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► To cite this version:

Mohamad El Haj, Claire Boutoleau-Bretonnière, Karim Gallouj, Philippe Allain, Pascal Antoine. Neuropsychological assessment of patients with alzheimer's Disease in the presence or absence of spouses. *Applied Neuropsychology: Adult*, 2022, pp.1-6. 10.1080/23279095.2021.2023811 . hal-04279000

HAL Id: hal-04279000

<https://hal.science/hal-04279000>

Submitted on 10 Nov 2023

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Short title: Spousal attendance

Neuropsychological assessment of patients with Alzheimer's Disease in the presence or absence of spouses

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Abstract

A common question in the neuropsychological testing of patients with Alzheimer's Disease is whether or not patients should be tested in the presence of their spouses. We addressed this issue by assessing the neuropsychological performances of Alzheimer's Disease patients in the presence or absence of spouses. Results showed no significant differences between patients' performances in the presence or absence of spouses on tests assessing general cognitive abilities, episodic memory, working memory, inhibition and flexibility. No significant differences were observed regarding either anxiety or depression in patients when tested alone, compared to when spouses were attending. However, patients demonstrated higher verbal fluency when tested alone compared to when spouses attended. Clinicians may carry out neuropsychological assessment in the presence or absence of spouses, except when assessing verbal fluency. In such cases, clinicians should privilege testing patients alone or, if spouses attend the test, take into account this variable when interpreting patients' performances.

Keywords: Alzheimer's Disease; dyads; neuropsychological assessment; spouses.

Introduction

In the neuropsychological testing of patients with Alzheimer's Disease (AD), especially in memory clinics, a basic question is whether or not patients should be tested in the presence of their spouses. Clinicians who are favorable to the presence of spouses argue that it may provide patients with a sense of familiarity, company and even security during testing, especially when they are unfamiliar with the testing environment. On the other hand, clinicians who are against the presence of spouses argue that spousal relationships are negatively impacted by AD, which may influence the cognitive performances of patients. This hypothesis is supported in research, which suggests that AD has a negative impact on spousal relationships (Ablitt, Jones, & Muers, 2009). For instance, decline in the verbal ability of AD patients had a negative effect on the quality of communication within the couple (Eloniemi-Sulkava et al., 2002). A declining awareness of patients regarding their own cognitive decline (i.e., anosognosia) also increases the spouses' burden, which impacts the spousal relationship (Kelleher, Tolea, & Galvin, 2016). Behavioral changes linked to AD can also have an effect on spousal relationships, such as aggressive behaviors that increase spouses' distress (Brodaty et al., 2014; Burns & Rabins, 2000; Truzzi et al., 2012; Wawrziczny, Pasquier, Ducharme, Kergoat, & Antoine, 2017). AD may thus impact spousal relationships, which may influence patients' performances during cognitive testing. For instance, a patient may not be motivated to perform well in cognitive testing if the spouse keeps emphasizing her/his low cognitive performances during the test.

To our knowledge, no research has yet addressed the effects of spousal attendance on neuropsychological testing. While our study was mainly prompted by clinical concerns about the advantages and drawbacks of spousal attendance, we were also inspired by research on the changes in spousal relationships in AD. On the one hand, certain spouses may feel like they are no longer

part of a couple when the spousal relationship becomes primarily defined by caregiving (Boylstein & Hayes, 2012; Evans & Lee, 2014; Kaplan, 2001; Lindauer & Harvath, 2015). For these spouses, the marital bond becomes similar to that of a parent-child relationship, as the sense of being a couple is significantly weakened and replaced by a sense of protectiveness (Boylstein & Hayes, 2011; Forsund, Skovdahl, Kiik, & Ytrehus, 2015; Walters, Oyeboode, & Riley, 2010). On the other hand, other spouses may consider that couple bonds are maintained and even strengthened by cognitive and behavioral changes (Hayes, Boylstein, & Zimmerman, 2009; Quinn, Clare, & Woods, 2015). In any case, AD impacts spousal relationships and interactions between patients and their spouses. These interactions may influence patients' performances during cognitive assessments in memory clinics, even when they are implicit/non-verbal.

We reasoned that, when tested alone, AD patients may feel less constrained by the judgement or influence of their spouses regarding their cognitive performances. In other words, the absence of spouses may allow patients to perform objectively, without being influenced by their spouses' beliefs about their cognitive abilities. They may also feel more at ease or less inhibited or anxious, which may improve their cognitive performances. This hypothesis is supported by research demonstrating that anxiety hampers cognitive performances in healthy older adults (Alosco et al., 2015; Beaudreau, MacKay-Brandt, & Reynolds, 2013; Hek et al., 2011). Anxiety even increases the risk of dementia (Becker et al., 2018; Gallacher et al., 2009; Mah, Binns, & Steffens, 2015; Potvin, Forget, Grenier, Preville, & Hudon, 2011), probably by interacting with beta-amyloid deposition, the main neurological hallmark of AD (Johansson et al., 2020). Anxiety can be also considered as a common psychiatric symptom of AD, and research suggests that anxiety results in problematic behaviors and limitations in the daily activities of patients (Ferretti, McCurry, Logsdon, Gibbons, & Teri, 2001; Teri et al., 1999). Therefore, we

reasoned that in the absence of spouses, patients may feel less anxious during cognitive assessment, resulting in better performances than when spouses attend testing.

