Description of authors' roles

Y. Maki designed the study, collected and analyzed the data, and wrote the paper. H. Yoshida designed the study and did the computer programming for the task. T. Yamaguchi collected and analyzed the data. H. Yamaguchi supervised the study and wrote the paper.

Acknowledgments

The authors thank all the study participants as well as their families, and Dr. Masamitsu Takatama for their contribution. No funding was provided for this work. However, H. Yamaguchi is supported by a grant-in-aid from the Ministry of Education, Science, Culture and Sports, Japan.

References

Bediou, B. *et al.* (2009). Impaired social cognition in mild Alzheimer disease. *Journal of Geriatric Psychiatry and Neurology*, 22, 130–140.

Brassen, S., Gamer, M. and Buchel, C. (2011). Anterior cingulate activation is related to a positivity bias and emotional stability in successful aging. *Biological Psychiatry*, 70, 131–137.

Bucks, R. S. and Radford, S. A. (2004). Emotion processing in Alzheimer's disease. *Aging & Mental Health*, 8, 222–232.

Burnham, H. and Hogervorst, E. (2004). Recognition of facial expressions of emotion by patients with dementia of the Alzheimer type. *Dementia and Geriatric Cognitive Disorders*, 18, 75–79.

Cadieux, N. L. and Greve, K. W. (1997). Emotion processing in Alzheimer's disease. *Journal of the International Neuropsychological Society*, 3, 411–419.

Carstensen, L. L., Isaacowitz, D. M. and Charles, S. T. (1999). Taking time seriously. A theory of socioemotional selectivity. *The American Psychologist*, 54, 165–181.

Donaldson, C., Tarrier, N. and Burns, A. (1998). Determinants of carer stress in Alzheimer's disease. *International Journal of Geriatric Psychiatry*, 13, 248–256.

Drapeau, J., Gosselin, N., Gagnon, L., Peretz, I. and Lorrain, D. (2009). Emotional recognition from face, voice, and music in dementia of the Alzheimer type. *Annals of the New York Academy of Sciences*, 1169, 342–345.

Dubois, B. *et al.* (2007). Research criteria for the diagnosis of Alzheimer's disease: revising the NINCDS-ADRDA criteria. *Lancet Neurology*, 6, 734–746.

Ekman, P. and Friesen, W. V. (1971). Constants across cultures in the face and emotion. *Journal of Personality and Social Psychology*, 17, 124–129.

Ekman, P. *et al.* (1987). Universals and cultural differences in the judgments of facial expressions of emotion. *Journal of Personality and Social Psychology*, 53, 712–717.

Goeleven, E. De Raedt, R. and Dierckx, E. (2010). The positivity effect in older adults: the role of affective interference and inhibition. *Aging & Mental Health*, 14, 129–137.

Guaita, A. *et al.* (2009). Impaired facial emotion recognition and preserved reactivity to facial expressions in people with severe dementia. *Archives of Gerontology and Geriatrics*, 49, 135–146.

Hargrave, R., Maddock, R. J. and Stone, V. (2002). Impaired recognition of facial expressions of emotion in Alzheimer's disease. *The Journal of Neuropsychiatry and Clinical Neurosciences*, 14, 64–71.

Kapucu, A., Rotello, C. M., Ready, R. E. and Seidl, K. N. (2008). Response bias in "remembering" emotional stimuli: a new perspective on age differences. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, 34, 703–711.

Luzzi, S., Piccirilli, M. and Provinciali, L. (2007). Perception of emotions on happy/sad chimeric faces in Alzheimer disease: relationship with cognitive functions. *Alzheimer Disease and Associated Disorders*, 21, 130–135.

Mather, M. and Carstensen, L. L. (2003). Aging and attentional biases for emotional faces. *Psychological Science*, 14, 409–415.

Mather, M. and Carstensen, L. L. (2005). Aging and motivated cognition: the positivity effect in attention and memory. *Trends in Cognitive Sciences*, 9, 496–502.

Mather, M. and Knight, M. (2005). Goal-directed memory: the role of cognitive control in older adults' emotional memory. *Psychology and Aging*, 20, 554–570.

Murphy, N. A. and Isaacowitz, D. M. (2008). Preferences for emotional information in older and younger adults: a meta-analysis of memory and attention tasks. *Psychology and Aging*, 23, 263–286.

Ruffman, T., Henry, J. D., Livingstone, V. and Phillips, L. H. (2008). A meta-analytic review of emotion recognition and aging: implications for neuropsychological models of aging. *Neuroscience and Biobehavioral Reviews*, 32, 863–881.

Shioiri, T., Someya, T., Helmeste, D. and Tang, S. W. (1999). Misinterpretation of facial expression: a cross-cultural study. *Psychiatry and Clinical Neurosciences*, 53, 45–50.

Spaniol, J., Voss, A. and Grady, C. L. (2008). Aging and emotional memory: cognitive mechanisms underlying the positivity effect. *Psychology and Aging*, 23, 859–872.

Spoletini, I. *et al.* (2008). Facial emotion recognition deficit in amnestic mild cognitive impairment and Alzheimer disease. *The American Journal of Geriatric Psychiatry : Official Journal of the American Association for Geriatric Psychiatry*, 16, 389–398.

Yamaguchi, T., Maki, Y. and Yamaguchi, H. (2012). Yamaguchi facial expression-making task in Alzheimer's disease: a novel and enjoyable make-a-face game. *Dementia and Geriatric Cognitive Disorders Extra*, 2, 248–257.

Yesavage, J. A., Brink, T. L. and Rose, T. L. (1982). Development and validation of a geriatric depression screening scale: a preliminary report. *Journal of Psychiatric Research*, 17, 37–49.

International Psychogeriatrics: page 1 of 8 © International Psychogeriatric Association 2012
doi:10.1017/S1041610212001147

Pitfall Intention Explanation Task with Clue Questions (Pitfall task): assessment of comprehending other people's behavioral intentions in Alzheimer's disease

Tomoharu Yamaguchi,[1,2] Yohko Maki[1,3] and Haruyasu Yamaguchi[1]

[1] *Gunma University Graduate School of Health Sciences, Gunma, Japan*
[2] *Department of Rehabilitation, Gunma University of Health and Welfare, Gunma, Japan*
[3] *Geriatrics Research Institute and Hospital, Gunma, Japan*

ABSTRACT

Background: In Alzheimer's disease (AD) patients, deficits in contextual understanding and intentions/beliefs of other people (theory of mind; ToM) cause communication problems between patients and caregivers. To evaluate deficits of contextual understanding/ToM, we developed the Pitfall Intention Explanation Task with Clue Questions (Pitfall task).

Methods: We recruited 26 healthy older adults in clinical dementia rating (CDR) 0, and 62 outpatients: 12 with amnestic mild cognitive impairment (aMCI) in CDR 0.5; 36 mild AD in CDR 1; and 14 moderate AD in CDR 2. The Pitfall task consists of a single-frame cartoon that shows a character's intention and seven serial questions that provide clues for contextual understanding/ToM.

Results: The total score (0–7) was decreased with progression of AD (CDR 0, 5.4 ± 2.6; CDR 0.5, 3.7 ± 2.7; CDR 1, 1.9 ± 3.1; CDR 2, 0.0 ± 0.0; respectively). In CDR 0, two-third of the participants responded correctly without clue questions. In CDR 0.5, one-third of the participants responded correctly without clue questions, and half of them understood with the help of the clue questions. In CDR 1, one-fourth of the participants responded correctly without clue questions, and the clue questions did not increase the correct response. In CDR 2, none responded correctly. Additionally, the Pitfall task provided the chance for patients' families to observe patients' responses.

Conclusion: Contextual understanding/ToM, a kind of social cognition, was impaired with progression of AD. The Pitfall task evaluates the function quickly with low burden for memory function, and may provide helpful clues for caregivers to achieve good communication with AD patients.

Key words: dementia, carers, behavioral and psychological symptoms of dementia (BPSD), cognitive assessment, family therapy

Introduction

Evaluating communication problems between caregivers and patients is important, when caring for Alzheimer's disease (AD) patients. These problems could potentially arouse feelings of anxiety, and lead to conflict in their relationship, depression, social isolation, and caregiver burden (Potkins *et al.*, 2003; Savundranayagam *et al.*, 2005). Furthermore, communication problems trigger behavioral and psychological symptoms of dementia (BPSD) in AD patients (Gitlin *et al.*, 2007). Therefore, education for caregivers to attenuate communication problems is effective in reducing BPSD (Ripich *et al.*, 1998; Gitlin *et al.*, 2007). Thus, in AD patients, it is important to assess the communication problems, one of the social skill deficits, in order to provide information to caregivers for appropriate care with attenuated communication problems.

Communication skills include both linguistic and non-linguistic skills. Linguistic communication skills, such as subtle spontaneous language, idiosyncratic pragmatic skill, linguistic changes in verbal expression, and referential communication, were reported to decline from the mild cognitive impairment (MCI) stage or very early stage of AD (Carlomagno *et al.*, 2005; Forbes-McKay and Venneri, 2005; Cuetos *et al.*, 2007; de Lira *et al.*, 2011). Therefore, the ability to comprehend complex references or difficult phrases

Correspondence should be addressed to: Tomoharu Yamaguchi, 3-39-15 Showa-machi, Maebashi, Gunma, 371-8514, Japan. Phone: +81-27-220-8946; Fax: +81-27-220-8946. Email: yamaguchi@shoken-gakuen.ac.jp. Received 1 Apr 2012; revision requested 18 Apr 2012; revised version received 26 May 2012; accepted 30 May 2012.

(e.g. understanding the story line of a TV drama or a complex conversation) is impaired with progression of AD. We have also reported impaired comprehension of figurative proverbs, which is associated with disinhibition, excuse, and confabulation in patients with dementia (Yamaguchi *et al.*, 2011).

Social cognition, one of the higher cerebral functions, includes recognition of emotions, theory of mind (ToM), and behavioral regulation, and its deficits may cause communication problems. The ToM, which requires both linguistic and non-linguistic skills, is reported to be preserved in mild to moderate AD, because failure in false-belief task, a representative ToM test, is secondary to impairment of other functions such as memory (Gregory *et al.*, 2002; Zaitchik *et al.*, 2004; Fernandez-Duque *et al.*, 2009). The ToM tasks were originally developed for children (Baron-Cohen *et al.*, 1985). Therefore, we tried to develop a kind of ToM task for AD, where memory function is impaired.

We focused on deficits in contextual understanding and intentions/beliefs of other people (ToM), rather than linguistic aspects. As a brief task available in a clinical setting, we developed a new cognitive task, the Pitfall Intention Explanation Task with Clue Questions (Pitfall task), to assess the ability for contextual understanding/ToM by explanation of a character's behavioral intentions/beliefs in a cartoon. The task consisted of a single-frame cartoon and seven clue questions to help contextual understanding/ToM step-by-step. We hypothesized that we could demonstrate decline of contextual understanding/ToM with AD progression qualitatively and quantitatively by using a kind of ToM task associated with low burden for memory function.

Methods

Participants

Healthy older adults (n = 26) were recruited from community dwellers who participated in the "Prevention of mental decline project" in Takasaki City, Gunma, Japan, and outpatients who visited the Geriatrics Research Institute and Hospital, Gunma, Japan. These participants were judged as normal, corresponding to clinical dementia rating (CDR) 0 based on the results of cognitive tests and medical interviews by a neurologist specializing in dementia.

We recruited 62 participants, who were diagnosed as having amnestic MCI (aMCI) or AD in an outpatient clinic. All the participants were classified according to CDR by the neurologist. The criteria of aMCI, mild AD, and moderate AD were CDR 0.5 (n = 12), CDR 1 (n = 36), and CDR 2 (n = 14), respectively. In this study, the AD patients were diagnosed based on the criteria of the National Institute of Neurological and Communicative Disorders and Stroke and Alzheimer's Disorders and Related Disorders Association (NINCDS-ADRDA) (Dubois *et al.*, 2007). Similarly, the aMCI patients were diagnosed based on a previous study (Petersen, 2007). CDR 0.5 was regarded as MCI, although a different classification was proposed, whereby CDR 0.5 encompasses both mild and earlier dementia (Reisberg *et al.*, 2008) or very mild dementia (Grundman *et al.*, 2004). Exclusion criteria were: problems with alcoholism, motor deficits such as paralysis, or neurological and psychiatric disorders other than the primary diagnosis of AD or aMCI.

