during the 1950-1980 period. According to t-tests or one-way ANOVA statistics, gender, age, and educational levels have no effects on the elderly's life satisfaction levels.

The health statuses of the respondents are relatively good in that almost one-third of them had 'good' or 'very good' health and more than a half of them had 'fair' health. Unlike gender, age, and educational level, the health status has a statistically significant influence on the elderly's life satisfaction ($p < .0005$). The elderly who have good health show higher life satisfaction levels than those who have poor or fair health.

Most of the Chinese elderly (98.7%) are married. However, the elderly who are living with their children are only 34.0%, while those who are not living with their children are 66.0%. Our investigation indicates that the elderly not living with their children have higher life satisfaction levels than those living with their children ($p < .05$).

The elderly with individual monthly income of 1,500-3,000 RMB[2] or less are more than two-thirds of the respondents (70.7%), while those with 3,000 RMB or more monthly income accounted for 29.3% of the respondents.

Both of economic factors bring differences to the elderly's life satisfaction. The elderly with individual monthly income of 4,500 RMB or more show higher life satisfaction levels than those with 1,500-3,000 RMB and those with 1,500 RMB or less ($p < .05$). Those who think their economic status as middle show higher life satisfaction levels than those who think their status as low ($p < .001$).

[2] USD 1 = 6.59 RMB(CNY) in September, 2017.

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<Table 1> Individual characteristics of respondents

	%	Mean	SD	t/F
Gender				.850
Female	55.9	3.74	0.33	
Male	44.1	3.70	0.37	
Age				.442
60-69	36.7	3.72	0.47	
65-74	45.1	3.73	0.37	
> 75	18.2	3.69	0.30	
Educational level				1.091
None	6.1	3.63	0.24	
Elementary school	29.6	3.73	0.29	
Middle school	23.9	3.69	0.41	
High school	13.5	3.70	0.33	
Vocational degree	19.2	3.73	0.40	
Bachelor or above	7.7	3.85	0.40	
Health status				11.391***
Poor and Very poor[a]	10.4	3.33	0.11	
Fair[b]	53.5	3.66	0.34	c>a, b
Good and Very good[c]	36.0	3.84	0.37	
Marital status				.291
Married/cohabiting	98.7	3.72	0.35	
Divorced	1.0	3.63	0.65	
Single/widowed	0.3	3.50	-	
Whether living with children				2.481*
Yes	34.0	3.65	0.33	
No	66.0	3.76	0.36	
Personal monthly income				3.795*
< 1500 RMB[a]	17.2	3.66	0.33	
1500-3000 RMB[b]	53.5	3.70	0.32	d>a, b
3000-4500 RMB[c]	21.9	3.74	0.39	
> 4500 RMB[d]	7.4	3.95	0.42	
Subjective economic status				-4.570***
Low	48.5	3.63	0.34	
Middle	51.5	3.81	0.34	

*p < .05, ***p < .0005

Mean, SD, and t/F show the results for the life satisfaction

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2. Social capital of the Chinese elderly

As mentioned before, social capital has two components: structural and cognitive. The Chinese elderly showed higher informal participation (mean = 3.61) than formal information (mean = 3.20). As expected, they participated the most often informally with their families (mean = 3.87), while they participated the least often formally with raising questions to their communities (mean = 2.60).

Another factor of the structural component of social capital is social networks. Regarding informal social networks, the elderly people have 1.89 children in average who give them money or gifts, while they have 2.63 relatives in average who give them money or gifts. They have 5.19 friends or neighbors who can help them when they are in trouble, while they have 3.23 neighbors who are willing to invite you to eat something. They have 3.23 persons in average in their informal social networks. The elderly people contacted their children 13.67 times in average a month and their relatives 8.91 times in average a month. Overall, they contacted 11.29 times in average. Regarding formal social networks, the elderly people participated in 2.24 collective activities in average, and they met 8.12 times with their collective activity members for a month.

<Table 2> Structural social capital among respondents aged 60 and over in Chengdu, China

	M	SD
Informal participation		
Do you gather, go shopping or travel with your family?	3.87	0.81
Do you gather, go shopping or travel with your friends?	3.36	0.97
Average informal participation	3.61	0.74
Formal participation		
Do you participate in collective activities held by the community?	3.23	1.15
Do you attend community election?	3.78	0.96
Do you raise questions with your community?	2.60	1.12
Average formal participation	3.20	0.85
Informal social networks: number of persons		
How many children give you money or gifts?	1.89	1.22
How many relatives give you money or gifts?	2.63	3.45
How many friends or neighbors can help you when you are in trouble?	5.19	8.01
How many neighbors are willing to invite you to eat?	3.23	4.62
Average number of people	3.23	3.09
How many times do you contact with your children for a month?	13.67	10.92
How many times do you contact with your relatives for a month?	8.91	11.92
Average contact of informal social networks	11.29	8.70
Formal social networks		
How many kinds of collective activities do you participate in?	2.24	2.04
How many times do you meet with your collective activities members per month?	8.12	9.67
Average formal social networks	5.18	5.11

