

## Original article

## Spot the Difference for Cognitive Decline: A quick memory and attention test for screening cognitive decline



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## ABSTRACT

**Background:** Dementia is currently one of the most common conditions in older adults, and early detection of cognitive decline is crucial for identifying dementia. We developed a new type of short-term memory and attention test that uses a spot-the-difference task: Spot the Difference for Cognitive Decline (SDCD). The purpose of the present study was to examine the accuracy of the SDCCD test for the identification of cognitive impairment in community-dwelling older adults.

**Methods:** The participants were 443 Japanese community-dwelling older adults. The SDCCD test uses two scenery pictures. Participants were instructed to memorize the details of the first picture for 30 seconds, after which the first picture was taken away and the second picture was shown. Next, the participants were asked to identify as many differences as possible between the first and second pictures, which were presented sequentially. The number of correct responses comprises the SDCCD score (scores: 0–10). The Mini-Mental State Examination and Scenery Picture Memory Test were used to measure the participants' cognitive function. We used receiver-operating characteristic analysis to examine the power of the SDCCD test and identify the optimal cutoff value of the SDCCD score.

**Results:** Of the 443 participants, 30 (6.77%) had some cognitive impairment based on the Mini-Mental State Examination scores. Participants without cognitive impairment had higher SDCCD scores than those with cognitive impairment ( $p < 0.001$ ). The SDCCD scores were significantly associated with the Mini-Mental State Examination ( $r = 0.333$ ) and Scenery Picture Memory Test ( $r = 0.402$ ) results. The receiver-operating characteristic curve used for the identification of cognitive impairment had a comparatively high area under the curve (0.798) for the SDCCD score with a cutoff value of 1/2 (with  $>1$  being normal; sensitivity: 70.5%; and specificity: 80.0%).

**Conclusion:** The present study found that the SDCCD test could be an effective clinical tool for the identification of cognitive impairment in older adults.

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## 1. Introduction

Dementia can drastically influence one's daily life and is currently one of the most common conditions in older adults. Dementia affects 5–8% of the population over 65 years of age<sup>1</sup> and up to 30% of the people aged  $\geq 85$  years.<sup>2</sup> Currently, the number of people with dementia is increasing. It has been estimated that

approximately 48% of the patients with Alzheimer's disease (AD), the most common form of dementia, live in Asia, and this percentage is projected to grow to 59% by 2050.<sup>3</sup> Dementia and AD have been associated with mortality<sup>4</sup>; therefore, prevention and early detection of cognitive decline are crucial.

The presence of cognitive decline increases the risk of progression to mild cognitive impairment (MCI) and AD.<sup>5,6</sup> It is generally agreed that older adults with early AD, compared to healthy older adults, exhibit a greater decline in memory function<sup>7</sup> and working memory<sup>8</sup> than in other major domains of cognitive function. A central feature of AD is the decline in episodic memory.<sup>9</sup> Visual memory, which is included in episodic memory, is

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an important component of daily life. There are several well-established visual memory tests, such as the Benton Visual Retention Test<sup>10</sup> and the Rey–Osterrieth Complex Figure Test,<sup>11</sup> that can be used to assess nonverbal visual memory. However, these tests are not reflective of situations and activities encountered in daily life, are time consuming, and have complex scoring systems.

Deficits in working memory functions (e.g., attention and executive function) caused by AD are thought to contribute to a range of significant problems such as impairments in performing everyday tasks (e.g., keeping track of conversations, walking while talking, and packing a bag). Thus, the attentional function would appear to be important for the early detection of cognitive decline, as this function decreases with the progression of cognitive decline.<sup>12</sup>

We developed a new short-term visual memory and attention test called the Spot the Difference for Cognitive Decline (SDCD) test. The SDCD test is a brief and simple test that uses pictures of familiar-looking sceneries. Examinees are asked to find the differences between two scenery pictures. This test can be used in clinical or community-based settings with a large population. In a previous study, it was reported that poor visual memory predicts the onset/progression of dementia.<sup>13</sup> The spot-the-difference task has been used as a cognitive test in previous studies,<sup>14–16</sup> although its usefulness for detecting cognitive impairment had not been described. These spot-the-difference tasks have often been used in memory function training for older adults with dementia in many countries, including Japan. However, the effects of this training have not been examined empirically. We hypothesized that the SDCD score would be associated with cognitive function, and this test would be able to identify community-dwelling older adults with cognitive impairment. The purpose of the present study, therefore, was to examine the accuracy of the SDCD test for the

identification of cognitive impairment in community-dwelling older adults.