The demographic data and clinical characteristics are shown in Table 1. All the participants reported normal or corrected-to-normal vision, and they were unaware of the purpose of the experiment. The Ethics Board of Gunma University School of Health Sciences approved all procedures (nos. 21–27), and signed informed consent was obtained. All the participants underwent the Mini-Mental State Examination (MMSE) (Folstein *et al.*, 1975).

Procedure

In the present study, we developed a new task. The task consisted of a single-frame cartoon (19 cm long and 25.5 cm wide), which was drawn on A4-size paper, and seven serial questions (Figure 1). The Q2–Q6 are clue questions. The cartoon depicts a scene of a misbehaving child: the person in the center is hiding behind a tree and imagines that the other person (on the left) falls into a pitfall (top right circle).

Protocol

1. The cartoon is placed in front of the sitting participant.
2. The examiner asks the participant whether the participant can see all parts of the cartoon or not, and then asks seven simple questions:
   Q1: "What is happening in this cartoon?"
   Q2: "What do you think this person on the left is doing?" (The examiner gives instructions by pointing to the leftmost person.)
   Q3: "What is this person in the center doing?" (Pointing to the center person.)
   Q4: "What is this?" (Pointing to the top right circle.)
   Q5: "What is this?" (Pointing to the bottom left pitfall.)
   Q6: "What do you think is going to happen to the person on the left?" (Pointing to the leftmost person.)

Table 1. Demographics and clinical characteristics

	ALL	CDR 0[a]	CDR 0.5[b]	CDR 1[c]	CDR 2[d]
Number	88	26	12	36	14
Male/female	30/58	11/15	6/6	12/24	1/13
Age, year	77.1 ± 6.5	73.2 ± 6.3	74.4 ± 5.0	79.2 ± 5.8	81.0 ± 5.5
Education, year	10.4 ± 2.7	12.5 ± 2.4	9.5 ± 2.8	9.5 ± 2.1	9.8 ± 2.4
MMSE	22.4 ± 5.9	28.9 ± 1.3	25.0 ± 3.2	19.9 ± 3.3	14.1 ± 3.1
Total task score	2.9 ± 3.2	5.4 ± 2.6	3.7 ± 2.7	1.9 ± 3.1	0.0 ± 0.0

Note: CDR – Clinical dementia rating; MMSE – Mini-Mental State Examination. Data are presented as mean ± SD.
[a]Healthy older adult.
[b]Amnestic mild cognitive impairment (aMCI).
[c]Mild AD.
[d]Moderate AD.

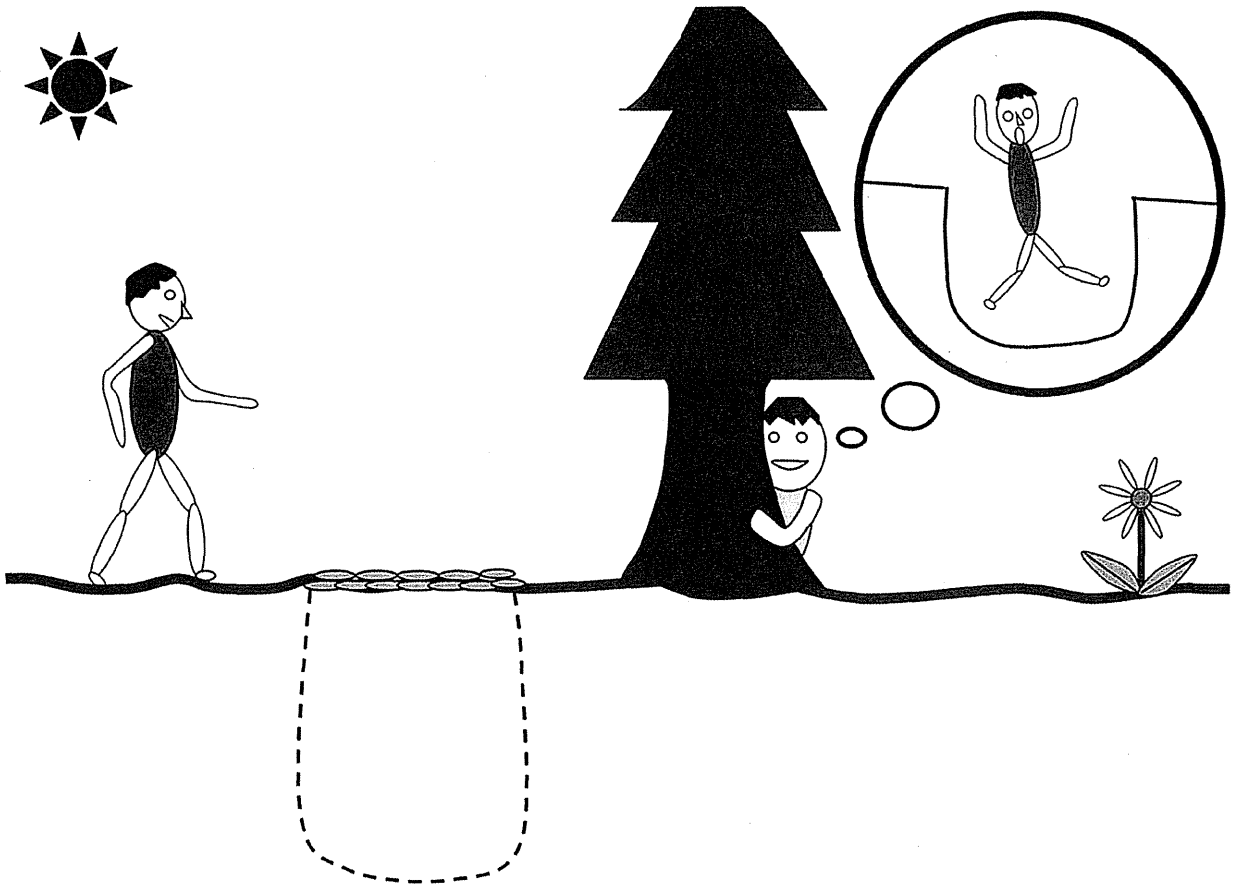

Figure 1. The cartoon for the Pitfall Task. The single-frame cartoon depicts a scene of a misbehaving child: the person in the center is hiding behind a tree and imagines that the other person (on the left) falls into a pitfall (top right circle).

Q7: "What do you think the person in the center intends to do?" (Pointing to the center person.)

3. If the participant says nothing within 30 sec or does not understand the question, skip the question. The participant is required to respond within 1 minute for each question.
4. The examiner records the response.
5. If visual loss is suspected, the participant's visual impairment can be checked by pointing to the flower and the sun, and asking the participant what they are.

Guideline for scoring

The total task score is 0–7 points (1 point for each question), and the score is determined by whether each question is responded to correctly or not. Some examples are as follows:

Q1: If the participant can explain the scene correctly, with terms such as "Mischief" or "Pitfall," the score is 1 point. If the participant does not explain the correct context, for example "There are three children playing hide-and-seek" or "Walking and resting under the shade of a tree," the score is 0 points.
Q2: If the response is similar to "He (or she) is walking and does not know about the hole" or "He is walking and does not know about the pitfall," the score is 1 point.
Q3: If the response is similar to "He (or she) is looking at another child who is walking and does not know about the pitfall, and is imagining that the other (left) child will fall into the pitfall," the score is 1 point.
Q4: If the response is similar to "This is an image of his (center child's) expectation," the score is 1 point.
Q5: If the response is similar to "Pitfall" or "A trap for the child on the left," the score is 1 point.
Q6: If the response is similar to "Fall into a pitfall" or "Walk into a trap," the score is 1 point.
Q7: If the response is similar to "He (or she) wanted to surprise his (or her) friend (or another person) with a pitfall that he (or she) made" or "He (or she) is annoying his (or her) friend (or another person) with a malicious and intentional act (or with a pitfall)."

Data analyses

We calculated the total task scores, and analyzed the number of correct responses and the effect of clue questions for each CDR group. Furthermore, the participant's responses were analyzed qualitatively.

To analyze the CDR group differences of the total task scores, we used analyses of covariance (ANCOVA) with covariates of age, educational years, and genders to exclude these effects. *Post hoc* analysis for each CDR group was conducted with Bonferroni correction in all 88 participants. We also analyzed by further adding MMSE scores as covariates. We examined the relationship of the total task scores with MMSE scores by Pearson's product–moment correlation coefficient in all 88 participants. We did not assess test–retest reliability because of learning effects. All statistical analyses were performed with the Japanese version of SPSS 19.0 for Windows (IBM Com., New York, NY). The results are reported at a significance level of $p < 0.05$.

Results

The total score and its relationship with cognitive tests

The demographic data and the total score for all the participants are shown in Table 1. The total task score (mean ± SD) in CDR 0 (5.4 ± 2.6, n = 26) was the highest of the four CDR groups, and next was that in CDR 0.5 (3.7 ± 2.7, n = 12). The mean total score decreased further in CDR 1 (1.9 ± 3.1, n = 36), and no patients scored any points in the CDR 2 (0.0 ± 0.0, n = 14). The total task score decreased significantly with progression of AD, as demonstrated by ANCOVA with covariates of age, educational years, and genders ($F_{6,81} = 10.65$, $p < 0.001$). The results of a *post hoc* analysis with Bonferroni correction indicated a significant difference between CDR 0 and CDR 1, and between CDR 0 and CDR 2 ($p = 0.004$, $p < 0.001$; respectively; Figure 2). Even when the MMSE score was further added to the covariates, the total task score decreased significantly with progression of AD ($F_{7,80} = 9.19$, $p < 0.001$), and significant differences were shown between CDR 0 and CDR 1 and between CDR 0 and CDR 2 on *post hoc* analysis ($p = 0.02$, $p = 0.02$; respectively).

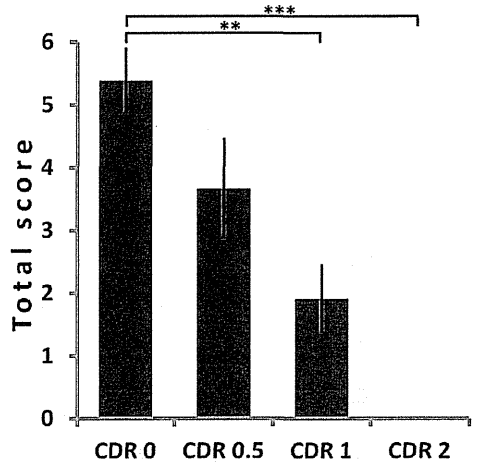

Figure 2. The total scores in the CDR groups. Total score (mean ± SE) was decreased with progression of AD (CDR 0, 5.4 ± 0.5; CDR 0.5, 3.7 ± 0.8; CDR 1, 1.9 ± 0.5; CDR 2, 0.0 ± 0.0; respectively). **p < 0.01, ***p < 0.001 (ANCOVA with covariates of age, educational years, and genders).

The correlation between the total task scores and MMSE scores in all participants (n = 88) was significant and moderate ($r = 0.51$, $p < 0.001$).

When did participants understand the context?

The question at which participants understood the context of the cartoon was analyzed in each CDR group (Figure 3).

In CDR 0, two-third of the participants (65.4%, n = 17) responded correctly from the first question (Q1), and some understood at Q2 (3.8%, n = 1), Q4 (7.7%, n = 2), Q5 (3.8%, n = 1), and Q6 (7.7%, n = 2). The correct response increased up to 88.5% (23/26) at Q7.

