

# Using an Electronic Diary to Bolster Self-Esteem in Persons with Early-Stage Dementia

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**Abstract:** Persons with early-stage dementia are at risk for decreasing self-esteem because they perceive discrepancies between their actual self-state and their preclinical self-state. We developed a psychological intervention that uses diaries with entries related to positive self-worth for persons with early-stage dementia. We report three exploratory case studies with a 59-year-old male with frontotemporal dementia (Mr. A), and a 53-year-old male (Mr. B) and a 46-year-old female (Ms. C) with Alzheimer's disease. Participants were asked to read their diaries focusing either on achievement, positive interpersonal, or other themes, and rate their self-esteem before and after. Mr. A demonstrated improvement of self-esteem after reading diaries focused on achievement themes. Mr. B demonstrated improvement after reading diaries focused on interpersonal themes. However, Ms. C did not show improvement of self-esteem. These results suggest that reading diaries focused on achievement or positive interpersonal themes could bolster the self-esteem of some persons with early-stage dementia.

**Keywords:** Self-esteem, frontotemporal dementia, Alzheimer's disease.

Dementia is a syndrome characterized by multiple cognitive deficits which interfere with activities of daily living, social and occupational functioning [1]. Alzheimer's disease (AD) is the most common cause of dementia, comprising 50–70% of all cases. Frontotemporal dementia (FTD) is less common, however makes up 50% of dementia cases presenting before age 60 [2]. AD is characterized by early memory deficits, followed by the gradual decline in other cognitive functions. The most severe degeneration of brain occurs in the hippocampus. On the other hand, FTD is associated mainly with behavioural impairment such as disinhibition, loss of initiative or apathy. Persons with FTD often display asymmetrical atrophy of the frontal and temporal cortex [3]. Both AD and FTD result in a progressive and irreversible loss of neurons and brain functions. Currently, there are no cures for these progressive neurodegenerative disorders.

Awareness of the deficits in dementia can affect the sense of self-worth. Naylor and Clare [4] reported that less awareness of memory dysfunction was associated with a more positive and definite sense of identity in persons with Alzheimer's disease or vascular or mixed

dementia. This suggests that persons with early-stage dementia particularly may be at risk of developing a negative self-image because they have more awareness of their cognitive decline. In this study, we propose a psychological intervention to help persons with early-stage dementia bolster their positive self-images by reading diary entries based on their recent positive experiences. We report three exploratory case studies to examine the effectiveness of this intervention.

The psychological maladjustment that this study focuses on is decreased self-esteem. Self-esteem is a psychological term indicating the degree of satisfaction with the actual self [5]. Self-discrepancy theory [6] proposes that people who hold conflicting information about themselves experience discomfort with themselves. Especially, people experience feelings of worthlessness (i.e. decrease in self-esteem) when their view of their actual attributes does not meet their expectations. A person with dementia is likely to hold conflicting information about the self: part of this self-knowledge is obtained from preclinical experiences (e.g. I used to be good speaker) and the other is obtained from experiences after the onset of dementia (e.g. I can't speak fluently). A discrepancy between these two kinds of self-knowledge reduces the self-esteem of persons with dementia (e.g. I don't do things

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like I used to). Low self-esteem tends to be associated with psychological maladjustment, such as depression [7]. Therefore it would be beneficial to develop a psychological intervention for bolstering the self-esteem of persons with early-stage dementia to improve their psychological well-being.

Several psychological interventions have been proposed for the self-esteem of persons with dementia. One intervention in widespread use is reminiscence therapy, where persons with dementia are encouraged to recall positive life experiences. The main targets of reminiscence therapy are memories about remote episodes associated with self-competence (e.g. a heroic story from adolescence). This therapy has been associated with positive changes in self-esteem and affect, increased life-satisfaction, decreased depression, and increased communication skills [8].

Assistive technologies have been developed for individual reminiscence therapy for persons with dementia who live alone, because this therapy usually requires a person who asks and prompts recall and speaking about past experiences. Gowans, Campbell, Alm, Dye, Astell, and Ellis [9] developed a computer-based multimedia system for reminiscence therapy which displayed photographs and played videos or music associated with past experiences. This technology employs a touch-screen which can be operated intuitively by persons with dementia. Massimi, Berry, Browne, Smyth, Watson, and Baecker [10] developed an in-home ambient display that cycled through music, photographs, movies, and narratives drawn from the patient's past and current life. This system also employs a touch-screen interface which allows users with dementia to control the cycle of materials and turn off the volume. They examined the psychological impact of this technology on a user with Alzheimer's disease. The user demonstrated improvement on standardized tests of apathy and positive self-identity.