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The second component of social capital is cognitive. The cognitive component consists of three factors: trust, social rule, and norms of reciprocity. The average trust level of public trust (4.00) is higher than that of interpersonal trust (3.60). Among the interpersonal trust factors, trust in the family is the highest (4.81) while trust in a stranger is the lowest. It is reasonable, but the gap is too big that the low trust in strangers may become a barrier to institutionalize welfare systems which depend on social trust. Among the public trust factors, trust in State Council is the highest (4.71) while trust in mass media is the lowest (3.40). This result is very interesting since most mass media in China is considered under the government control.

The social rule, another factor of the cognitive component, is very high in average among the elderly (4.75). Thus, the elderly people are expected to follow social rules related to welfare systems if the government imposes the rules.

Items of norms of reciprocity, which is the last factor of the cognitive component, show interesting results. The Chinese elderly people show higher average norms of reciprocity related to themselves (4.83, 4.20) than related to others (4.31, 3.82).

3. Effects of social capital on the life satisfaction of the Chinese elderly

A multiple regression analysis is used to explore the effects of social capital on the life satisfaction of the Chinese elderly in Chengdu, China. Table 5 summarizes the results of the multiple regression on the life satisfaction of the elderly. The model has good explanatory power (Adj. R^2) of 0.404. Among the control variables, only health status is statistically significant (β= .136, p<.01), which means the elderly people show higher life satisfaction if they are healthy. This finding is consistent with these previous studies. Rouch et al. (2014) found that the elderly's health status was significantly associated with their life satisfaction. Utilizing the data collected in the global aging survey from 2006-2007 in five major global regions, Khan and Raeside (2014) also found that older adults' health status was significantly associated with the quality of life among older adults. Pinquart and Sorensen (2000) also observed that health status might be related to subjective well-being. Moreover, Mossey and Shapiro (1982) found that better health status was associated with higher life satisfaction.

On the contrary, social capital has several statistically significant factors on the life satisfaction of the elderly. Among the structural component of social capital, both of informal participation (β= .184, p<.01) and formal participation (β=.195, p<.001) are statistically significant on the life satisfaction of the elderly. Therefore, they have a higher level of life satisfaction when they have higher informal participation or higher formal participation. Levels of formal social networks are also statistically significant on the life satisfaction of the elderly (β= .166, p < .01), while levels of informal social networks are not statistically significant. Among the cognitive component of social capital, norms of reciprocity are the most significant factor (β= .283, p < .001) among all the factors of social capital. Thus, the elderly people have higher life satisfaction when

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they show a higher level of norms of reciprocity. Interpersonal trust is also statistically significant on the life satisfaction of the elderly (ß= .102, p < .05), while public trust is not.

<Table 3> Cognitive social capital among respondents aged 60 and over in Chengdu, China

	M	SD
Interpersonal trust		
Trust in family	4.81	0.52
Trust in relatives	4.17	0.73
Trust in friends	3.77	0.70
Trust in neighbors	3.67	0.62
Trust in strangers	1.60	0.73
Average interpersonal trust	3.60	0.45
Public trust		
Trust in residents committee	4.03	0.65
Trust in educational institutions	3.68	0.73
Trust in medical institutions	3.73	0.81
Trust in local government	4.10	0.68
Trust in State Council	4.71	0.54
Trust in National People's Congress	4.43	0.68
Trust in Public Security Bureau	4.07	0.54
Trust in mass media	3.40	0.80
Trust in Ministry of Justice	3.90	0.66
Average public trust	4.00	0.45
Social rule		
Do you obey traffic regulations, queue up, and do not make noise and smoke in public places?	4.80	0.43
Do you pay attention not to bring trouble to others?	4.74	0.48
Will you call the police or report to relevant departments if you find security risks in the community?	4.71	0.66
Average social rule	4.75	0.36
Norms of reciprocity		
Do you believe that someone who receives help from you will help you when you are in trouble?	4.31	0.70
Will you help others who have helped you when they are in trouble?	4.83	0.45
Have you been helped by someone else?	3.82	0.90
Have you helped others?	4.20	0.80
Average norms of reciprocity	4.30	0.52

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<Table 5> Regression analysis on the life satisfaction of the Chinese elderly