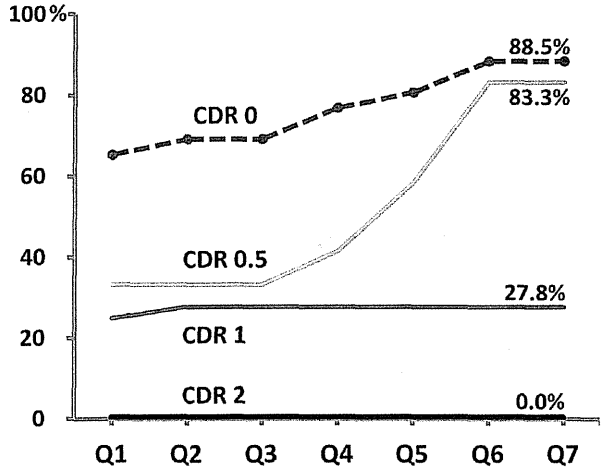

Figure 3. Rate of correct response (contextual understanding/ToM). In CDR 0, most of the participants understood the context from the first question (Q1). In CDR 0.5, the rate of correct response at Q1 was one-third, and the rate increased between Q4 and Q6. In CDR 1, one-fourth of the participants understood at Q1, and the rate did not increase with the clue questions. In CDR 2, none of the participants responded correctly.

In CDR 0.5, the rate of correct response at Q1 was only one-third (33.3%, $n = 4$). Many participants understood at Q4 (8.3%, $n = 1$), Q5 (16.7%, $n = 2$), and Q6 (25.0%, $n = 3$) with the exclusion of two participants (16.7%) who did not understand. The rate of correct response increased between Q3 and Q6, and finally became 83.3% (10/12). The rate of correct response at the last question (Q7) in CDR 0.5 was comparable with that in CDR 0.

The result in CDR 1 was interesting. Although a quarter of participants understood the context at first Q1 (25.0%, $n = 9$), none understood at Q3–Q7. They did not understand with the help of clue questions, except one participant who understood the context at Q2. Thus, the rate of correct response did not increase with each clue question, and was maintained at 27.8% (10/36) to the last question in CDR1.

In CDR 2, none of the participants understood the context at any question.

Characteristic incorrect responses in each CDR group

At Q1, the most common incorrect response in CDR 0 to CDR 1 was an explanation of the interrelation between the two characters in the cartoon; the typical response was "They are playing hide-and-seek" or "He is looking for his friend who is hiding behind the tree." The ratio of this type of response to all the incorrect responses decreased with progression of AD (66.7% of incorrect responses in CDR 0, $n = 6$; 62.5% in CDR 0.5, $n = 5$; 44.4% in CDR 1, $n = 12$; 7.1% in CDR 2, $n = 1$; respectively) (Figure 4a). In contrast, incorrect responses that lacked interrelation between the characters, such as "There is a child" or "There is a flower" increased with progression of AD (11.1% of incorrect responses in CDR 0, $n = 1$; 12.5% in CDR 0.5, $n = 1$; 18.5% in CDR 1, $n = 5$; 28.6% in CDR 2, $n = 4$; respectively) (Figure 4a). These responses did not include interrelation between the two characters. Participants in CDR 2 had difficulty in seeing the cartoon as a whole.

The characteristic incorrect responses at Q2–Q6 reflected a part of the cartoon; for example,

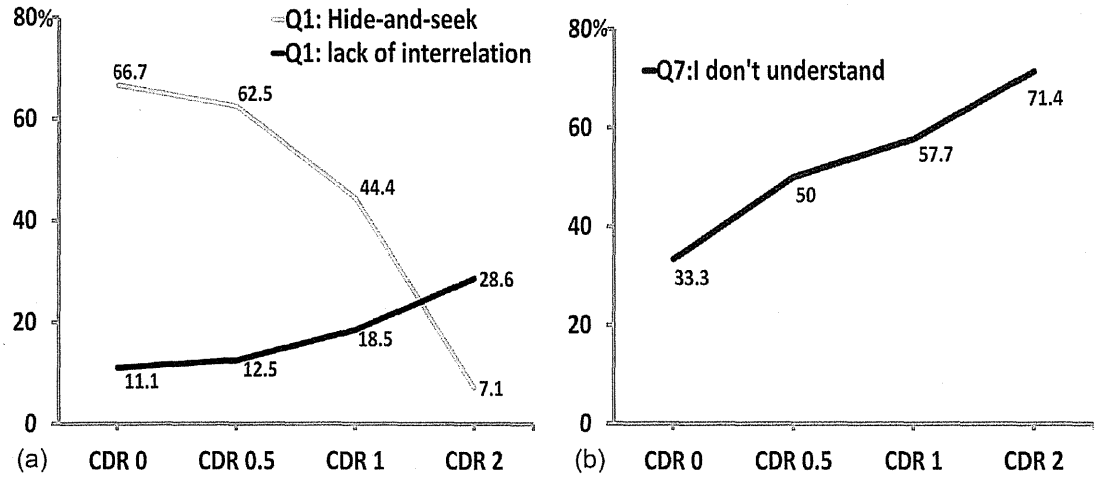

Figure 4. The ratio of response to all incorrect responses for Q1 and Q7. (a) At Q1, the ratio of incorrect response of "Hide-and-seek," which indicated an interrelation between the two characters in the cartoon, decreased according to AD progression, whereas explanations that lacked interrelation between the two characters increased. (b) At Q7, the ratio of incorrect response of "I don't understand" to total incorrect response increased according to AD progression, and was prominent at CDR2.

"Walking or jogging" in Q2, "Climbing a tree" in Q3, and "Throwing one's arms in the air in celebration" in Q4. However, no interrelation between each character was described. Furthermore, for Q5, many participants who failed to understand the context of the cartoon responded such as "A hole in the ground" or "Hole," but not "Pitfall." Similarly, for Q6, they provided responses such as "He is just walking" or "He is walking through the park (without any change)," even though they described a hole in Q5.

For Q7 (Figure 4b), the most common incorrect response was "I really don't understand it" or "Hmmm...I can't make any sense of this" (3.8% of incorrect responses in CDR 0, $n = 1$; 50.0% in CDR 0.5, $n = 1$; 55.7% in CDR 1, $n = 15$; 71.4% in CDR 2, $n = 10$). Many participants in CDR 2 said "I don't understand" without thinking, whereas the participants in CDR 1 provided several possibilities as the response.

Discussion

Findings of the present investigation

In the present study, the total score of the Pitfall task in mild (CDR1) to moderate (CDR2) AD participants was significantly lower than that in healthy older adults (CDR 0). Even when the MMSE score was further added to the covariate of ANCOVA, the total task score also decreased significantly with progression of AD. Furthermore, the Pitfall task showed mild correlation with the MMSE score, indicating that the Pitfall task partly reflects comprehensive cognitive function, but mostly reflects a kind of social cognitive function.

As previously noted, there is considerable agreement that communicative disability is a prominent symptom of AD, and studies have focused on various aspects of linguistic skill disorders (Carlomagno *et al.*, 2005; Forbes-McKay and Venneri, 2005). These studies often used the picture description task, such as the Cookie Theft Picture, which was originally developed for aphasia (Goodglass and Kaplan, 1983) to assess linguistic changes in verbal expression or subtle spontaneous language decline, but not to assess intentions/beliefs of characters in the cartoon (ToM) (Bschor *et al.*, 2001; Carlomagno *et al.*, 2005; Cuetos *et al.*, 2007).

Some studies showed that AD patients succeeded in first-order false–belief tasks, but failed in second-order false–belief tasks, and suggested that any deficits on ToM testing are secondary to impairment in other functions such as memory and/or verbal skills (Gregory *et al.*, 2002; Zaitchik *et al.*, 2004; Fernandez-Duque *et al.*, 2009). However, it is possible that the second-order false–belief task was too difficult, because the sentences used are complex and require memory and other cognitive functions. Our current task was designed to minimize these factors.

In the course of developing the Pitfall task, we tried several single-frame cartoons including other people's intentions/beliefs, and determined the task and clue questions based on a difficulty level where most healthy older adults perform contextual understanding/ToM without clue questions. The task is brief, easy to administer in the outpatient clinic, and less stressful for patients than conventional cognitive tests.

The Pitfall task is associated with seven serial questions, which gradually provide clues to understand the whole context: the Q1 is not a clue question, Q2 and Q3 are clues about the character's objective context, Q4–Q6 are clues to understand the whole context of the cartoon, and Q7 is a direct question of the character's intention.

In this study, most of the participants in CDR 0 understood the context at Q1 without clue questions. In contrast, about half of the participants in CDR 0.5 understood with helpful clues (Q4–Q6), suggesting that social skills such as contextual understanding/ToM start to become impaired from the aMCI stage. Many of the participants in CDR 0.5 understood the context at Q4–Q6, suggesting that the clues for aMCI patients may promote contextual understanding/ToM, including understanding of other people's intentions. Although, about one-fourth of the participants in CDR 1 understood the context at Q1 or Q2, none of the remaining participants understood at Q3–Q7. Furthermore, no participants in CDR 2 understood the context of the cartoon. Thus, contextual understanding/ToM is mildly impaired in early AD patients and impaired more severely with progression of AD.

There is evidence that visuospatial attention declines in early AD (Parasuraman *et al.*, 2000). A study by Rösler *et al.* (2005) suggested reduced efficiency of visual search in AD, which is caused by reduced control of attentional zoom and disengagement of attention from peripheral targets. Thus, some of the incorrect responses in the present study may have been related to deficits of visual attention or simultanagnosia, which is associated with parieto-occipital damage (Huberle and Karnath, 2010).

Using the findings of the Pitfall task for AD care

The communication problems between caregivers and patients trigger BPSD (Potkins *et al.*, 2003; Gitlin *et al.*, 2007). Moreover, family education,

which attenuated communication problems, was effective in reducing BPSD (Ripich *et al.*, 1998; Gitlin *et al.*, 2007).

According to the current results of the Pitfall task, we recommend promising strategies for caregivers to provide appropriate explanations or helpful clues for AD patients. The majority of aMCI patients had difficulty in understanding context without explanation. If the patients understand the context with clue questions, a simple explanation may be effective. In the current study, some participants in CDR 0 and CDR 0.5, who did not understand the context, quickly understood after the examiner's explanation and said things such as "He falls into a hole..... Oh! I see!" or "This is a pitfall! The other child is playing a funny trick on him!". However, in CDR 1 and CDR 2, only a few participants understood the context, even after the examiner's explanation. If mild (CDR1) and moderate (CDR 2) AD patients fail to understand the context with clue questions, detailed explanations or clues could cause confusion. The current study indicated that social reasoning skills were considerably poorer in patients with mild AD and further deteriorated in patients with moderate AD. These findings suggest that caregivers should provide simple explanations for patients in the milder stages of AD, and factual information with minimal explanation for patients in the moderate stages of AD.

In the present study, we allowed patients' families to observe the patients' responses during the task. The family caregivers showed various responses; some expressed feelings of shock and disappointment on seeing the results or reprehended the patients' mistakes, while other caregivers nodded encouragingly with a warm smile even if the patient responded with incorrect responses or did not understand. We observed some communication problems between caregivers and patients through caregivers' responses to patient's mistakes during the Pitfall task. The Pitfall task could provide helpful clues to assist caregivers for better understanding of communication problems in AD patients.

As limitations, the Pitfall task assessed only one narrow area of social cognition. Vasse *et al.* (2010) suggest in their systematic review that there is insufficient evidence of communication strategies for people with dementia. Effective use of the Pitfall task in successful care should be demonstrated in our future study.

Conflict of interest

None.

Description of authors' roles

T. Yamaguchi designed the study, collected the data, carried out the statistical analysis, and wrote the paper. Y. Maki collected the data and wrote the paper. H. Yamaguchi supervised the design of study, collected the data, and wrote the paper.

Acknowledgments

We thank the participants in this study, as well as their relatives, for their contribution. No funding was provided for this work. However, H. Yamaguchi is supported by a grant-in-aid from the Ministry of Education, Science, Culture and Sports, Japan. T. Yamaguchi is supported by a grant-in-aid from the Asawo Health Promotion Foundation, Gunma.

References

Baron-Cohen, S., Leslie, A. M. and Frith, U. (1985). Does the autistic child have a "theory of mind"? *Cognition*, 21, 37–46.