However, reminiscence therapy may not be effective for persons with early-stage dementia or mild cognitive impairment who are aware of a conflict between their self-knowledge based on preclinical experiences and less successful experiences after the onset of dementia. Reminiscence therapy aims to increase self-esteem by recalling preclinical experiences and activating past positive self-images. This approach may not increase the self-esteem of persons with early-stage dementia because it cannot resolve their conflict between their preclinical and

present self-images. In response to this concern, we have developed an electronic diary system that assists persons with early-stage dementia to remember *recent* successful experiences as a method for reducing their conflict [11]. This electronic diary system prompts them to record daily personal episodes that are related to achievement or desirable personal relationships. Pillemer, Ivcevic, Gooze, and Collins [12] found that college students and middle-aged adults reported episodes focusing on achievement and interpersonal themes as memories that impacted their self-esteem. Episodes with an achievement theme pertain primarily to events that are experienced as meeting a personal standard of excellence (e.g. "I picked high quality vegetables from my garden"). Episodes with an interpersonal theme pertain primarily to events that are experienced as directly related to being with others (e.g. "I had a pleasant meal with my family").

The electronic diary system was intended to enhance positive self-images for persons with early-stage dementia, who tend to have a decline in self-esteem, by recording and reviewing diary entries about recent episodes that focused on achievement or desirable interpersonal themes. Otherwise persons with early-stage dementia tend to focus their attention on their impaired cognitive functioning. In our psychological intervention model, remembrance of contemporaneous events related to achievement or a good relationship could direct attention to their residual functioning or empathetic bonds, and draw attention away from their impaired cognitive functioning. However, the effectiveness of this psychological intervention designed to bolster the self-esteem of persons with early-stage dementia remains unproven.

In the current exploratory study, we used a multiple case-study design to examine whether reading diaries about experiences within the previous month that focused on achievement or desirable interpersonal themes could increase the self-esteem of persons with early-stage dementia. If the psychological intervention increases self-esteem, then persons with early-stage dementia should score higher on the Self-Esteem Scale [13] after reading their diary entries related to achievement or interpersonal themes than after reading diary entries that are not about these themes. Since we expected that the intervention would have a positive impact on emotional status, we evaluated positive and negative affect states. If the intervention enhanced the positive self-image of persons with early-stage dementia, then they might experience a positive affective response and an alleviation of negative affect.

## METHOD

### Participants

Three persons with early-stage dementia participated in this study. They have normal vision, exhibit no motor impairments, and reported not to have any history of mood disorder. Mr. A was diagnosed with FTD based on atrophy of the frontal lobe. He was a 60-year-old right-handed Japanese male. He scored 28 on the Mini-Mental State Examination (MMSE) [14]. Two other participants were diagnosed with AD based on atrophy of the hippocampus. Mr. B was a 53-year-old right-handed Japanese male, who scored 30 on the MMSE. Ms. C was a 46-year-old right-handed Japanese female, who scored 27 on the MMSE. Typically, participants are separated into four categories of impairment based on their MMSE score: no impairment (30–26 points), mild (25–20 points), moderate (19–10 points), and severe (9–0 points) [15]. Under the criterion, participants' scores indicate that they had very mild cognitive dysfunction, consistent with early-stage dementia. They all were retired or fired due to troubles caused by their decline in cognitive function, and had begun medical treatment. The time from their diagnosis to participation in this study did not exceed three years. The protocol was approved by the ethics committees of the University of Fukui, National Rehabilitation Center for Persons with Disabilities, and the University of Tokyo. After a complete description of the study to the participants, they provided written consent to use their data for scientific investigations and communications.

### Materials

To develop diaries for presentation in the experimental sessions, semi-structured interviews were

conducted with the participants. We asked participants to recall three experiences related to each of three themes (achievement, interpersonal, and other) that had occurred within the last month, and to write them down in less than 200 characters each as diary entries. We presented a definition, examples and keywords for the themes to promote recalling experiences related to the specified theme. The definitions of the themes were based on Pillemer *et al.* [12]. Achievement themes were defined as experiences resulting in a sense of achievement, such as “achievement of objectives”, “accomplishment of work”, “solution of a hard problem”, “acquiring knowledge” and “acquisition of skills”. Keywords for achievement themes were *achievement, accomplishment, attainment, exploit, cultivation, talent, completion, and honor*. Desirable interpersonal themes were defined as experiences involving connections with others, such as “feeling someone's affection”, “feeling of friendship”, “acquirement of empathy”, and “receive acceptance”. Keywords for interpersonal themes were *love, friendship, familiarity, mutual understanding, social acceptance, and share enjoyment*. The category of “other themes” were experiences that did not result in a sense of achievement or involve important connections with others, such as solitary activity. Keywords for the other themes were *television, bath, cooking, meal, break, cleaning, reading, walking, and shopping*.