Variable	b	β
Gender (male = 0)	-.057	-.080
Age (65-74 = 0)		
60-69	-.055	-.053
> 75	-.009	-.013
Educational level (elementary school = 0)		
None	-.034	-.023
Middle school	-.029	-.035
High school	-.007	-.007
Vocational degree	.013	.014
Bachelor or above	.084	.064
Health status	.076	.136*
Marital status (divorced = 0)		
Married/cohabiting	.186	.061
Single/widowed	.267	.044
Whether living with children (no = 0)	-.027	-.037
Individual monthly income ("< 1500 RMB" = 0)		
1500-3000 RMB	-.020	-.028
3000-4500 RMB	.030	.035
> 4500 RMB	.082	.061
Subjective economic status (low = 0)	.065	.092
Informal participation	.088	.184**
Formal participation	.082	.195***
Informal social networks: number of people	.004	.038
Informal social networks: number of contacts	.002	.047
Formal social networks	.125	.166**
Interpersonal trust	.112	.102*
Public trust	-.143	-.073
Social rule	.057	.080
Norms of reciprocity	.283	.200***
Constant	2.282	

$R^2 = 0.452$; Adjusted $R^2 = 0.404$; $F = 9.346$

*p < .05, ** p < .01, ***p < .001.

The findings of the effects of social capital in this study are consistent with other studies. Regarding the factor of participation, Bryla et al. (2013) found that participating in family gatherings was associated with the life satisfaction of the elderly. Wei and Milman(2002) also found that the elderly tourist's activity levels were significantly related to their quality of life. Serrat et al. (2017) found the political context of the elderly's life experiences and participation were important in their life satisfaction in Australia and Spain. The World Health Organization (2007) also described active participation in society as means to support older people's life satisfaction. Regarding the factor of social networks, Grundy and Sloggett (2003) identified the positive effects of strong social networks on the health and life satisfaction of the elderly.

Regarding the cognitive social capital, Lu et al. (2016) examined indicators of individual-level cognitive social capital and found that norms of reciprocity were related to the life satisfaction of older adults. Yamaoka (2008) found that interpersonal trust was

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associated with life satisfaction of the elderly and that lower interpersonal trust was related to poor life satisfaction in East Asia (Japan, South Korea, Singapore, five areas in Mainland China, and Taiwan).

IV. Conclusion

The results of the multiple regression show that social capital is very important to improve the life satisfaction of the elderly. Especially, norms of reciprocity, a factor of the cognitive social capital, have the highest impact on the life satisfaction of the elderly. However, the structural component factors of formal participation, informal participation, and formal social networks are also important factors affecting the elderly's life satisfaction.

The cognitive component factors may not be easily changed by social interventions such as social services. In other words, providing social services would not improve the elderly's levels of norms of reciprocity or interpersonal trust since these factors are cognitive. On the contrary, the structural component factors of social capital could be improved by social service programs. Therefore, the government and the society need to provide various social service programs to improve participation levels of the Chinese elderly.

It is a limitation of this study that the findings are not generalizable to other areas of China since the data were collected from Chengdu, China.

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ORIGINAL ARTICLE

Development of a Tool for Collaboration between the Fields of Medicine and Education Based on "Inclusive Needs-Child Record"

: With Focus on Autism Spectrum Disorder (ASD) and Attention Deficit/Hyperactivity Disorder (ADHD)

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ABSTRACT

With regard to the diagnosis of developmental disorders in Japan, it has been reported that it takes a long time (3-10 months) for children to be examined to find out if they have a developmental disorder due to the limited number of medical specialists and specialized healthcare institutions. To resolve this problem, collaboration between the fields of medicine and education has been suggested, by using the "Inclusive Needs-Child Record (IN-Child Record: ICR)." ICR, however, was originally created for the teachers in the field of education, and as such, there are many items therein that are not needed by medical specialists. As such, the necessity of coming up with a new tool has arisen to facilitate the communication and collaboration between the fields of medicine and education. Therefore, this study aimed to develop a tool for effectively providing medical specialists with the information on children possessed by teachers, who spend the longest time with the children. The new tool was designed by combining ICR with DSM-5. To determine the core information that medical specialists need to know for the diagnosis of developmental disorders, a survey was conducted among 1,059 children from elementary and junior high schools in Okinawa Prefecture. From the results of the survey and of the correlation analysis between ICR and DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition), the items that should be included in the new tool were selected, with focus on autism spectrum disorder (ASD) and attention deficit/hyperactivity disorder (ADHD). Finally, the tool for collaboration between the fields of medicine and education was established, consisting of 35 items in four domains. Through the future research, the tool needs to be further developed after verifying its reliability and validity.

＜Key-words＞

Inclusive Needs-Child (IN-Child), IN-Child Record (ICR), ASD, ADHD

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I. Introduction

DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition) has been medically utilized to diagnose developmental disorders (American Psychiatric Association [APA], 2013). DSM-5 refers to developmental disorders as neurodevelopmental disorders with onset during the developmental period, and includes therein adaptive functional deficits in personal or social life or at school or work (APA, 2013).