The effects of spousal attendance on patients' performances during neuropsychological testing can thus be associated with anxiety. Besides anxiety, depression may also explain differences in patients' cognitive performances between testing in the presence of spouses and in their absence. Generally speaking, depression is the main common psychiatric symptom of AD (Chi, Yu, Tan, & Tan, 2014), and in AD it is associated with an increased risk of institutionalization and mortality (Orgeta, Tabet, Nilforooshan, & Howard, 2017). Depression not only impacts AD patients but also their spouses, who experience high rates of depression (Watson, Tatangelo, & McCabe, 2018). Spousal depression compromises the quality of care that spouses are able to provide for the patients (Fonareva & Oken, 2014). Importantly, such depression results in negative consequences on spousal relationships (Michon, Weber, Rudhar, & Giannakopoulos, 2005). It may even contribute to the development of negative feelings towards AD patients (Michon et al., 2005). Spousal depression may increase that of patients and vice-versa (Watson et al., 2018), which may consequently lower patients' performances during neuropsychological testing.

To summarize, we investigated the effects of spousal attendance on anxiety/depression as well as on performances of AD patients during neuropsychological testing. We hypothesized that in the absence of spouses, patients may feel less anxious/depressive during cognitive assessment, resulting in better performances compared with when they attend testing.

Methods

Participants

The study included 31 dyads consisting of married couples in which one partner was a patient who had been diagnosed with probable mild AD dementia of the amnesic form. Diagnosis was established by an experienced neurologist or geriatrician, based on the clinical criteria of the National Institute on Aging and Alzheimer's Association (McKhann et al., 2011). All spouses were independent and living at home with the patients. By including only dyads who lived together, we ensured that any potential differences in patients' performances could not simply be due to the fact that some dyads lived together while others did not. Out of the 31 dyads, 16 dyads were couples in which the patients were men and 15 were women. The mean duration of marriage for the dyads was 38.19 years ($SD = 10.38$), with a range of 21–56 years (very few, $n = 3$, being second marriages). The mean age of patients was 71.22 years ($SD = 4.65$) and that of spouses was 69.82 years ($SD = 6.44$). No significant differences were found regarding age [$t(29) = .69$, $p = .49$]. For all participants, exclusion criteria were a history of traumatic brain injury, cerebrovascular disease or significant neurological (other than AD) or psychiatric illness. No participants presented any major visual or auditory acuity difficulties that would have prevented completion of the study tasks. Patients were recruited and tested in memory clinics. **The local ethical committee declared this study except (i.e., non-interventional).** Informed consent was obtained from patients and spouses, in accordance with the principles of the Declaration of Helsinki.

Procedures

Patients were tested in two conditions: in the presence and in the absence of spouses. We implemented a within-subject rather than a between-subject design (i.e. half of the dyads assigned for each of the two conditions) for several reasons. First, compared with the between-subject

design, the within-subject design increases the sample size in each condition, thus increasing its statistical power. Second, a large set of covariates such as marriage duration and number of children cannot be controlled with a between-subject design. However, one potential risk of the within-subject design is the practice effect; indeed, participants' performances in the presence of spouses condition vs. in the absence of spouses condition may be influenced by the repetition of tasks. To control for this risk, the two conditions were counterbalanced and separated by a two-week interval. The allocation of spousal attendance was randomly allocated to the two conditions and this randomization took into account gender distribution. The neuropsychological assessment was conducted by the same clinician and in the same office for both conditions. During the "spousal attendance" condition, patients sat next to their spouses, and the clinician sat on the other side of the desk. Spouses and patients were informed that the session aimed at assessing cognitive abilities. Spouses were specifically asked to observe the assessment without interfering, interrupting, or commenting on the patients' performances. During the "spousal absence" condition, the patients were tested alone and the spouses waited outside of the office. As in the "spousal attendance" condition, spouses and patients were informed that the session aimed at assessing cognitive abilities.

Materials

General cognitive functioning

The Mini Mental State Examination (Folstein, Folstein, & McHugh, 1975) assesses the severity of cognitive impairment. It includes 30 questions assessing spatiotemporal orientation, registration, attention and calculation, as well as memory, language and visual construction. The maximum score is 30 points, with lower scores indicating higher cognitive impairment.

Verbal episodic memory

We used a French adaptation (Van der Linden et al., 2004) of the task of Grober and Buschke (1987). We invited the patients to retain 16 words, each of which described an item belonging to a different semantic category. The immediate cued recall was followed by a distraction phase, during which the patients were asked to count backwards from 374 in series of 20 s. This distraction phase was followed by two minutes of free recall and the score from this phase (out of a maximum of 16) provided an indicator of episodic memory, with higher scores indicating better episodic memory.