Before writing down a diary entry, we asked the participants to recall the time of day and place for their episode because positive autobiographical memories contain more contextual (location, time) information than negative memories [16]. Mr. A and Mr. B wrote three diary entries for each theme, as requested. Ms. C wrote three diary entries for the interpersonal

**Table 1: Diary Entries Developed by Mr. A**

Theme	Diary Item
Achievement	I kept the garden. I ran up a ladder and sawed a branch off the overgrown trees. I was tired, but I was refreshed. I picked high quality vegetables from my garden. I ate these vegetables and was completely satisfied with their taste. I joined the volunteers in my neighborhood nursing home. I woke up early in the morning and took out the trash. The home looked beautiful.
Interpersonal	I had a pleasant meal with my family. I was thankful that I could have a very good time with them. I gave my neighbor vegetables that were picked from my garden. Then the neighbor gave me eggs and fruits in return. It's been great talking to her. I called at my daughter's house. I was very happy because I picked up my grandchild. My wife bought him a kiddie car. I was just happy to see him pleased with the gift.
Other	I enjoyed watching the Japan Series on TV. It was refreshing to see men fought for victory. I watched a baseball game on TV. I could watch it from a distance because I wasn't a fan of either team. I envied players who lived life to the extreme. I watched a TV period drama. I was impressed by feudal lords who gave thought to the people under their dominion. I thought that Japan required such a leader in our time.

communication theme and the other theme, but only one diary entry for the achievement theme because she could not recall any more recent achievement experiences. Instead, she wrote two more diary entries about the interpersonal theme. The semi-structured interviews were conducted two weeks prior to the initiation of experimental sessions and were finished within two hours. As an example, the diary entries developed by Mr. A are shown in Table 1.

## **Outcome Measures**

### ***State Self-Esteem***

We assessed self-esteem using the Rosenberg Self-Esteem Inventory [13], a well-validated measure of global self-esteem. Sample items are: "I certainly feel useless at times." and "On the whole, I am satisfied with myself." Participants completed the scale with instructions to give the response that best reflected how they felt at the moment [17]. Participants indicated how they felt about themselves immediately before and after reading their diary entry on 10 five-point scales (each anchored by 1 and 5): 1 (strongly disagree) to 5 (strongly agree). A state self-esteem index was calculated by reversed scoring of some of items (e.g. "I certainly feel useless at times.") and summing the ratings for these 10 scales so that higher numbers indicated a higher state self-esteem.

### ***Positive and Negative Affect***

Positive affect was measured with the following items: (1) "Now, I'm glad."; (2) "Now, I'm happy."; and (3) "Now, I'm satisfied." Negative affect was measured with the following items: (1) "Now, I'm sad."; (2) "Now, I'm nervous."; and (3) "Now, I'm lonely." Participants indicated how they felt with reference to these affective states immediately before and after reading their diary entry on 6 five-point scales (each anchored by 1 and 5): 1 (strongly disagree) to 5 (strongly agree). We calculated a positive affect index by summing the ratings for glad, happy, and satisfied. In a similar way, we calculated a negative affect index by summing the ratings for sad, nervous, and lonely. Higher numbers meant more positive or more negative affect.

## **Experimental Procedure**

Participants were provided with a touch screen tablet PC (APD-UMC-77, APD Co., Ltd), programmed with Microsoft Visual Basic 2008, a dedicated program for administering the electronic diaries and recording participants' responses for the outcome measures. The touch screen interface is a suitable device for persons