Bschor, T., Kühl, K. P. and Reischies, F. M. (2001). Spontaneous speech of patients with dementia of the Alzheimer type and mild cognitive impairment. *International Psychogeriatrics*, 13, 289–298.

Carlomagno, S., Santoro, A., Menditti, A., Pandolfi, M. and Marini, A. (2005). Referential communication in Alzheimer's type dementia. *Cortex*, 41, 520–534.

Cuetos, F., Arango-Lasprilla, J. C., Uribe, C., Valencia, C. and Lopera, F. (2007). Linguistic changes in verbal expression: a preclinical marker of Alzheimer's disease. *Journal of the International Neuropsychological Society*, 13, 433–439.

de Lira, J. O., Ortiz, K. Z., Campanha, A. C., Bertolucci, P. H. and Minett, T. S. (2011). Microlinguistic aspects of the oral narrative in patients with Alzheimer's disease. *International Psychogeriatrics*, 23, 404–412.

Dubois, B. *et al.* (2007). Research criteria for the diagnosis of Alzheimer's disease: revising the NINCDS-ADRDA criteria. *Lancet Neurology*, 6, 734–746.

Fernandez-Duque, D., Baird, J. A. and Black, S. E. (2009). False-belief understanding in frontotemporal dementia and Alzheimer's disease. *Journal of Clinical and Experimental Neuropsychology*, 31, 489–497.

Folstein, M., Folstein, S. and McHugh, P. (1975). "Mini-mental state." A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, 12, 189–198.

Forbes-McKay, K. E. and Venneri, A. (2005). Detecting subtle spontaneous language decline in early Alzheimer's disease with a picture description task. *Neurological Sciences*, 26, 243–254.

Gitlin, L. N., Winter, L., Dennis, M. P. and Hauck, W. W. (2007). A non-pharmacological intervention to

manage behavioral and psychological symptoms of dementia and reduce caregiver distress: design and methods of project ACT3. *Clinical Interventions in Aging*, 2, 695–703.

Goodglass, H. and Kaplan, E. (1983). *The Assessment of Aphasia and Related Disorders*. Philadelphia, PA: Lea and Febiger.

Gregory, C. *et al.* (2002). Theory of mind in patients with frontal variant frontotemporal dementia and Alzheimer's disease: theoretical and practical implications. *Brain: A Journal of Neurology*, 125, 752–764.

Grundman, M. *et al.* (2004). Mild cognitive impairment can be distinguished from Alzheimer disease and normal aging for clinical trials. *Archives of Neurology*, 61, 59–66.

Huberle, E. and Karnath, H. O. (2010). Saliency modulates global perception in simultanagnosia. *Experimental Brain Research*, 204, 595–603.

Parasuraman, R., Greenwood, P. M. and Alexander, G. E. (2000). Alzheimer disease constricts the dynamic range of spatial attention in visual search. *Neuropsychologia*, 38, 1126–1135.

Petersen, R. C. (2007). Mild cognitive impairment: current research and clinical implications. *Seminars in Neurology*, 27, 22–31.

Potkins, D. *et al.* (2003). Language impairment in dementia: impact on symptoms and care needs in residential homes. *International Journal of Geriatric Psychiatry*, 18, 1002–1006.

Reisberg, B., Ferris, S. H., Kluger, A., Franssen, E., Wegiel, J. and den Leon, M. J. (2008). Mild cognitive impairment (MCI): a historical perspective. *International Psychogeriatrics*, 20, 18–31.

Ripich, D. N., Ziol, E. and Lee, M. M. (1998). Longitudinal effects of communication training on caregivers of persons with Alzheimer's disease. *Clinical Gerontologist*, 19, 37–55.

Rösler, A., Mapstone, M., Hays-Wicklund, A., Gitelman, D. R. and Weintraub, S. (2005). The "zoom lens" of focal attention in visual search: changes in aging and Alzheimer's disease. *Cortex*, 41, 512–519.

Savundranayagam, M. Y., Hummert, M. L. and Montgomery, R. J. (2005). Investigating the effects of communication problems on caregiver burden. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 60, S48–S55.

Vasse, E., Vernooij-Dassen, M., Spijker, A., Rikkert, M. O. and Koopmans, R. (2010). A systematic review of communication strategies for people with dementia in residential and nursing homes. *International Psychogeriatrics*, 22, 189–200.

Yamaguchi, H., Maki, Y. and Yamaguchi, T. (2011). A figurative proverb test for dementia: rapid detection of disinhibition, excuse and confabulation, causing discommunication. *Psychogeriatrics*, 11, 205–211.

Zaitchik, D., Koff, E., Brownell, H., Winner, E. and Albert, M. (2004). Inference of mental states in patients with Alzheimer's disease. *Cognitive Neuropsychiatry*, 9, 301–313.

Reijo S. Tilvis, MD, PhD
Department of Medicine, University of Helsinki and University Hospital, Geriatric Clinic, Helsinki, Finland

ACKNOWLEDGMENTS

Conflict of Interest: The editor in chief has reviewed the conflict of interest checklist provided by the authors and has determined that the authors have no financial or any other kind of personal conflicts with this paper. Not related directly to this epidemiological study, Dr. T. Strandberg has had cooperation with various companies marketing statin drugs and owns a small amount of stock in Orion Pharma, which markets statins. The authors' work has been supported by the Jahnsson Foundation, the University Central Hospitals of Oulu and Helsinki (EVO funding), and the Konung Gustaf V:s och Drottning Victorias Frimurarestiftelse.

Author Contributions: T. Strandberg had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: T. Strandberg. Acquisition of data: T. Strandberg, Pitkala, Tilvis. Analysis and interpretation of data: T. Strandberg, A. Strandberg, Pienimaki, Pitkala, Tilvis. Drafting of the manuscript: T. Strandberg, Pienimaki. Critical revision of the manuscript for important intellectual content: T. Strandberg, A. Strandberg, Pienimaki, Pitkala, Tilvis. Statistical analysis: T. Strandberg. Obtained funding: T. Strandberg, Tilvis. Administrative, technical, or material support: Pitkala, Tilvis.

Sponsor's Role: The funding sources had no role in the design or conduct of the study; collection, analysis, or interpretation of the data; or preparation, review, or approval of the manuscript.

REFERENCES

1. Sattar N, Preiss D, Murray HM, et al. Statins and risk of incident diabetes: A collaborative meta-analysis of randomised statin trials. Lancet 2010;375:735–742.
2. Culver AL, Ockene IS, Balasubramanian R, et al. Statin use and risk of diabetes mellitus in postmenopausal women in the Women's Health Initiative. Arch Intern Med 2012;172:144–152.
3. Strandberg TE, Strandberg AY, Salomaa VV, et al. Explaining the obesity paradox: Cardiovascular risk, weight change, and mortality during long-term follow-up in men. Eur Heart J 2009;30:1720–1727.
4. Walston J, Hadley EC, Ferrucci L, et al. Research agenda for frailty in older adults: Toward a better understanding of physiology and etiology: Summary from the American Geriatrics Society/National Institute on Aging Research Conference on frailty in older adults. J Am Geriatr Soc 2006;54:991–1001.
5. LaCroix AZ, Gray SL, Aragaki A, et al. Women's Health Initiative Statin use and incident frailty in women aged 65 years or older: Prospective findings from the Women's Health Initiative Observational Study. J Gerontol A Biol Sci Med Sci 2008;63A:369–375.

INTERVENTION USING A COMMUNITY-BASED WALKING PROGRAM IS EFFECTIVE FOR ELDERLY ADULTS WITH DEPRESSIVE TENDENCIES

To the Editor: Dementia has become a socioeconomic burden in Japan because of the increasing elderly population, and delaying the onset of dementia would significantly reduce its incidence. Under the Japanese public Long-Term Care Insurance Act, municipality-led interventions for the prevention of mental decline are encouraged in accordance with the concept of community-based rehabilitation.[1] A previously reported randomized controlled trial demonstrated the efficacy of a walking program in preventing mental decline in elderly individuals with subjective memory complaints, and significant benefits were shown ina categorical word fluency test related to frontal lobe function.[2]

This intervention aimed at producing synergetic effects of aerobic exercise and social interaction based on the five principles of brain-activating rehabilitation for dementia: maintaining a pleasant atmosphere, enhancing participants' motivation and self-directed thinking, maintaining interactive communication, providing social roles for participants, and providing positive feedback for learning.[3] It has been reported that aerobic exercise such as walking is beneficial for prevention of mental decline, as well as for slowing the progression of dementia.[4] A rich social network and interaction may protect against mental decline,[5] whereas social isolation is associated with risk of mental decline.[6] Social isolation and loneliness is fundamentally associated with depression in senile individuals.[7] Thus, the previous study was continued with a larger population, and the relationship between participants' depressive tendency and improvement in word fluency tests was reviewed.

The intervention participants were 138 community residents aged 65–80. Based on a medical examination, 106 participants had no cognitive decline (normal controls, NC), and 32 were diagnosed with mild cognitive impairment (MCI). All participated in a 90-minute intervention program conducted once a week for 12 weeks. The intervention was conducted as described previously.[2] The program consisted of a 30-minute exercise period and 60 minutes of small-group work with five to eight participants. Evaluation was conducted twice: at a baseline assessment before the intervention and at a postintervention assessment. Function of word fluency was measured using a categorical test of "animals," and depressive tendency was measured using a self-completed questionnaire

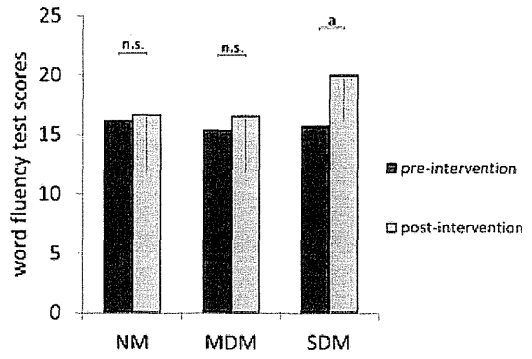

Figure 1. Results of word fluency test. Participants were classified into three groups according to Geriatric Depression Scale score; a score of 0–4 indicated normal mood (NM), 5–9 indicated a mild tendency toward depressed mood (MDM), and 10–15 indicated a severe tendency toward depressed mood (SDM). A higher score on the word fluency test indicates improvement. [a]$P < .001$.

from the Geriatric Depression Scale (GDS);[8] a score of 0–4 indicated normal mood (NM), 5–9 indicated a mild tendency toward depressed mood (MDM), and 10–15 indicated a severe tendency toward depressed mood (SDM).

The effects of the intervention were analyzed in the participants whose attendance rate was greater than 80%. There were 117 participants (mean age ± standard deviation 72.4 ± 4.3, 11.9 ± 2.6 years of education; 36 male and 81 female; 91 NC and 26 MCI). Participants were divided into three groups according to baseline GDS score (79 NM, 31 MDM, 7 SDM). Scores on a word fluency test and GDS were analyzed using two by three analysis of covariance with covariates of age, sex, and years of education: two terms for pre- and postintervention and three groups for NM, MDM, and SDM. The Japanese version of SPSS for Windows version 19.0 (IBM Corp., New York, NY) was used, and statistical significance was set as $P < .05$. The ethics board of Gunma University School of Health Sciences approved all procedures, and written informed consent was obtained from all participants.

The results of the word fluency test were significantly different between the groups ($F(2,111) = 5.345$, $P = .006$), and within-subject post hoc analysis showed significant improvement only in the SDM group (NM, preintervention 16.2 ± 4.2, postintervention 16.7 ± 4.9, $P = .13$; MDM, preintervention 15.4 ± 3.8, postintervention 16.6 ± 4.7, $P = .06$; SDM, preintervention 15.7 ± 2.9, postintervention 20.0 ± 3.7, $P < .001$; increase indicated improvement; Figure 1). In addition, the attendance rate of each SDM participant was greater than 80%, and depressive mood was ameliorated. The GDS results were significantly different between the groups ($F(2, 111) = 8.304$, $P < .001$), and within-participant post hoc analysis showed amelioration in MDM and SDM (NM, preintervention 1.6 ± 1.4, postintervention 2.0 ± 2.1, $P = .16$; MDM, preintervention 6.4 ± 1.4, postintervention 5.5 ± 2.0, $P = .02$; SDM, preintervention 11.0 ± 1.0, postintervention 8.9 ± 2.5, $P = .003$; decrease indicated amelioration).