Problems have arisen of late due to the limited number of medical specialists and specialized healthcare institutions that can conduct medical diagnosis of developmental disorders in Japan (Ministry of Internal Affairs and Communications [MIC], 2017). For instance, it takes 3-10 months for children to receive their first medical examination in the majority of healthcare institutions that provide developmental disorder diagnosis services. Furthermore, as the examination based on which it is determined if a child has a developmental disorder includes an in-depth investigation of the child's infanthood and growth process, the diagnosis takes 1-2 hours per patient, which limits the number of patients that can be examined in a day (MIC, 2017).

According to the Ministry of Education, Culture, Sports, Science, and Technology (MEXT), an estimated 6.5% of the children attending school may have a developmental disorder (MEXT, 2012). MEXT has recommended the utilization of the standard checklist that enables the identification of children with an early-stage developmental disorder in schools from kindergartens to high schools (MIC, 2017). If the teachers and school administrators, who spend much time with the children, can provide medical specialists with the information on such children's behaviors, it will enable the medical specialists to understand the children and to expedite the diagnosis process. Furthermore, if there are standard scales with clear criteria, teachers can observe the children more objectively and can more easily provide the objective information about them to medical specialists, making it possible for the children who have difficulties in school life to receive the proper services in a timely fashion.

In this context, Han, Ota, and Kwon (2016) have developed the Inclusive Needs-Child Record (IN-Child Record or ICR), which is useful for understanding the characteristics of students with developmental disorder tendencies. IN-Child refers to the children who need comprehensive educational support because of their problematic behavior in the classroom caused by problems related to physical or mental health, family problems, or developmental disorders (Han, Ota, & Kwon, 2016).

The concept of IN-Child was established focusing on the educational needs of an individual child, regardless of whether the child has been diagnosed with a developmental disorder (Han, Ota, & Kwon, 2016). Therefore, ICR is a tool that enables the comprehensive understanding of the needs of children in school (Han, Ota, & Kwon, 2016) and can be regarded as the standard checklist recommended by MIC (2017). ICR

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consists of 82 items pertaining to education-related behavior (Han, Ota, & Kwon, 2016), and some of these items do not need to be provided to medical specialists. As such, the necessity of coming up with a new tool that contains the items from both ICR and DSM-5 that are needed by medical specialists for diagnosing children's developmental disorders has arisen.

Therefore, this study aimed to develop a new tool that enables collaboration between the fields of medicine and education based on ICR and DSM-5, for the facilitation of the medical diagnosis of and the provision of continuous educational support for children with developmental disorders.

II. Methods

1. Assessment Tool

For this study, ICR developed by Han, Ota, and Kwon (2016) was used. ICR is a tool for assessing the needs of children classified under "IN-Child" for their comprehensive education, and for planning how to continuously provide them with the support that they need (Han, Ota, & Kwon, 2016). ICR consists of two domains: "Cause" and "Result" (Han, Ota, & Kwon, 2016). The cause domain includes the "Physical" and "Mental" subdomains. The "Physical" subdomain consists of "Body condition" and "Posture, movement, and motion" while the "Mental" domain consists of "Inattention" "Hyperactivity/impulsivity", "Adherence", and "Self-esteem" (Han, Ota, & Kwon, 2016). The "Result" domain, on the other hand, includes the "Daily living" and "Learning" subdomains. The "Daily living" subdomain consists of "Social functioning" and "Communication" while the "Learning" subdomain consists of "Listening", "Speaking", "Reading", "Writing", "Calculating", and "Reasoning" (Han, Ota, & Kwon, 2016).

In total, ICR consists of 82 items (Han, Ota, & Kwon, 2016). The scores are given based on a 5-point scale, where 1=strongly agree; 2=agree; 3=neutral; 4=disagree; and 5=strongly disagree (Han, Ota, & Kwon, 2016). The scores are added by subdomain; as the score of the subdomain is lower, the needs of the subdomain are stronger (Han, Ota, & Kwon, 2016). To determine if the child is an IN-Child, the cutoff value was set as shown in Table 1 (Han, Yano, Kohara, et al., 2017). ICR is a tool whose reliability and validity have been tested in the precedent study (Han, Yano, Kohara, et al., 2017).

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Table 1. Cutoff value of ICR

Domains	Cutoff value/ Domain score
Total score	307/410
Body Condition	41/50
Posture, Movement, and Motion	41/50
Inattention	18/35
Hyperactivity/Impulsivity	21/30
Adherence	21/30
Self-esteem	17/25
Social Functioning	18/25
Communication	17/25
Listening	16/25
Speaking	17/25
Reading	17/25
Writing	16/25
Calculating	13/25
Reasoning	8/15

Cutoff value＝Average score－2SD
Source: Author-modified, Han, Yano, Kohara, et al., 2017.