with dementia because it is intuitive to use and does not require fine muscle control to operate [18]. The participants were trained in using the program, where the diary entries were presented, or the assessment items were presented on the screen of the device one at a time and rated on a five-point scale (a total of 16 scales: 10 self-esteem items, 3 positive affect items, and 3 negative affect items). Participants could initiate an experimental session at any time, once a day at home. The program controls prevented them from repeating the experimental sessions in a day. Participants were asked to rate themselves on the outcome measures, and then read the displayed diary entry, and then (after a 30 sec delay) rate themselves on the outcome measures again. The displayed diary entry was from one of their own diary entries that had been collected in the semi-structured interviews before the experimental sessions. For Mr. A and Mr. B, the diary entry was selected from the three diary entries related to achievement themes, three diary entries related to interpersonal themes, three diary entries related to the other themes, and three no-diary items. For Ms. C, the diary entry was selected from the one diary entry related to the achievement theme, five diary entries related to interpersonal themes, three diary entries related to the other themes, and three no-diary items. The no-diary items were used to get a baseline for the variability of state self-esteem, positive affect, and negative affect. The diary entries were quasi-randomly assigned to experimental sessions, so that participants read every diary entry only once. Participants were asked to read the diary entry and to recall the events, their thoughts and feelings at the time in detail. They could not move on to the second round of rating themselves on the outcome measures until a period of 30 seconds had elapsed since the display of the diary entry. In the case of the no-diary items, the following message was displayed instead of a diary entry: "No diary today. You can move on to the next part (i.e. rating the second outcome measures) after the pause." Participants returned the devices after completion of 12 experimental sessions and received credit for participation in this research. An experimental session took less than 30 minutes to complete.

## **RESULTS**

In this study, the participants' state self-esteem, positive affect, and negative affect were rated just before and after they read a diary entry. However, due to the multiple case-study design, we were unable to use inferential statistics. Of the norms that were available, none reported the central tendency or

variance of change over time, making it difficult to make reliable inferences regarding the effects of our psychological intervention. Therefore, we compared the means and SD of the difference scores of the outcome measures before and after the participant read a diary entry. We calculated the mean and SD for the outcome measures for the three experimental sessions for each theme of the diary entries. (For Ms. C, we could not calculate the mean and SD for the achievement theme because she had only provided one diary entry. For Ms. C., we calculated the mean and SD for five experimental sessions of diary entries about the interpersonal themes.) We calculated difference scores by subtracting the mean scores before the participants read the diary entries from the mean scores after they read the diary entries. We judged that our psychological intervention had a positive impact on the participants when the mean of the difference score when they read diary entries about achievement or interpersonal themes exceeded the mean of the difference score when they read diary entries about the other themes or read no diary items. When comparing with the difference scores, we used SD to consider measurement error.

### State Self-Esteem

Table 2 shows the means and SDs for the state Self-Esteem Scale. For Mr. A, the mean + SD of his

difference score when he read diary entries about achievement themes was higher than when he read diary entries about the other themes or read no diary items. However, there was no difference when he read diary entries about interpersonal themes. For Mr. B, the mean + SD of his difference score when he read diary entries about interpersonal themes was higher than when he read diary entries about the other themes or read no diary items. However, there was no difference when he read diary entries about achievement themes. For Ms. C, there was no difference in rating scores that indicated an increase in state self-esteem.

### Positive Affect

Table 3 shows means and SDs for the positive affect scale. For Mr. A, the mean + SD of his difference score where he read diary entries about achievement or interpersonal themes was higher than when he read diary entries about the other themes or read no diary items. For Mr. B, the mean + SD of his difference score when he read diary entries about interpersonal themes was higher than when he read diary about the other themes or read no diary items. However, there was no difference when he read diary entries about achievement themes. For Ms. C, there was no difference of scores that indicated an increase in positive affect.

**Table 2: Means and SDs of Scores on the Self-Esteem Inventory, Before and After Reading Diary Entries**

Theme of Diary Entries	Before		After		Difference	
	M	SD	M	SD	M	SD
Mr. A						
Achievement	29.33	0.58	34.00	1.00	4.67	1.15
Interpersonal	31.00	1.73	33.33	2.31	2.33	3.51
Other	27.67	2.08	29.67	1.53	2.00	2.65
No diary item	32.00	1.73	32.33	1.15	0.33	1.53
Mr. B						
Achievement	33.33	6.66	33.33	8.33	0.00	1.73
Interpersonal	34.00	1.00	36.67	2.08	2.67	2.89
Other	35.00	0.00	35.67	0.58	0.67	0.58
No diary item	35.67	0.58	36.00	0.00	0.33	0.58
Ms. C						
Achievement	20.00		23.00		3.00	
Interpersonal	16.00	4.18	16.40	4.56	0.40	1.91
Other	19.00	1.73	17.33	8.02	-1.67	6.51
No diary item	15.67	2.52	16.00	6.24	0.33	3.79

Note: "Difference" indicates difference scores calculated by subtracting the scores before participants read the diary entries from scores after they read the diary entries. For Ms. C, SDs for the achievement theme could not be calculated because there was only one item.