These results suggest that this intervention provided dual benefits in cognitive function and amelioration of depressive mood in community residents with depressive tendencies. Presenile depressive states are common in elderly individuals, and depressive state and withdrawal related to depressive mood have been found to be risk factors for dementia. Thus, this intervention may be worthwhile for community-based rehabilitation programs. The intervention reported here involved a small group of subjects, although the intervention is continuing, and the results will be confirmed in a larger population as well as longitudinal follow-up of participants.

Yohko Maki, PhD
Gunma University Graduate School of Health Sciences
Maebashi, Gunma, Japan
Department of Neurology, Geriatrics Research Institute and Hospital, Maebashi, Japan

Chiaki Ura, PhD
Research on Social and Human Sciences, Tokyo Metropolitan Institute of Gerontology, Tokyo
Itabashi, Japan

Tomoharu Yamaguchi, MA
Gunma University Graduate School of Health Sciences
Maebashi, Gunma, Japan
Gunma University of Health and Welfare, Maebashi
Gunma, Japan

Ryutaro Takahashi, MD, PhD
Research on Social and Human Sciences, Tokyo Metropolitan Institute of Gerontology, Tokyo
Itabashi, Japan

Haruyasu Yamaguchi, MD, PhD
Gunma University Graduate School of Health Sciences
Maebashi, Gunma, Japan

ACKNOWLEDGMENTS

The authors thank Rumi Shinohara and Yuko Tsunoda at the Gunma University, Maebashi, for their support.

Conflict of Interest: The editor in chief has reviewed the conflict of interest checklist provided by the authors and has determined that the authors have no financial or any other kind of personal conflicts with this paper.

This study was supported in part by a grant from the Japanese Ministry of Health, Labor, and Welfare (Project for optimizing long-term care; B-3). Dr. Yamaguchi is supported by a Grant-in-Aid for Scientific Research from the Ministry of Education, Science, Sports, Culture, and Technology, Japan (23300197 and 22650123) and a Grant-in-Aid for Scientific Research (H22-Ninchisho-Ippan-004) from the Ministry of Health, Labor, and Welfare of Japan.

Author Contributions: Study concept and design: Maki Y, Ura C, Yamaguchi T, Takahashi R, and Yamaguchi H. Acquisition of data: Maki Y, Yamaguchi T, and Yamaguchi H. Intervention: Yamaguchi T. Analysis and interpretation of data and preparation of manuscript: Maki Y, Ura C, and Yamaguchi H.

Sponsor's Role: None.

REFERENCES

1. World Health Organization. Community-based Rehabilitation [on-line]. Available at http://www.who.int/disabilities/cbr/en/ Accessed March 12, 2012.
2. Maki Y, Ura C, Yamaguchi T et al. Effects of intervention using a community-based walking program for prevention of mental decline: A randomized controlled trial. J Am Geriatr Soc 2012;60:505–510.
3. Yamaguchi H, Maki Y, Yamagami T. Overview of non-pharmacological intervention for dementia and principles of brain-activating rehabilitation. Psychogeriatrics 2010;10:206–213.
4. Lautenschlager NT, Cox KL, Flicker L et al. Effect of physical activity on cognitive function in older adults at risk for Alzheimer disease: A randomized trial. JAMA 2008;300:1027–1037.
5. Fratiglioni L, Wang HX, Ericsson K et al. Influence of social network on occurrence of dementia. Lancet 2000;355:1315–1319.
6. Wilson RS, Krueger KR, Arnold SE et al. Loneliness and risk of Alzheimer disease. Arch Gen Psychiatry 2007;64:234–240.
7. Anderson DN. Treating depression in old age: The reasons to be positive. Age Ageing 2001;30:13–17.
8. Yesavage JA, Brink TL, Rose TL. Development and validation of a geriatric depression screening scale: A preliminary report. J Psychiatr Res 1982;17: 37–49.

American Journal of Alzheimer's Disease & Other Dementias®
27(5) 339-345

DOI: 10.1177/1533317512452039
http://aja.sagepub.com
SAGE

Anosognosia: Patients' Distress and Self-awareness of Deficits in Alzheimer's Disease

Yohko Maki, PhD[1,2], Masakuni Amari, MD, PhD[2], Tomoharu Yamaguchi, MA[1], Shutaro Nakaaki, MD, PhD[3] and Haruyasu Yamaguchi, MD, PhD[1]

Abstract

We aimed to study how patients with mild cognitive impairment (MCI) and Alzheimer's disease (AD) suffer from awareness of their deficits. Self-awareness was assessed using the Anosognosia Questionnaire for Dementia in 12 pairs of MCI outpatients and caregivers, 23 with mild AD, and 18 with moderate AD. The discrepancy between patient's and caregiver's evaluation (anosognosia) became greater as AD progressed. The predictors of patients' distress, shown by multiple linear regression analyses, were awareness of decline in intellectual or social functioning; self-awareness of deficits in remembering appointments in MCI; in remembering appointments, writing, mental calculation, and understanding the newspaper in mild AD; and in mental calculation and doing clerical work in moderate AD. Caregivers assumed the predictors of patients' distress differently: awareness of deterioration of memory in MCI and mild AD, and basic activities of daily living in moderate AD. Understanding patients' disability from patients' perspective is required for successful care.

Keywords

Alzheimer's disease, anosognosia, self-monitoring, self-awareness, empathy

Introduction

Deficits in self-awareness of disease, anosognosia, has been recognized as one of the typical symptoms in Alzheimer's disease (AD).[1] The unawareness of impairment is manifested in several domains, including memory and other cognitive functions, and psychological and behavioral functions.[2-4] As for neural substrates of self-awareness, previous research has identified involvement of posterior dorsomedial regions of the parietal lobe including the precuneus and the temporoparietal junction, as well as the prefrontal cortex, in experiments with healthy volunteers.[5-7] The experiments in patients with AD showed that those areas are related to deficits in self-awareness[8-10] and decline of regional cerebral blood flow is observed from the early stages of disease.[11-13] The finding is consistent with the symptomatic changes occurring as neurodegeneration progresses; self-awareness gradually deteriorates as the disease progresses.[4,14]

These neuropsychological findings are beneficial if they are implemented to care for patients with AD. Previous studies reported that behavioral and psychological symptoms of dementia (BPSD) could be caused by deficits of self-awareness.[15-17] From the caregivers' perspective, BPSD increases caregiver distress.[18] However, it is essential to understand the perspective of patients for treatment and care of BPSD.[19,20] To our knowledge, few studies have tried to elucidate the awareness of the deficits from the patients' perspective. For a better understanding of patients' perspective, we assessed the self-awareness of patients and analyzed their distress caused by self-awareness of their deficits. To understand the discrepancy, we also assessed caregivers' perspectives of patients' abilities and how the caregivers assessed patients' distress. We hypothesized that patients retain self-awareness of deficits partially and/or insufficiently and feel distressed by self-awareness at least in the early stage of AD, which the caregivers' might assess differently. The BPSD could result from such misunderstanding of how patients feel, rather than objective assessment of function. It would contribute to beneficial care of

[1] Department of Rehabilitation Sciences, Gunma University School of Health Sciences, Gunma, Japan
[2] Geriatrics Research Institute and Hospital, Gunma, Japan
[3] Laboratory of Aging, Behavior and Cognition, Department of Neuropsychiatry, Keio University School of Medicine

Corresponding Author:
Haruyasu Yamaguchi, MD, PhD, Gunma University School of Health Sciences, 3-39-15 Showa-machi, Maebashi, 371-8514 Gunma, Japan
Email: yamaguti@health.gunma-u.ac.jp

Table 1. Demographic Data[a]

CDR	n	Gender, n (M, F)	Mean ± SD		
			Age, years	Education, years	MMSE
0.5	12	(2, 10)	74.8 ± 5.0	10.5 ± 2.3	26.9 ± 1.5
1	23	(9, 14)	79.6 ± 7.8	9.4 ± 2.1	19.9 ± 4.1
2	18	(3, 15)	82.3 ± 17.8	9.4 ± 3.5	12.5 ± 5.7

Abbreviations: CDR, Clinical Dementia Rating scale; M, male; F, female; MMSE, Mini-Mental State Examination; SD, standard deviation.
[a] There were no significant differences among groups in age ($P = .193$), gender ($P = .185$, chi-square test), or education ($P = .535$). Scores on MMSE were significantly different among groups ($P < .001$).

patients with AD to understand patients' distress related to self-awareness of deficits.

Methods

The participants were 53 pairs of outpatients and their caregivers: 12 amnesic patients with Clinical Dementia Rating scale (CDR) 0.5, 23 with mild AD (CDR 1), and 18 with moderate AD (CDR 2). Demographic data are shown in Table 1. The exclusion criteria were psychiatric diseases, delirium, and verbal incomprehension including aphasia. Participants were diagnosed based on the criteria for AD by National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA),[21] and mild cognitive impairment (MCI) by the report of the International Working Group on Mild Cognitive Impairment.[22] The CDR 0.5 was regarded as MCI, although a different classification was proposed whereby CDR 0.5 encompasses both mild and earlier dementia[23] or it corresponds to very mild dementia.[24] Patients with CDR 0.5 were limited to those free from objective symptoms of other types of dementia such as dementia with Lewy bodies or frontotemporal dementia. Patients with scores over 7 on the Japanese version of the Short Form of the Geriatric Depression Scale,[25] which has a full score of 15, were also excluded because depressive tendency could affect self-evaluation.[26,27] The ethics board of the Gunma University School of Health Sciences approved all procedures (No. 21-27), and written informed consent was obtained from participants.

Anosognosia was evaluated by the questionnaire discrepancy method, which compares patient's self-report with that of a caregiver.[28] The patients and caregivers were required to answer the same questions about the function of the patients independently. The caregivers' assessment was considered as the objective standard and discrepancy was analyzed between the patients' and the caregivers' assessment.

We chose the Japanese version of the Anosognosia Questionnaire for Dementia (AQ-D),[3,29,30] which contains questions asking awareness of deficits on intellectual functioning (22 items), and mood and behavior domains (8 items). Each item of the AQ-D was evaluated on 0 to 3 scales: *never* (0 point), *sometimes* (1 point), *usually* (2 points), or *always* (3 points). Lower scores of the patients meant deficits of awareness in comparison with those of the caregivers. Self-awareness for each item was analyzed by one-sample t test. Summed scores of the 2 domains were compared among CDR groups using 1 × 3 analysis of variance ([ANOVA]; 3 groups according to CDR). The caregivers' scores were analyzed in the same fashion. Discrepancy of each item was evaluated by paired t test. Scores of the 2 domains were summed up, and those summed scores were compared among CDR groups using 2 × 3 repeated measured ANOVA (the patients and their caregivers in pairs and 3 groups according to CDR).

To understand patients' perspective, how patients feel distressed by self-awareness of deficits was analyzed as below. The patients' scores of mood and behavior domain were regarded as their distress from the patients' perspective.[31] The predictors of scores of mood and behavior domain were analyzed using multiple linear regression analyses. The dependent variables were summed scores of mood and behavior domains (8 items), and the candidates of predictors were chosen among items in intellectual functioning domain. All the 22 items in intellectual functioning domain were assessed by one sample t test, and those items with statistical significance ($P < .05$) were entered in a stepwise fashion into multiple linear regression analyses. The caregivers' assessment was analyzed in the same fashion to show how the caregivers assessed the patients' distress.

The patients were also tested using the Mini-Mental State Examination. All analyses were conducted using the Japanese version of SPSS for Windows version 19.0 (IBM Corporation, New York). Significance was set as $P < .05$.

Results

Self-awareness of the Patients

In intellectual functioning domain, patients' assessments were 8.5 ± 4.9 in CDR 0.5, 11.6 ± 6.7 in CDR 1, and 7.2 ± 4.1 in CDR 2 (Table 2). There was a significant difference among the groups ($P = .042$); however, self-evaluation of patients in CDR 2 was not significantly different from that of patients in CDR 0.5 (Figure 1).