2. Correspondence between ICR and the Medical Diagnostic Criteria

DSM-5 was used for the medical diagnostic criteria. By analyzing the correspondence between DSM-5 and ICR, the missing items in ICR were added to the new tool.

This study targeted autism spectrum disorder (ASD) and attention deficit/hyperactivity disorder (ADHD) among the neurodevelopmental disorders of DSM-5 for the creation of a new tool. It has been reported that in schools, there are many children with a specific learning disorder (SLD) as well as with ASD and ADHD (MEXT, 2012). As there are no clear diagnosis criteria in DSM-5, however, for which reason the missing data were included in the new tool (APA, 2013), SLD was excluded from the target disorders of the new tool.

DSM-5 provides criteria for diagnosing ASD, such as the social communication and repetitive patterns of behavior, interests, and activities (APA, 2013), which are analyzed as corresponding to the “Adherence” and “Communication” domains of ICR.

3. Data Analysis Based on the Survey through ICR

3.1 Subjects and procedure

A survey was conducted among the children attending elementary and middle schools in Okinawa Prefecture. Before the survey, a letter signed by the principal explaining the purpose and anonymity of the survey was sent to the parents; the parents were also notified that they would not be disadvantaged by their non-participation in the survey, and that the anonymization of the survey ensured that the children’s data could not be revealed. Finally, the survey was conducted among the children whose parents agreed to their participation in this study. It was conducted by the homeroom teachers between February and March 2017, using ICR, with 624 students from one elementary school and 504 students from one middle school participating.

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3.2 Analysis

3.2.1 Definition of children with ASD and ADHD tendencies

ASD and ADHD tendencies need to be defined to analyze the data of the children who showed similar characteristics through ICR. Even though ICR is not a tool for medical purposes, it has common domains with DSM-5. In this study, the children whose scores for the "Adherence" and "Communication" domains of ICR were below the cutoff values were categorized as children with ASD tendencies, and the children whose scores for the "Inattention" and "Hyperactivity/ impulsivity" domains of ICR were below the cutoff values were categorized as children with ADHD tendencies.

3.2.2 Correlation analysis

Correlation analysis was conducted to collect the data of the children with ASD and ADHD tendencies through ICR; the correlations among the items in the "Adherence" and "Communication" subdomains of ICR were analyzed using the data of the children with ASD tendencies, and the correlations among the items in the "Inattention" and "Hyperactivity/ impulsivity" subdomains of ICR were analyzed using the data of the children with ADHD tendencies.

3.2.3 Test of reliability

The reliability of the data collected through the survey, using ICR, was tested. To test the reliability, the internal consistency was measured with Cronbach's α. As the Cronbach's α value was close to 1, it is considered more reliable; the scale with a value higher than 0.700 is considered reliable (Cronbach, 1951).

3.2.4 Statistical analysis

Statistical analysis was conducted through SPSS (IBM SPSS Statistics ver.23). The significance level was $p<0.05$.

III. Results

1. Correspondence Analysis between ICR and DSM-5

Consistency analysis was conducted among the items of ICR and DSM-5. The analysis results related to ASD and ADHD are shown in Table 2 and 3, respectively. The diagnostic criteria of ASD are covered by DSM-5, and the social communication domains are covered by the items of ICR. Among the social functioning items of ICR, Q47, Q48, and Q49 corresponded with the criteria of DSM-5. No items in ICR, however, corresponded with the items of "Stereotyped or repetitive motor movements, use of objects, or speech" and "Hyper- or hypo-reactivity to sensory input or unusual interests in sensory aspects of the environment "in the "Repetitive movement" domain of DSM-5.

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No item in ICR corresponded with the items of "Often has trouble holding his/her attention on tasks or play activities" and "Often loses things necessary for tasks and activities" in the "Inattention"domain of DSM-5, which are related to the diagnosis of ADHD. In addition, no item in ICR corresponded with the items of "Often unable to play or take part in leisure activities quietly","Is often "on the go," acting as if "driven by a motor"" and "Often talks excessively" in the "Hyperactivity/impulsivity" domain in DSM-5.

Table 2. Correspondence between DSM-5 and ICR (ASD)