**Table 3: Means and SDs of Scores for Positive Affect, Before and After Reading Diary Entries**

Theme of Diary Entries	Before		After		Difference	
	M	SD	M	SD	M	SD
Mr. A						
Achievement	6.67	1.15	11.67	0.58	5.00	1.00
Interpersonal	10.00	2.65	12.33	0.58	2.33	2.08
Other	6.00	0.00	6.67	0.58	0.67	0.58
No diary item	9.00	1.73	9.67	2.08	0.67	1.53
Mr. B						
Achievement	10.33	1.53	11.00	1.73	0.67	1.15
Interpersonal	9.33	1.15	12.67	1.15	3.33	2.31
Other	10.33	1.53	11.67	1.53	1.33	0.58
No diary item	11.00	1.00	10.67	1.15	-0.33	0.58
Ms. C						
Achievement	10.00		12.00		2.00	
Interpersonal	10.60	1.34	11.80	1.10	1.20	0.84
Other	10.00	2.00	12.00	2.00	2.00	3.46
No diary item	10.00	1.00	10.33	1.53	0.33	1.53

*Note.* "Difference" indicates difference scores calculated by subtracting the scores before participants read the diary entries from scores after they read the diary entries. For Ms. C, SDs for the achievement theme could not be calculated because there was only one item.

### Negative Affect

Table 4 shows means and SDs for the negative affect scale. For Mr. A, the mean + SD of his difference score when he read diary entries about achievement or interpersonal themes was lower than when he read diary entries about the other themes or read no diary items. For Mr. B, the mean + SD of his difference score when he read diary entries about interpersonal themes was lower than when he read diary entries about the other themes or read no diary items. However, there was no difference when he read diary entries about achievement themes. For Ms. C, there was no difference of scores that indicated a decrease in negative affect.

### DISCUSSION

We developed a psychological intervention using electronic diaries focused on achievement or interpersonal themes for persons with early-stage dementia. We asked our participants to remember events from the previous month related to achievement or good relationships to direct their attention to their residual function or empathetic bonding and take attention away from their impaired cognitive function. We predicted that the intervention could increase their self-esteem and provide an uplifting feeling (i.e. an

increase in positive affect and a decrease in negative affect).

Interestingly, we found different patterns of results for each of our three case studies. We found that the state self-esteem of some persons with early FTD or AD was increased by reading diary entries that focused on their recent achievement or interpersonal themes. In addition, reading diary entries focused on those themes increased their positive affect and decreased their negative affect when their state self-esteem increased. In particular, for Mr. A reading diary entries focused on achievement themes increased his state self-esteem, while for Mr. B reading diary entries focused on interpersonal themes increased his state self-esteem. Why did the themes of the diary entries that increased self-esteem vary from person to person? This difference may have roots in different construals of the self. Markus and Kitayama [19] indicated that there are two divergent construals of the self: an independent view and an interdependent view. The independent construal is based on maintaining independence from others by attending to the self and by discovering and expressing unique inner attributes. On the other hand, the interdependence construal is based on attending to others, fitting in, and harmonious interdependence. Self-esteem for those with an independent construal of the self depends on one's abilities, attributes, and

**Table 4: Means and SDs of Scores for Negative Affect, Before and After Reading Diary Entries**

Theme of Diary Entries	Before		After		Difference	
	M	SD	M	SD	M	SD
Mr. A						
Achievement	7.33	1.15	5.67	0.58	-1.67	0.58
Interpersonal	5.00	1.73	4.00	1.73	-1.00	1.73
Other	7.67	2.89	7.67	3.79	0.00	1.00
No diary item	5.33	0.58	5.33	2.08	0.00	2.00
Mr. B						
Achievement	5.33	4.04	5.33	2.52	0.00	2.00
Interpersonal	5.67	2.52	3.00	0.00	-2.67	2.52
Other	3.00	0.00	3.33	0.58	0.33	0.58
No diary item	3.33	0.58	3.00	0.00	-0.33	0.58
Ms. C						
Achievement	3.00		3.00		0.00	
Interpersonal	4.00	2.24	3.20	0.45	-0.80	2.39
Other	3.00	0.00	3.67	1.15	0.67	1.15
No diary item	6.67	3.06	4.67	2.89	-2.00	1.00