The results of each item are shown in Table 2. In CDR 1, patients were aware of their problems in all the 16 items where discrepancy was observed. Concerning 2 items of problems with orientation in the neighborhood (#11) and mental calculation (#15), patients' awareness was not significantly different from that of caregivers.

In CDR2, patients were not aware of their problems in remembering telephone call (#3), understanding conversations (#4), signing one's name (#5), understanding the newspaper (#6), writing (#9), handling money (#10), orientation in the neighborhood (#11), practicing favorite hobbies (#13), communicating with people (#14), bladder control (#17), understanding the plot of a movie (#18), orientation in the house (#19), doing home activities (#20), and feeding oneself (#21), although caregivers noticed the patients' deficits.

In mood and behavior domains, patients' assessments were 3.3 ± 3.0 in CDR 0.5, 3.4 ± 2.9 in CDR 1 and 4.6 ± 4.0 in CDR 2 (Table 2). The results of each item are shown in Table 2.

Table 2. The Results of Each Item

		CDR	Caregivers[a] Mean ± SD	Patients[b] Mean ± SD	Disc[c] *P* value	Pred. C[d]	Pred. P[e]
Intellectual functioning domain							
1	Problems with remembering dates	0.5	1.17 ± 0.83[g]	0.92 ± 0.67[g]	.429		
		1	1.91 ± 0.79[h]	1.30 ± 0.76[h]	.016[f]		
		2	2.61 ± 0.50[h]	1.11 ± 0.76[h]	<.001[h]		
		0.5	0.42 ± 0.51[f]	0.25 ± 0.45	.166		
2	Problems with orientation in new places	1	1.17 ± 1.03[h]	0.74 ± 0.92[g]	.047[f]		
		2	1.78 ± 1.00[h]	0.78 ± 0.73[h]	.004[g]		
		0.5	0.50 ± 0.67[f]	0.33 ± 0.49[f]	.551		
3	Problems with remembering telephone call	1	1.43 ± 0.79[h]	0.65 ± 0.71[h]	<.001[h]		
		2	2.06 ± 1.11[h]	0.17 ± 0.38	<.001[h]		
		0.5	0.58 ± 0.67[f]	0.33 ± 0.49[f]	.389		
4	Problems with understanding conversations	1	1.13 ± .63[h]	0.52 ± 0.59[h]	.002[g]		
		2	1.78 ± 0.88[h]	0.11 ± 0.47	<.001[h]		
		0.5	0.08 ± 0.29	0.00 ± 0.00	.339		
5	Problems with signing your name	1	0.22 ± 0.42[f]	0.17 ± 0.49	.747		
		2	1.33 ± 1.14[h]	0.00 ± 0.00	<.001[h]		
		0.5	0.25 ± 0.45	0.58 ± 0.67[f]	.166		
6	Problems with understanding the newspaper	1	1.00 ± 0.95[h]	0.43 ± 0.51[h]	.020[f]		.221[f]
		2	1.94 ± 0.94[h]	0.11 ± 0.32	<.001[h]		
		0.5	0.75 ± 0.97[f]	0.58 ± 0.79[f]	.551		
7	Problems with keeping belongings in order	1	1.61 ± 0.99[h]	0.43 ± 0.66[g]	<.001[h]		
		2	2.44 ± 0.70[h]	0.22 ± 0.43[f]	<.001[h]		
		0.5	1.50 ± 0.80[h]	0.83 ± 0.39[h]	.005[g]	.555[f]	
8	Problems with remembering where things were left	1	1.78 ± 0.80[h]	1.04 ± 0.64[h]	.001[g]	.352[g]	
		2	2.33 ± 0.77[h]	0.83 ± 0.51[h]	<.001[h]		
		0.5	0.67 ± 0.89[f]	0.33 ± 0.49[f]	.166		
9	Problems with writing	1	0.96 ± 0.71[h]	0.52 ± 0.79[g]	.022[f]	.934[h]	.533[h]
		2	2.17 ± 0.86[h]	0.28 ± 0.75	<.001[h]		
		0.5	0.50 ± 1.00	0.25 ± 0.62	.082		
10	Problems with handling money	1	1.04 ± 1.07[h]	0.35 ± 0.71[f]	.015[f]		
		2	2.06 ± 1.00[h]	0.11 ± 0.47	<.001[h]		
		0.5	0.33 ± 0.89	0.08 ± 0.29	.389		
11	Problems with orientation in your neighborhood	1	0.65 ± 0.83[g]	0.30 ± 0.56[f]	.103		
		2	1.39 ± 1.14[h]	0.11 ± 0.32	<.001[h]		
		0.5	0.67 ± 0.89[f]	0.50 ± 0.52[g]	.504		.766[g]
12	Problems with remembering appointments	1	1.78 ± 0.95[h]	0.78 ± 0.67[h]	<.001[h]		.388[g]
		2	1.94 ± 0.80[h]	0.56 ± 0.62[g]	<.001[h]		
		0.5	0.17 ± 0.39	0.25 ± 0.45	.674		
13	Problems with practicing favorite hobbies	1	0.83 ± 0.94[h]	0.39 ± 0.72[f]	.038[f]	−.309[f]	
		2	1.67 ± 0.97[h]	0.28 ± 0.75	<.001[h]		
		0.5	0.08 ± 0.29	0.25 ± 0.45	.339		
14	Problems with communicating with people	1	0.74 ± 0.69[h]	0.35 ± 0.49[g]	.025[f]		
		2	1.39 ± 0.92[h]	0.00 ± 0.00	<.001[h]	−.471[h]	
		0.5	0.42 ± 0.67	0.83 ± 0.39[h]	.054		
15	Problems with mental calculations	1	1.17 ± 0.89[h]	1.22 ± 0.80[h]	.852		.322[g]
		2	1.83 ± 1.10[h]	0.83 ± 1.15[g]	.022[f]		.523[g]
		0.5	0.75 ± 0.87[f]	0.58 ± 0.51[g]	.638		
16	Problems with remembering shopping lists	1	1.65 ± 0.93[h]	0.74 ± 0.81[h]	<.001[h]		
		2	2.22 ± 0.81[h]	0.50 ± 0.71[g]	<.001[h]		
		0.5	0.17 ± 0.58	0.00 ± 0.00	.339		
17	Problems with bladder control	1	0.39 ± 0.84[f]	0.13 ± 0.34	.186		
		2	1.00 ± 1.03[g]	0.00 ± 0.00	.001[g]	.382[g]	
		0.5	0.25 ± 0.45	0.42 ± 0.51[f]	.438		
18	Problems with understanding the plot of a movie	1	1.09 ± 0.67[h]	0.52 ± 0.51[h]	.006[g]		
		2	1.67 ± 1.03[h]	0.11 ± 0.32	<.001[h]		
		0.5	0.00 ± 0.00	0.00 ± 0.00	–		
19	Problems with orientation in the house	1	0.13 ± 0.34	0.00 ± 0.00	.083		
		2	0.94 ± 1.11[g]	0.00 ± 0.00	.002[g]		

(continued)

Table 2. (continued)

		CDR	Caregivers[a] Mean ± SD	Patients[b] Mean ± SD	Disc[c] *P* value	Pred. C[d]	Pred. P[e]
		0.5	0.92 ± 1.16[f]	0.42 ± 0.67	.166		
20	Problems with doing home activities	1	1.09 ± 1.04[h]	0.22 ± 0.42[f]	.001[g]		
		2	2.06 ± 0.94[h]	0.11 ± 0.32	<.001[h]		
		0.5	0.42 ± 1.00	0.00 ± 0.00	.175		
21	Problems with feeding oneself	1	0.17 ± 0.49	0.04 ± 0.21	.266		
		2	1.00 ± 1.14[g]	0.06 ± 0.24	.004[g]	.490[h]	
		0.5	0.92 ± 1.16[f]	0.75 ± 0.97[f]	.504	.439[f]	
22	Problems with doing clerical work	1	1.52 ± 1.08[h]	0.74 ± 1.10[g]	.002[g]		
		2	2.33 ± 0.84[h]	0.94 ± 1.35[g]	.002[g]	.574[h]	.439[f]
		0.5	11.50 ± 10.48[h]	8.50 ± 4.87[h]	0.389		
	Sum	1	23.48 ± 9.68[h]	11.61 ± 6.66[h]	<.001[h]		
		2	39.94 ± 14.65[h]	7.22 ± 4.14[h]	<.001[h]		
Mood and behavior domains							
		0.5	0.75 ± 0.87[f]	0.58 ± 0.90[f]	.339		
23	More rigid and inflexible about decisions	1	1.57 ± 0.90[h]	0.61 ± 0.72[g]	<.001[h]		
		2	2.06 ± 0.80[h]	0.94 ± 1.21[g]	.003[g]		
		0.5	0.92 ± 0.90[g]	0.58 ± 0.67[f]	.266		
24	More egotistical and self-centered	1	1.39 ± 0.94[h]	0.26 ± 0.45[f]	<.001[h]		
		2	1.56 ± 0.86[h]	0.67 ± 0.97[f]	<.001[h]		
		0.5	0.50 ± 0.67[f]	0.58 ± 0.51[g]	.723		
25	More irritable	1	0.96 ± 0.93[h]	0.39 ± 0.58[g]	.020[f]		
		2	1.22 ± 0.88[h]	0.83 ± 1.04[g]	.149		
		0.5	0.08 ± 0.29	0.42 ± 0.51[f]	.104		
26	More frequent crying episodes	1	0.48 ± 0.79[g]	0.43 ± 0.66[g]	.770		
		2	0.67 ± 0.84[g]	0.83 ± 0.99[g]	.636		
		0.5	0.08 ± 0.29	0.17 ± 0.39	.586		
27	Laughing inappropriately	1	0.17 ± 0.39[f]	0.22 ± 0.52	.770		
		2	0.39 ± 0.61[f]	0.06 ± 0.24	.029[f]		
		0.5	0.00 ± 0.00	0.17 ± 0.39	.166		
28	Increased sexual interest	1	0.13 ± 0.34	0.09 ± 0.29	.665		
		2	0.11 ± 0.32	0.06 ± 0.24	.579		
		0.5	0.50 ± 0.67[f]	.42 ± 0.51[f]	.723		
29	Less interest in favorite activities	1	1.00 ± 0.85[h]	.65 ± 0.93[g]	.088		
		2	1.61 ± .92[h]	.61 ± 1.04[f]	.001[g]		
		0.5	.83 ± 0.83[g]	.42 ± 0.67	.096		
30	More depressed	1	1.13 ± 0.87[h]	0.70 ± 0.76[h]	.038[f]		
		2	1.33 ± 0.69[h]	.56 ± 0.92[f]	.012[f]		
		0.5	3.67 ± 2.77[h]	3.33 ± 2.99[h]	0.768		
	Sum	1	6.83 ± 3.41[h]	3.35 ± 2.92[h]	<.001[h]		
		2	8.94 ± 2.60[h]	4.56 ± 4.00[h]	<.001[h]		

Abbreviation: SD, standard deviation; CDR, Clinical Dementia Rating scale.
[a] Scores of caregivers were analyzed by one-sample *t* test, and statistically significance was denoted.
[b] Scores of caregivers patients were analyzed by one-sample *t* test, and statistically significance was denoted.
[c] Discrepancy between caregivers' and patients' assessment, showing severity of anosognosia; discrepancy was evaluated by paired *t* test.
[d] Predictors of distress in caregivers were analyzed by multivariate regression model, and statistically significant standardized beta value was shown in the column.
[e] Predictors of distress in patients were analyzed by multivariate regression model, and statistically significant standardized beta value was shown in the column.
[f] $P < .05$.
[g] $P < .01$.
[h] $P < .001$.

Caregivers' Evaluation

Caregivers' assessments were 11.5 ± 10.5 (mean ± standard deviation) in CDR 0.5, 23.5 ± 9.7 in CDR 1 and 39.9 ± 14.7 in CDR 2 in intellectual functioning domain (Table 2 and Figure 1), and they were 3.7 ± 2.8 in CDR 0.5, 6.8 ± 3.4 in CDR 1, and 8.9 ± 2.6 in CDR 2 in mood and behavior domains (Table 2).