DSM-5		ICR
A. Persistent deficits in social communication and social interaction across multiple contexts, as manifested by the following, currently or by history	(1) Deficits in social-emotional reciprocity, ranging, for example, from abnormal social approach and failure of normal back-and-forth conversation; to reduced sharing of interests, emotions, or affect; to failure to initiate or respond to social interactions.	Q48 "Sometimes tells something unrelated to the conversation for no purpose" Q50 "Does not try to interact with others during the class" Q51 "Sometimes says something to others out of context"
	(2) Deficits in nonverbal communicative behaviors used for social interaction, ranging, for example, from poorly integrated verbal and nonverbal communication; to abnormalities in eye contact and body language or deficits in understanding and use of gestures; to a total lack of facial expressions and nonverbal communication.	Q52 "Sometimes talks in an awkward or peculiar way, without intonation and a sense of timing; talk is not appropriate" Q54 "Sometimes cannot choose the appropriate way of communicating"
	(3) Deficits in developing, maintaining, and understanding relationships, ranging, for example, from difficulties adjusting behavior to suit various social contexts; to difficulties in sharing imaginative play or in making friends; to absence of interest in peers.	Q47 "Cannot cooperate with his/her friends when playing" Q49 "Plays alone even if his/her friends are nearby" Q53 "Cannot understand sarcasm or irony"
B. Restricted, repetitive patterns of behavior, interests, or activities, as manifested by at least two of the following, currently or by history	(1) Stereotyped or repetitive motor movements, use of objects, or speech	
	(2) Insistence on sameness, inflexible adherence to routines, or ritualized patterns or verbal nonverbal behavior	Q34 "Is obsessed with specific objects" Q38 "Has a peculiar daily routine and hates changes" Q39 "Sometimes cannot perform simple daily activities as he/she is obsessed by specific actions and ideas"
	(3) Highly restricted, fixated interests that are abnormal in intensity or focus	Q35 "While extremely good at doing something, is extremely bad at other things" Q36 "Shows knowledge of a specific field but does not understand its meaning due to rote memorization" Q37 "Is not interested in what other children are usually interested in, and has his/her own world of knowledge of specific subjects"
	(4) Hyper- or hypo-reactivity to sensory input or unusual interests in sensory aspects of the environment	

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Table 3. Correspondence between DSM-5 and ICR (ADHD)

DSM-5			ICR
A. People with ADHD show a persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development	(1) Inattention: Six or more symptoms of inattention for children up to age 16, or five or more for adolescents 17 and older and adults; symptoms of inattention have been present for at least 6 months, and they are inappropriate for developmental level	(a) Often fails to give close attention to details or makes careless mistakes in schoolwork, at work, or with other activities	Q23 "Often fails to give close attention to details or makes careless mistakes in schoolwork, at work, or with other activities."
		(b) Often has trouble holding attention on tasks or play activities	
		(c) Often does not seem to listen when spoken to directly	Q24 "Often does not seem to listen when spoken to directly"
		(d) Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace	Q27 "Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace"
		(e) Often has trouble organizing tasks and activities	Q26 "Often has trouble organizing tasks and activities"
		(f) Often avoids, dislikes, or is reluctant to do tasks that require mental effort over a long period of time	Q25 "Often avoids, dislikes, or is reluctant to do tasks that require mental effort over a long period of time"
		(g) Often loses things necessary for tasks and activities	
		(h) Is often easily distracted	Q21 "Is often easily distracted"
		(i) Is often forgetful in daily activities	Q22 "Is often forgetful in daily activities"
	(2) Hyperactivity and Impulsivity: Six or more symptoms of hyperactivity-impulsivity for children up to age 16, or five or more for adolescents 17 and older and adults; symptoms of hyperactivity-impulsivity have been present for at least 6 months to an extent that is disruptive and inappropriate for the person's developmental level	(a) Often fidgets with or taps hands or feet, or squirms in seat	Q28 "Often fidgets or taps his/her hands or feet, or squirms in his/her seat"
		(b) Often leaves seat in situations when remaining seated is expected	Q29 "Often leaves his/her seat in situations when remaining seated is expected"
		(c) Often runs about or climbs in situations where it is not appropriate	Q30 "Often runs about or climbs in situations where it is not appropriate"
		(d) Often unable to play or take part in leisure activities quietly	
		(e) Is often "on the go" acting as if "driven by a motor"	
		(f) Often talks excessively	
		(g) Often blurts out an answer before a question has been completed	Q32 "Often blurts out an answer before the question has been completed"
		(h) Often has trouble waiting his/her turn	Q31 "Often has trouble waiting for his/her turn"
		(i) Often interrupts or intrudes on others	Q33 "Often interrupts or intrudes on others' businesses"

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2. Data Analysis Based on the Survey Results through ICR

Among the collected data of 1,131 children from one elementary school and one junior high school, the data of 1,059 children were analyzed. The sociodemographic data of the children are shown in Table 4.

Table 4. Characteristics of the study subjects

Total (n=1,059)		
Elementary school (n=594)		
Sex	Male	290 (48.8)
	Female	304 (51.2)
Grade	1	103 (17.3)
	2	98 (16.5)
	3	103 (17.3)
	4	89 (15.0)
	5	100 (16.8)
	6	101 (17.0)
Junior high school (n=465)		
Sex	Male	235 (50.5)
	Female	230 (49.5)
Grade	1	231 (49.7)
	2	234 (50.3)

2.1 ICR scores and reliability coefficient

The ICR scores are shown in Table 5. The internal consistency test results through Cronbach's α are shown in Table 5.