Note. "Difference" indicates difference scores calculated by subtracting the scores before participants read diary entries from the scores after they read the diary entries. For Ms. C, SDs for the achievement theme could not be calculated because there was only one item.

achievements, while self-esteem associated with an interdependent construal of the self depends on one's significant social roles, statuses, and important interpersonal relations. This study did not directly examine the relationship between construal of the self and self-esteem, but the results of this study may suggest that the self-esteem of persons with independent construal could be increased by remembrance of episodes focused on achievement themes (i.e. Mr. A), while the self-esteem of persons with interdependent construal could be increased by remembrance of episodes focused on interpersonal themes (i.e. Mr. B). This corresponds to our general impressions of these two men.

However, the situation seems different for our third case study, Ms. C. Her state self-esteem and positive and negative affect was not changed by reading diary entries focused on achievement or interpersonal themes. We would like to note that the decline in her self-esteem caused by her attention to impairments of cognitive functioning was more serious than for the two men. The mean score for her state self-esteem before reading the diary entries ( $M=17.67$ ,  $SD=2.16$ ) was much lower than those of the two men (Mr. A:  $M=30.00$ ,  $SD=1.90$ ; Mr. B:  $M=34.50$ ,  $SD=1.04$ ). In addition, she was anxious to get a job because she was a single parent of three school children and had

debts. Therefore, she complained of impatience with unemployment, which she attributed to her impairment in cognitive functioning. For example, she reported that an employee had said to her "You couldn't remember the procedures of work even if you took notes". This is consistent with the fact that she could recall only one positive experience in the past month for the achievement theme, while the other participants could recall three experiences without difficulty. We suspect our psychological intervention was not powerful enough to influence her more entrenched condition.

Some might question whether persons with dementia could remember recent experiences focused on achievement or interpersonal themes. This is a minor problem for persons with FTD because the core symptom of this type of dementia is not memory impairment but dysfunction of executive functioning, which includes emotional control. However, persons with AD could have difficulty remembering recent experiences. Addis and Tippett [20] reported that participants with AD (MMSE scores:  $M=19.85$ ,  $SD=3.15$ , with a range of 13-24) showed a temporal gradient of loss for episodic memory, such that recall of recent adulthood memories (from the past 5 years rather than the past year) was poorer than recall of childhood memories. However, they pointed out that the temporal gradient of impairment of episodic

memory may depend on the level of dementia (assessed by the MMSE). In our experience, persons with AD could remember recent experiences when the level of dementia was mild, as was the case for the two participants with AD in our study. Moreover, Naylor and Clare [4] reported that participants with higher levels of cognitive function, as indicated by higher MMSE scores, were more successful in recalling recent experiences. Persons with early-stage and mild dementia are more likely to experience a conflict between preclinical and present self-images because of their higher levels of awareness of memory function, to the extent that they may show better autobiographical recall [4]. Therefore we consider that the main target of our psychological intervention should be persons with early-stage, mild dementia.

Due to the small number of participants, our results should not be generalized to other individuals or populations. Case study methodologies like ours raise interesting questions, without necessarily being able to resolve them all. Nevertheless, the results of this study have clinical implications. This study showed a successful intervention for improving self-esteem by using electronic diaries for some persons with early-stage dementia where there was a conflict between preclinical and present self-images. It showed the benefit of directing attention to their residual achievement function or empathetic social bonds. Thus it suggests benefit from broadening interventions with persons with early-stage dementia to focus on recalling more recent experiences, instead of focusing only on the autobiographical past. Such interventions could have a positive impact on the well-being of persons with an early stage of dementia.

This study has several limitations that compromise the validity of our data interpretation. First, a larger sample is needed to extend the results found in this study. Second, this study should use control groups with random assignment. In order to accrue sufficient sample sizes to evaluate the impact of a treatment in a randomized study including an age-sex-education matched control group, multi-site treatment trials are needed. Third, little is known about the stability of treatment effects over time. Fourth, we didn't estimate participants' cognitive profile with the exception of MMSE. Cognitive abilities of the participants are important information for understanding enablement of an electronic diary. Moreover, although we found improvements on self-esteem by using diaries in written format, we have no empirical data about different information format (e.g. movies, pictures, and

photos). In conclusion, our electronic diary approach may be a useful intervention for persons with early stage dementia, based on evidence provided by preliminary case studies. However, because of the small sample size, the lack of control group and other limitations, this study should probably be looked at as heuristic and generating hypotheses in this research field rather than stringently testing them.

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