Anosognosia: Discrepancy Between Caregivers' and Patients' Assessment

In intellectual functioning domain,discrepancy between caregivers' and patients' assessment was significantly different among groups ($P < .001$), and post hoc analysis showed that caregiver's assessment was significantly higher than patients' assessment in the CDR 1 and CDR 2 groups ($P < .001$ in both

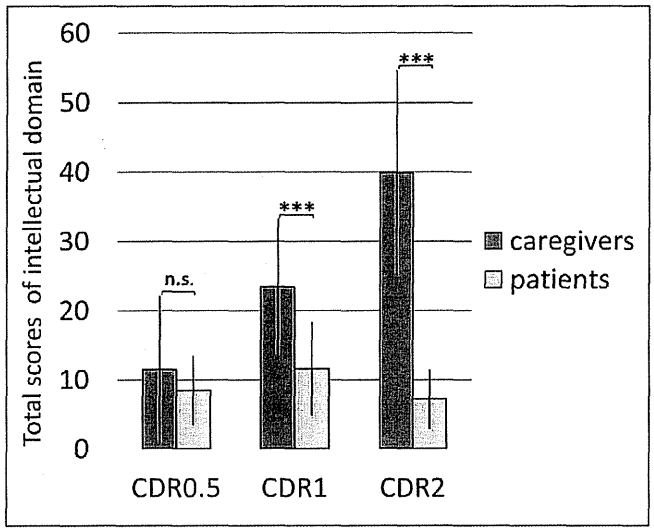

Figure 1. Discrepancy between patients' and caregivers assessment in intellectual functioning domain. Discrepancy was evident in CDR, Clinical Dementia Rating scale (CDR) 1 and 2 groups ($P < .001$ in both), but not in CDR 0.5 group ($P = .389$). Caregivers assessment was aggravated as the disease progressed ($P < .001$). Patients' self-assessment in CDR 1 was worse than that in CDR 2 group ($P = .045$), and there were no significant differences between patients' self-assessment in CDR 2 and that in CDR 0.5. Significant level: ***$P < .001$, ns: not significant.

groups) but not in the CDR 0.5 group ($P = .389$). The findings for each item are shown in Table 2. In CDR 0.5, discrepancy was significant only in mislaying (#8). In CDR 1, discrepancy was observed in 16 items except 6items: problems with signing one's name (#5), orientation inthe neighborhood (#11), mental calculation (#15), and bladder control (#17), orientation in the house (#19), and feeding oneself(#21). Concerning the last 2 items (#19 and #21), the caregivers answered that the patients were capable of these activities. In CDR 2, discrepancy was observed in all 22 items (Table 2 and Figure 1).

In mood and behavior domains, discrepancy between caregivers' and patients' assessment was significantly different among groups ($P = .022$), and post hoc analysis showed that caregivers' assessments were significantly higher than patients' assessment in the CDR 1 and CDR 2 groups ($P < .001$), but not in the CDR 0.5 group ($P = .768$). The findings for each item are shown in Table 2.

Patients' Perspective and Caregivers' Perspectives of Patients' Distress

In CDR 0.5, according to patients' perspectives, problems with remembering appointments (#12) were predictors of distress defined as patients' scores of mood and behavior domain, whereas according to caregivers' perspective, problems with remembering where things were left (#8) and doing clerical work (#22) were predictors.

In CDR 1, according to patients' perspectives, problems with remembering appointments (#12), writing (#9), mental calculation (#15), and understanding the newspaper (#6) were predictors. Problems with writing (#9) were common predictors in assessment of patients and caregivers. According to caregivers' perspectives, problems with remembering where things were left (#8) were a positive predictor, whereas problems with practicing favorite hobbies (#13) were a negative predictor.

In CDR 2, according to patients' perspectives, problems with mental calculation (#15) and doing clerical work (#22) were predictors. Problems with doing clerical work (#22) were common predictors in the assessment of patients and caregivers. According to caregivers' perspectives, problems with feeding oneself (#21) and bladder control (#17) were positive predictors, and problems with communicating with people (#14) was a negative predictor (Table 2).

Discussion

From patients' perspectives, awareness of deficits remained until CDR 2, although awareness diminished as disease progressed. In CDR 0.5, patients' assessments of function and those of caregivers were similar. In CDR 1, the patients were generally aware of their deficits even if their assessment was insufficient. In CDR 2, insufficient awareness of deficits remained and was related to the elemental cognition such as memory (#8, #12, and #16), and time and spatial orientation (#1 and #2). At the same time, it was also shown that the patients no longer retained self-awareness in many aspects. They lost awareness of deficits in activities requiring executive function such as handling money (#10), practicing favorite hobbies (#13), and doing home activities (#20). Metacognition is considered to be closely related to executive functions,[32,33] and it should be noted that self-awareness concerning executive function could deteriorate before self-awareness related to memory or orientation.

In CDR 2, deficits in self-awareness were also apparent in the activities regarding communication and social interaction: understanding conversations (#4), communicating with people (#14), understanding the newspaper for accessing information on society (#6) and understanding the plot of a movie that involves communication of characters (#18). Unawareness of communication deficits could be partly explained by a defense mechanism[34] in the desire to cling to social interaction.

Discrepancy was observed between patients' and caregivers' perspective in what patients felt distressed, adding to the difference between patients' and caregivers' assessment of patients' deficits. From the patients' perspective, patients in CDR 0.5 and 1 might feel distressed due to attenuated social interaction; difficulty with remembering appointments (#12) was chosen as a predictor of distress in CDR 0.5 and in CDR 1. Social interaction and network tend to become limited due to the disease,[35] and the patients may be aware of the difficulties in maintaining social

interaction. Problems with writing (#9) and understanding the newspaper (#6) were also chosen in CDR 1. Those 2 are intellectual tasks related to communication. Writing is an important measure of communication, especially for patients who may have difficulty with face-to-face communication because of the deterioration of comprehension and language abilities. Newspapers are one of the useful tools to catch up with the world. Home delivery service of newspapers is common in Japan, and many elderly individuals habitually read newspapers.

Patients with AD might also be annoyed with awareness of deficits in intellectual tasks.[31] Patients in CDR 1 and 2 felt distressed as a result of awareness of problems with mental calculation (#15). Patients in CDR 2 also felt distressed as a result of awareness of deficits in clerical work (#22); in the Japanese version, the clerical work was limited to household budget management. The caregivers understood the patients' distress concerning deficits in writing (#9, CDR 1) and deficits in doing clerical work (#22, CDR 2); however, they imagined that the patients in CDR 0.5 and 1 only felt distressed by awareness of deterioration of memory (#8 difficulties in remembering where things were left) and those in CDR 2 felt distressed by awareness of deterioration of basic activities of daily living in bladder control (#17) and feeding oneself (#21). Caregivers also thought that patients did not care about problems in practicing favorite hobbies (#13, CDR 1) or communicating with people (#14, CDR 2).

The results indicated that patients felt distressed by awareness of deficits, especially deficits in social interaction and intellectual work. The results also suggested that the patients would prefer to satisfy social needs rather than basic physiological need, which caregivers assumed to be patients' concerns in CDR 2. Misunderstanding of these needs could lead to BPSD. The BPSD is not triggered solely by physiological factors, but rather reflects social environments in which the behavior occurs.[36-38] Thus, modifying environmental factors could be beneficial approach to managing BPSD. As the relationship with caregivers is one of the most influential social environmental factors for the patients, modifying caregivers' behaviors should be beneficial treatment of BPSD.[39] To the contrary, modifying patients' awareness, for example, awareness-raising approaches would be inappropriate. Decline of abilities is inevitable for patients with AD, and the approach forces the patients to confront their deficits and could lead to adverse effects such as anxiety and lowering of self-esteem and motivation.[31,40] The essence of care as nonpharmacological intervention is interpersonal empathetic relationship. Empathy involves cognitive processes to understand others and situations analytically,[41] and cognitive empathy focuses on understanding what the patient needs based on the patients' perspective. It could be an effective tool for cognitive empathy to analyze why patients feel distressed due to self-awareness of disease.

This study had some limitations. The questionnaire discrepancy method recognizes caregivers' assessment as an objective standard, which could be biased by patient–caregiver relationship and caregivers' factors such as depression and health status. This research was conducted in a small number of participants. For the next step, we are planning an interventional study to enhance the coping resources of caregivers with a larger number of participants.

Acknowledgments

The authors thank Dr Masamitsu Takatama, Geriatrics Research Institute and Hospital, Maebashi, and Rumi Shinohara and Yuko Tsunoda, at the Gunma University, Maebashi, for their support.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Dr Yamaguchi is supported by a Grant-in-Aid for Scientific Research from the Ministry of Education, Science, Sports, Culture and Technology, Japan (23300197 and 22650123), and a Grant-in-Aid for Scientific Research (H22-Ninchisho-Ippan-004) from the Ministry of Health, Labor and Welfare, Japan.

References

1. McGlynn SM, Kaszniak AW. When metacognition fails: impaired awareness of deficit in Alzheimer's disease. *J Cogn Neurosci*. 1991;3(2):184-189.
2. Kotler-Cope S, Camp CJ. Anosognosia in Alzheimer disease. *Alzheimer Dis Assoc Disord*. 1995;9(1):52-56.
3. Starkstein SE, Sabe L, Chemerinski E, Jason L, Leiguarda R. Two domains of anosognosia in Alzheimer's disease. *J Neurol Neurosurg Psychiatry*. 1996;61(5):485-490.
4. Vasterling JJ, Seltzer B, Watrous WE. Longitudinal assessment of deficit unawareness in Alzheimer's disease. *Neuropsychiatry Neuropsychol Behav Neurol*. 1997;10(3):197-202.
5. Vogeley K, Bussfeld P, Newen A, et al. Mind reading: neural mechanisms of theory of mind and self-perspective. *Neuroimage*. 2001;14(1 pt 1):170-181.
6. Kjaer TW, Nowak M, Lou HC. Reflective self-awareness and conscious states: PET evidence for a common midline parietofrontal core. *Neuroimage*. 2002;17(2):1080-1086.
7. Decety J, Grezes J. The power of simulation: imagining one's own and other's behavior. *Brain Res*. 2006;1079(1):4-14.
8. Mimura M, Yano M. Memory impairment and awareness of memory deficits in early-stage Alzheimer's disease. *Rev Neurosci*. 2006;17(1-2):253-266.
9. Salmon E, Perani D, Herholz K, et al. Neural correlates of anosognosia for cognitive impairment in Alzheimer's disease. *Hum Brain Mapp*. 2006;27(7):588-597.
10. Amanzio M, Torta DM, Sacco K, et al. Unawareness of deficits in Alzheimer's disease: role of the cingulate cortex. *Brain*. 2011; 134(pt 4):1061-1076.
11. Matsuda H. Role of neuroimaging in Alzheimer's disease, with emphasis on brain perfusion SPECT. *J Nucl Med*. 2007;48(8): 1289-1300.
12. Cavanna AE. The precuneus and consciousness. *CNS Spectr*. 2007;12(7):545-552.