Table 5. ICR score and Cronbach's α

Domains (full score)	Mean	SD	Cronbach's α
Body condition (50)	48.57	3.51	.846
Posture, movement, and motion (50)	48.66	3.81	.898
Inattention (35)	31.05	6.52	.942
Hyperactivity/impulsivity (30)	28.50	3.63	.895
Adherence (30)	28.47	3.54	.896
Self-esteem (25)	23.50	2.94	.853
Social functioning (25)	23.78	2.65	.786
Communication (25)	23.62	3.00	.849
Listening (25)	23.17	3.56	.916
Speaking (25)	23.56	3.20	.920
Reading (25)	23.54	3.26	.938
Writing (25)	23.29	3.62	.923
Calculating (25)	22.61	4.50	.962
Reasoning (15)	13.67	2.60	.962

2.2 Data analysis related to ASD

According to the cutoff values, the data of the children whose scores for "Adherence" were below 21 and whose scores for "Communication" were below 17 were extracted. Such children numbered 34 in all (3.21%). In the results, the data of 26 (76.5%) out of the 34 children were analyzed. Their average age was 11.44±2.13.

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2.3 Data analysis related to ADHD

According to the cutoff values, the data of the children whose scores for "Inattention"were below 18 and whose scores for "Hyperactivity/impulsivity" were below 21 were extracted. Such children numbered 38 in all. In the results, the data of 32 (84.2%) out of the 38 children (3.58%) were analyzed. Their average age was 11.24±2.22.

2.4 Correlation analysis

The results of the correlation analysis of the ICR items related to ASD tendencies are shown in Table 6. It was found that Q35, Q38, Q39, Q41, and Q51 are correlated with the "Adherence" and "Communication"domains of ICR, as the ASD-related items.

Table 6. Correlation analysis of ICR in children with ASD tendencies

Domains	Q35	Q38	Q39	Q41	Q51
Adherence	.392*	.530**	.642**	.459**	.348*
Communication	.374*	.447**	.369**	.350*	.504**

The results of the correlation analysis of the ICR items related to ADHD tendencies are shown in Table 7. It was found that Q21, Q27, Q33, Q47, and Q51 are correlated with the "Inattention"and "Hyperactivity/impulsivity"domains of ICR, as the ADHD-related items.

Table 7. Correlation analysis of ICR in children with ADHD tendencies

Domains	Q21	Q27	Q33	Q47
Inattention	.388*	.458**	.359*	.416**
Hyperactivity/impulsivity	.398*	.396*	.640**	.383*

IV. Discussion

As aforementioned, this study aimed to develop a tool that would enable collaboration between the fields of medicine and education based on ICR, for the facilitation of medical diagnosis and the provision of continuous educational support for children with developmental disorders.

In this study, the correspondence between ICR and DSM-5 was analyzed for ASD and ADHD. There exist items in ICR that correspond with "Stereotyped or repetitive motor movements, use of objects, or speech" and "Hyper- or hypo-reactivity to sensory input or unusual interests in sensory aspects of the environment", which are the criteria for ASD in DSM-5. "Repetitive motor movement, use of object, or speech" are the representative characteristics of ASD (APA, 2013). Sensory difficulty is one of the characteristics that children with ASD show most frequently (Schaaf & Case-Smith,

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2014). Furthermore, as children with hypoesthesia and/or hyperesthesia refuse to touch other persons and objects, they become poor at verbally reporting their perceptions through their sense of touch, which obstructs their communication (Chikai & Miyake, 2014). Therefore, children with hypoesthesia and/or hyperesthesia need to be distinguished from those without these conditions, and it was for this reason that the items related to repetitive movement and the senses were included in the new tool.

Three items in the social functioning domain correspond to the social communication ability of ASD patients in DSM-5. Including these items, ICR covers many of the ASD criteria in DSM-5, but the number of items for assessing the social communication ability of children with ASD tendencies needs to increase to enable the conditions of such children to be understood better. It is effective to intervene in the treatment of children with ASD who have difficulty communicating by detecting it in its early stage (Lai, Lombardo, & Baron-Cohen, 2014). From this perspective, the social communication ability of children with ASD needs to be dealt with more specifically and comprehensively at the same time. Therefore, the three items related to the social communication ability of ASD patients and that correspond to the social functioning domain in ICR were included in the new tool.

Likewise, for the ADHD criteria, the items in DSM-5 that are not in ICR were also added, such as "Often has trouble holding his/her attention on tasks or play activities" and "Often loses things necessary for tasks and activities" in the "Inattention" domain and "Often unable to play or take part in leisure activities quietly", "Is often "on the go," acting as if "driven by a motor"", and "Often talks excessively" in the "Hyperactivity/impulsivity" domain.