## 2. Methods

### 2.1. Participants

Participants for this study were recruited through advertisements in the local newspaper. A total of 443 Japanese people aged  $\geq 65$  years (mean age,  $73.1 \pm 5.3$  years) responded. We included only community-dwelling older adults who were able to perform their activities of daily living independently. A screening interview was conducted to exclude participants with severe cardiac, pulmonary, or musculoskeletal disorders, as well as those using medications that affect attention (e.g., psychoactive drugs or drugs prescribed for sleep). Written informed consent was obtained from each participant in accordance with the guidelines of the Kyoto University Graduate School of Medicine, Kyoto, Japan and the Declaration of Helsinki, 1975. The study protocol was approved by the Ethics Committee of the Kyoto University Graduate School of Medicine.

### 2.2. SDCD test protocol

The SDCD test uses two scenery pictures (Figs. 1 and 2) on A4 size papers. Fig. 1 is called the “first picture” and Fig. 2 the “second picture”. There are 10 differences between the two pictures: the shape of the chimney smoke, shape of the doorknob, height of the fountain, shape of the mountain (seen between the house and the fountain), number of fruits on the tree, direction that the dog on the right is facing, shape of the leftmost flower, shape of the child's mouth, presence of a bird versus a butterfly, and presence of the father's backpack. First, the examinees are instructed to memorize

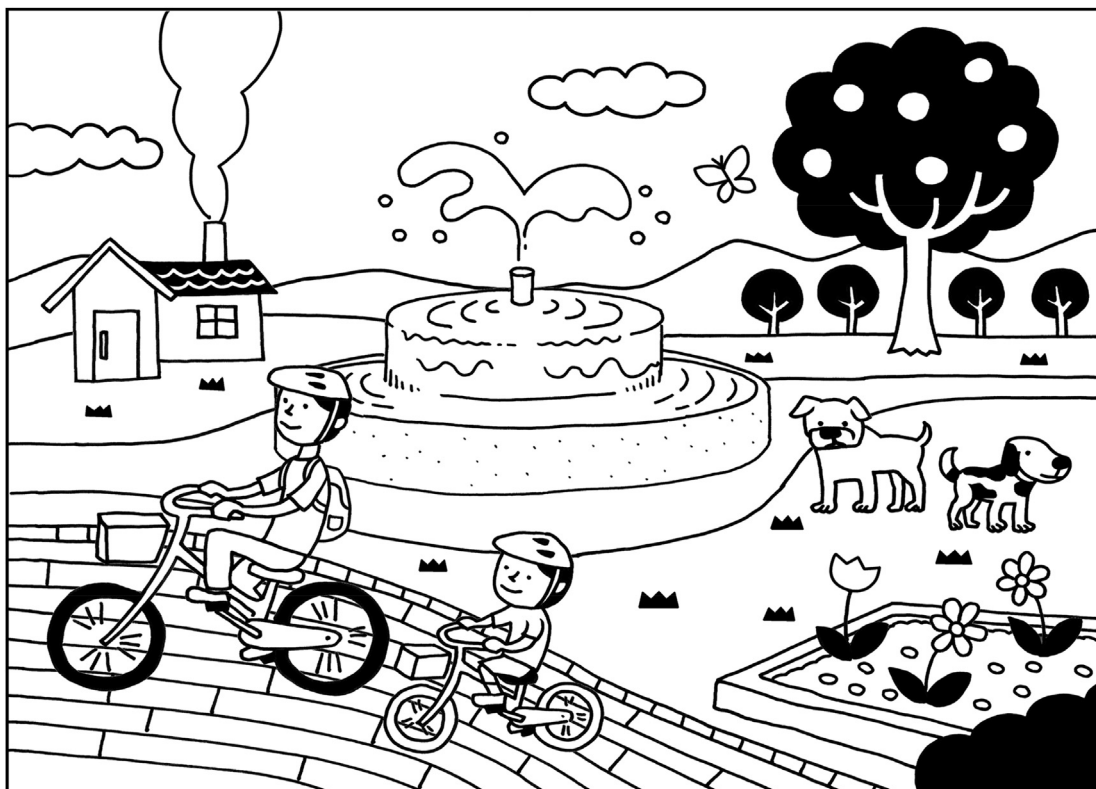


Fig. 1. First picture used in the Spot the Difference for Cognitive Decline test. The examinees were instructed to memorize the details of the picture, which was presented for 30 seconds.

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