13. Dickerson BC, Sperling RA. Large-scale functional brain network abnormalities in Alzheimer's disease: insights from functional neuroimaging. *Behav Neurol.* 2009;21(1):63-75.
14. Starkstein SE, Chemerinski E, Sabe L, et al. Prospective longitudinal study of depression and anosognosia in Alzheimer's disease. *Br J Psychiatry.* 1997;171:47-52.
15. Harwood DG, Sultzer DL, Wheatley MV. Impaired insight in Alzheimer disease: association with cognitive deficits, psychiatric symptoms, and behavioral disturbances. *Neuropsychiatry Neuropsychol Behav Neurol.* 2000;13(2):83-88.
16. Kashiwa Y, Kitabayashi Y, Narumoto J, Nakamura K, Ueda H, Fukui K. Anosognosia in Alzheimer's disease: association with patient characteristics, psychiatric symptoms and cognitive deficits. *Psychiatry Clin Neurosci.* 2005;59(6):697-704.
17. Spalletta G, Girardi P, Caltagirone C, Orfei MD. Anosognosia and neuropsychiatric symptoms and disorders in mild Alzheimer disease and mild cognitive impairment. *J Alzheimers Dis.* 2012; 29(4):761-772.
18. Black W, Almeida OP. A systematic review of the association between the Behavioral and Psychological Symptoms of Dementia and burden of care. *Int Psychogeriatr.* 2004;16(3):295-315.
19. Lyketsos CG, Colenda CC, Beck C, et al. Position statement of the American Association for Geriatric Psychiatry regarding principles of care for patients with dementia resulting from Alzheimer disease. *Am J Geriatr Psychiatry.* 2006;14(7):561-572.
20. Cohen-Mansfield J, Libin A, Marx MS. Nonpharmacological treatment of agitation: a controlled trial of systematic individualized intervention. *J Gerontol A Biol Sci Med Sci.* 2007;62(8):908-916.
21. Dubois B, Feldman HH, Jacova C, et al. Research criteria for the diagnosis of Alzheimer's disease: revising the NINCDS-ADRDA criteria. *Lancet Neurol.* 2007;6(8):734-746.
22. Reisberg B, Ferris SH, Kluger A, Franssen E, Wegiel J, de Leon MJ. Mild cognitive impairment (MCI): a historical perspective. *Int Psychogeriatr.* 2008;20(1):18-31.
23. Grundman M, Petersen RC, Ferris SH, et al. Mild cognitive impairment can be distinguished from Alzheimer disease and normal aging for clinical trials. *Arch Neurol.* 2004;61(1):59-66.
24. Winblad B, Palmer K, Kivipelto M, et al. Mild cognitive impairment—beyond controversies, towards a consensus: report of the International Working Group on Mild Cognitive Impairment. *J Intern Med.* 2004;256(3):240-246.
25. Yesavage JA, Brink TL, Rose TL, et al. Development and validation of a Geriatric Depression Screening Scale: a preliminary report. *J Psychiatr Res.* 1982-1983;17(1):37-49.
26. Smith CA, Henderson VW, McCleary CA, Murdock GA, Buckwalter JG. Anosognosia and Alzheimer's disease: the role of depressive symptoms in mediating impaired insight. *J Clin Exp Neuropsychol.* 2000;22(4):437-444.
27. Nakaaki S, Murata Y, Sato J, et al. Impact of depression on insight into memory capacity in patients with Alzheimer disease. *Alzheimer Dis Assoc Disord.* 2008;22(4):369-374.
28. Mimura M. Memory impairment and awareness of memory deficits in early-stage Alzheimer's disease. *Tohoku J Exp Med.* 2008; 215(2):133-140.
29. Migliorelli R, Teson A, Sabe L, et al. Anosognosia in Alzheimer's disease: a study of associated factors. *J Neuropsychiatry Clin Neurosci.* 1995;7(3):338-344.
30. Sato J, Nakaaki S, Murata Y, et al. Two dimensions of anosognosia in patients with Alzheimer's disease: reliability and validity of the Japanese version of the Anosognosia Questionnaire for Dementia (AQ-D). *Psychiatry Clin Neurosci.* 2007;61(6): 672-677.
31. Lai JM, Hawkins KA, Gross CP, Karlawish JH. Self-reported distress after cognitive testing in patients with Alzheimer's disease. *J Gerontol A Biol Sci Med Sci.* 2008;63(8):855-859.
32. Shimamura AP. Toward a cognitive neuroscience of metacognition. *Conscious Cogn.* 2000;9(2 pt 1):313-323.
33. Clare L. Awareness in early-stage Alzheimer's disease: a review of methods and evidence. *Br J Clin Psychol.* 2004;43(pt 2):177-196.
34. Mograbi DC, Brown RG, Morris RG. Anosognosia in Alzheimer's disease–the petrified self. *Conscious Cogn.* 2009;18(4): 989-1003.
35. Fratiglioni L, Wang HX, Ericsson K, Maytan M, Winblad B. Influence of social network on occurrence of dementia: a community-based longitudinal study. *Lancet.* 2000;355(9212): 1315-1319.
36. Cohen-Mansfield J. Nonpharmacologic interventions for inappropriate behaviors in dementia: a review, summary, and critique. *Am J Geriatr Psychiatry.* 2001;9(4):361-381.
37. Ayalon L, Gum AM, Feliciano L, Arean PA. Effectiveness of nonpharmacological interventions for the management of neuropsychiatric symptoms in patients with dementia: a systematic review. *Arch Intern Med.* 2006;166(20):2182-2188.
38. O'Connor DW, Ames D, Gardner B, King M. Psychosocial treatments of behavior symptoms in dementia: a systematic review of reports meeting quality standards. *Int Psychogeriatr.* 2009;21(2): 225-240.
39. Gitlin LN, Winter L, Dennis MP, Hauck WW. A nonpharmacological intervention to manage behavioral and psychological symptoms of dementia and reduce caregiver distress: design and methods of project ACT3. *Clin Interv Aging.* 2007; 2(4):695-703.
40. Dietch JT, Hewett LJ, Jones S. Adverse effects of reality orientation. *J Am Geriatr Soc.* 1989;37(10):974-976.
41. Decety J. The neuroevolution of empathy. *Ann N Y Acad Sci.* 2011;1231:35-45.

Geriatr Gerontol Int 2012

ORIGINAL ARTICLE

Pleasant physical exercise program for prevention of cognitive decline in community-dwelling elderly with subjective memory complaints

Tadahiko Kamegaya,[1] Long-Term-Care Prevention Team of Maebashi City,[2] Yohko Maki,[1] Tetsuya Yamagami,[3] Tomoharu Yamaguchi,[1] Tatsuhiko Murai[1] and Haruyasu Yamaguchi[1]

[1]Gunma University Graduate School of Health Science, [2]Maebashi City Office, and [3]Takasaki University of Health and Welfare, Gunma, Japan

Aim: Japan is one of the most rapidly aging societies in the world. Measures to prevent dementia are urgently required in Japan, although such strategies have not yet been established. This study investigated the effectiveness of a pleasant physical exercise intervention on the prevention of cognitive decline in community-dwelling elderly participants with subjective memory complaints. In this intervention, a pleasant atmosphere was emphasized to enhance the participants' motivation.

Method: We administered a 12-week intervention program consisting of pleasant physical exercise. This program for the prevention of cognitive decline was carried out as a service of Maebashi city. The service targeted elderly residents aged 65 years and older who had subjective memory complaints. After a control period of 12 weeks, 42 participants, aged between 65–86 years, received intervention once a week at community centers. Participants carried out group exercise, and were encouraged to perform home exercise and walking during the intervention period. The program was carried out by co-medical professional staff, with the help of senior citizen volunteers.

Results: A total of 30 participants were included in the analysis. There was significant improvement on the Wechsler digit symbol substitution test ($P = 0.01$).

Conclusion: Participants with subjective memory complaints who continued the pleasant physical exercise programs for 12 weeks showed improvement in some aspects of cognitive function. Participation of senior citizen volunteers enabled smooth implementation of the program, and alleviated the burden on the professional staff. The pleasant physical exercise intervention described in the present study could be regarded as a community-led intervention to prevent cognitive decline. **Geriatr Gerontol Int 2012; ••: ••–••.**

Keywords: community-dwelling elderly, physical exercise intervention, senior citizen volunteer, service for prevention of cognitive decline, subjective memory complaints.

Accepted for publication 10 January 2012.

Correspondence: Mr Haruyasu Yamaguchi MD PHD, Gunma University Graduate School of Health Science, 39-22 Showa-machi 3-chome, Maebashi, Gunma 371-8511, Japan.Email: yamaguti@health.gunma-u.ac.jp

Author contributions: Tadahiko Kamegaya, 30%; Long-Term-Care Prevention Team of Maebashi City, 20%; Yohko Maki, 15%; Tetsuya Yamagami, 10%, Tomoharu Yamaguchi and Tatsuhiko Care Prevention Team of Maebashi City, 20%; Yohko Maki, 15%; Tetsuya Yamagami, 10%, Tomoharu Yamaguchi and Tatsuhiko Murai, 5%; Haruyasu Yamaguchi, 15%.

doi: 10.1111/j.1447-0594.2012.00840.x

Introduction

It is estimated that 24.3 million people have dementia worldwide, with 4.6 million new cases every year.[1] Japan is one of the most rapidly aging societies in the world, and the number of demented elderly people who require nursing care is predicted to be 2.5 million in 2015 and 3.2 million in 2025.[2] Measures to prevent dementia are urgently required in Japan, although such strategies have not yet been established.

Physical exercise intervention for individuals with subjective memory complaints (SMC) is expected to be one of the efficient strategies to reduce the risk of cognitive decline. Several studies have suggested that SMC are associated with increased risk of dementia, even in persons with normal cognitive function.[3–5] A meta-analysis focused on older adults with dementia and related cognitive impairments suggested that physical exercise increases fitness, physical function, cognitive function and positive behavior.[6] In non-demented subjects, the results of a recent meta-analysis showed that subjects who carried out physical activity had a significantly reduced risk of cognitive decline.[7] A randomized controlled trial in older adults with SMC showed that physical activity programs were associated with an improvement in cognition.[8]

Physical activities in a pleasant atmosphere can be more effective for the prevention of cognitive decline. It has been proven in an animal study that exercise in enriched environments has a suppressive effect on the accumulation of amyloid β protein.[9] We have proposed the efficacy of intervention carried out in a pleasant atmosphere with an emphasis on communication (brain-activating rehabilitation).[10] Therefore, it could be meaningful to facilitate a pleasant atmosphere, and form a group where participants enjoyed mutual communication.

In Japan, public concern about care prevention has been growing since the Long-Term Care Insurance system was revised in 2008. Many municipalities have already started services for preventing cognitive decline. The services focus on maintaining and/or improving the cognitive functions of those who do not require care at present. However, the effectiveness of these services is currently insufficient. Furthermore, it remains necessary to prove the effectiveness of such services in preventing cognitive decline, if the services are to be provided as a public service.

We carried out a pleasant physical exercise intervention, which was conducted as a service of Maebashi city, in elderly with SMC. The programs were administered by co-medical professional staff along with senior citizen volunteers. The present study investigated the effectiveness of this service for preventing cognitive decline in elderly residents with SMC.

Method

Participants

The intervention program was carried out for the prevention of cognitive decline as a service of the municipality of Maebashi city in 2010. The service targeted elderly subjects aged 65 years and older residing in two districts of Maebashi city. Participants were recruited from these districts by the following methods.

1 Lectures on the prevention of cognitive decline for community residents were held twice.
2 Leaflets were distributed to each household, 1958 in total.
3 Public health nurses and local welfare commissioners visited door-to-door to invite elderly residents to the program.

The Medical Ethics Committee of Gunma University approved this study (21–47), and written informed consent was obtained from all participants.

Initial screening

Participants ($n = 100$) were screened by a questionnaire and medical interview (Fig. 1). They were examined by a clinician specializing in dementia. Those who met the two criteria below were excluded, and 87 participants remained.

1 Diagnosed as having dementia according to the criteria of International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10).
2 Having a medical condition that made them unable to engage in physical activity.

Evaluation

The change in cognitive function was evaluated using Five-cog test, which evaluates the following cognitive domains: attention, memory, visuospatial function, language and reasoning. The Five-cog test consists of five items: (i) "character position referencing task" for evaluating attention; (11) "category cued recall task" for evaluating memory ability; (iii) "clock drawing task" for evaluating visuospatial function; (iv) "animal name listing task" for evaluating language ability; and (vi) "analogy task" for evaluating abstract reasoning ability.[11,12] Participants were also evaluated using the Wechsler digit symbol substitution test (WDSST).

To evaluate the physical function of each participant, grip strength test, one-leg standing duration test, timed up and go test, and 5 m maximum walking times test were carried out.

Participants were required to complete a questionnaire consisting of questions regarding age, sex, education and previous/current medical history. Their