Through the aforementioned process, the items for the new tool were collected based on ICR. As for ASD, six items were added to the "Adherence" and "Communication" domains in ICR, which made the items in those domains total 17. Likewise, for ADHD, five items were added to the "Inattention" and "Hyperactivity/impulsivity" domains, which made the items in those domains total 19. The final version of the new tool is shown in Appendix.

Through this study, a new tool was made, but its reliability and validity have yet to be verified. The verification of the reliability and validity of the new tool by professionals from the fields of medicine and education has been left as the future research task. Furthermore, the data that need to be collected through the tool that was used to test the contents' validity and reliability and the construct validity also need to be verified.

The new tool that was created through this study will be the common tool between the fields of medicine and education as well as the only means to provide medical specialists with the information on children who need to undergo medical examination, and is also expected to be a useful tool for both the medical diagnosis of developmental disorders and the provision of educational support for children with difficulties due to their developmental disorders.

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Appendix

Sheet 1

Domains		Items	(ICR)	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Adherence	Q1*	Is obsessed with specific objects	(Q34)	1	2	3	4	5
	Q2*	While extremely good at doing something, is extremely bad at other things	(Q35)	1	2	3	4	5
	Q3*	Shows knowledge of a specific field but does not understand its meaning due to rote memorization	(Q36)	1	2	3	4	5
	Q4*	Is not interested in what other children are usually interested in, and has his/her own world of knowledge of specific subjects	(Q37)	1	2	3	4	5
	Q5*	Has a peculiar daily routine and hates changes	(Q38)	1	2	3	4	5
Score /40	Q6*	Sometimes cannot perform simple daily activities as he/she is obsessed by specific actions and ideas	(Q39)	1	2	3	4	5
	Q7	Stereotyped or repetitive motor movements, use of objects, or speech		1	2	3	4	5
	Q8	Hyper- or hypo-reactivity to sensory input or unusual interests in sensory aspects of the environment		1	2	3	4	5
Communication	Q9*	Does not try to interact with a familiar adult with him/her	(Q41)	1	2	3	4	5
	Q10*	Cannot cooperate with his/her friends when playing	(Q47)	1	2	3	4	5
	Q11*	Sometimes tells something unrelated to the conversation for no purpose	(Q48)	1	2	3	4	5
	Q12*	Plays alone even if his/her friends are nearby	(Q49)	1	2	3	4	5
	Q13*	Does not try to interact with others during the class	(Q50)	1	2	3	4	5
	Q14*	Sometimes says something to others out of context	(Q51)	1	2	3	4	5
Score /45	Q15*	Sometimes talks in an awkward or peculiar way, without intonation and a sense of timing; talk is not appropriate	(Q52)	1	2	3	4	5
	Q16*	Cannot understand the sarcasm, irony	(Q53)	1	2	3	4	5
	Q17*	Sometimes cannot choose the appropriate way of communicating	(Q54)	1	2	3	4	5

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Sheet 2

Domains		Items	(ICR)	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Inattention	Q18*	Is often easily distracted	(Q21)	1	2	3	4	5
	Q19*	Is often forgetful in daily activities	(Q22)	1	2	3	4	5
	Q20*	Often fails to give close attention to details or makes careless mistakes in schoolwork, at work, or with other activities	(Q23)	1	2	3	4	5
	Q21*	Often does not seem to listen when spoken to directly	(Q24)	1	2	3	4	5
	Q22*	Often avoids, dislikes, or is reluctant to do tasks that require mental effort over a long period of time	(Q25)	1	2	3	4	5
	Q23*	Often has trouble organizing tasks and activities	(Q26)	1	2	3	4	5
Score /50	Q24*	Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace	(Q27)	1	2	3	4	5
	Q25	Often has trouble holding attention on tasks or play activities		1	2	3	4	5
	Q26	Often loses things necessary for tasks and activities		1	2	3	4	5
Hyperactivity/Impulsivity	Q27*	Often fidgets with or taps hands or feet, or squirms in seat	(Q28)	1	2	3	4	5
	Q28*	Often leaves seat in situations when remaining seated is expected	(Q29)	1	2	3	4	5
	Q29*	Often runs about or climbs in situations where it is not appropriate	(Q30)	1	2	3	4	5
	Q30*	Often has trouble waiting his/her turn	(Q31)	1	2	3	4	5
	Q31*	Often blurts out an answer before a question has been completed	(Q32)	1	2	3	4	5
	Q32*	Often interrupts or intrudes on others	(Q33)	1	2	3	4	5
Score /45	Q33*	Often unable to play or take part in leisure activities quietly		1	2	3	4	5
	Q34	Is often “on the go” acting as if “driven by a motor		1	2	3	4	5
	Q35	Often talks excessively		1	2	3	4	5

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