Working memory spans

For the assessment of spans, we invited the patients to repeat a string of single digits in the same order (i.e., forward span) or in reverse order (i.e., backward span), with higher scores indicating a better working memory (Baddeley, 1992).

Verbal fluency

For the verbal fluency test (Azouvi et al., 2016), we invited the patients to generate as many words as they could beginning with the letter P. Proper nouns and word variations (e.g., “psychologist” and “psychology”) were not allowed. Patients were allocated two minutes to generate the words. The score referred to the number of correctly generated words, with higher scores indicating better verbal fluency.

Inhibition

With the Stroop Color Word Test (Stroop, 1935), the patients performed three tasks: word-reading, color-naming and color-word interference. In the first task, patients were asked to read 100 color names printed in black ink. In the second task, patients named the color of 100 colored ink squares. In the third (i.e., interference) task, we invited the patients to name the color of 100

color-words printed in incongruously colored ink (for instance, the word “yellow” was written in red). The interference score referred to the completion time for the interference task minus the average completion time for the first and second tasks, with higher scores indicating lower inhibition.

Flexibility

In the Plus-Minus task (Azouvi et al., 2016), the patients performed three tasks: addition, subtraction and shifting. In the first task, patients were asked to read a list of 20 numbers and to add 1 to each number. In the second task, the patients read a list of 20 numbers and to subtract 1 from each number. In the third (i.e., shifting) task, we invited the patients to read a list of 20 numbers and to add and subtract 1 alternately. The score referred to the difference between the time participants needed to complete the third task and the average time that they needed to complete the first and second tasks, with higher scores indicating lower shifting ability.

Anxiety and depression

We used the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983) as this test has been found to perform well in assessing the symptom severity and quality of anxiety disorders and depression in pathological and general populations (Bjelland, Dahl, Haug, & Neckelmann, 2002). On this test, we invited patients to answer a 14-item questionnaire on a four-point scale from 0 (not present) to 3 (considerable). The subscale of anxiety consisted of seven items (e. g, “I feel tense or wound up”) and that of depression consisted of seven other items (i.e., “I feel as if I am slowed down”). The subscales addressed how the participants have felt recently (i.e., in the past four weeks). The maximum score on each subscale was 21 points and the cut-off for anxiety/depression was set at > 11/21 points. Eleven participants scored above the cut-off of anxiety and/or depression.

Data analysis

We compared performances of patients in the presence and in the absence of their spouses (as shown in Table 1). Comparisons were conducted using paired-t tests because the same participants were tested in two different conditions and because the sample size was too small for sophisticated analysis such as ANCOVA or logistic regression. We applied the t-tests after checking for deviations in normality of distribution with the Shapiro and Wilk test. The significance level was set at $p < .05$. We provided effect sizes by using Cohen's d (Cohen, 1992): 0.20 = small, 0.50 = medium, 0.80 = large.

Results

Higher verbal fluency in the absence of spouses than in their presence

Analyses demonstrated no significant differences between patients' performances in the absence of spouses and in their presence, regarding general cognitive performances [$t(30) = 1.09$, $p = .28$, Cohen's $d = .20$], episodic memory [$t(30) = .90$, $p = .37$, Cohen's $d = .16$], forward spans [$t(30) = 1.22$, $p = .23$, Cohen's $d = .22$], backward spans [$t(30) = 1.00$, $p = .32$, Cohen's $d = .18$], inhibition [$t(30) = 1.42$, $p = .16$, Cohen's $d = .25$], shifting [$t(30) = .76$, $p = .46$, Cohen's $d = .14$], anxiety [$t(29) = .83$, $p = .41$, Cohen's $d = .15$], or depression [$t(30) = 1.15$, $p = .26$, Cohen's $d = .21$]. However, patients demonstrated higher verbal ability in the absence than in the presence of spouses [$t(30) = 4.02$, $p < .001$, Cohen's $d = .90$].

INSERT TABLE 1 HERE

Discussion

This study was prompted by a clinical concern about the attendance of spouses during neuropsychological assessments, as it may influence patients' performances. To investigate this

issue, we assessed the neuropsychological performances of patients in the presence or absence of their spouses. Results demonstrated no significant differences between the presence or the absence of spouses on tests assessing general cognitive abilities, episodic memory, working memory, inhibition and flexibility. While we expected that spousal attendance would increase anxiety and depression in patients, this hypothesis was not validated as no significant differences were observed regarding anxiety and depression in patients between spousal attendance and spousal absence. However, patients demonstrated higher verbal fluency when tested alone compared to when their spouses attended the assessment.

Contrary to our hypothesis, spousal attendance did not influence anxiety and depression in patients. It did not even impact most of the cognitive performances of patients. These results seem to be at **odd** with previous research on the effect of observers on cognitive performances as this research has demonstrated that the presence of an observer can be associated with poorer cognitive performances, especially on tests of memory and attention (Eastvold, Belanger, & Vanderploeg, 2012). However, this research has not been concerned with the influence of spouses or with AD patients.

Our findings are relevant for clinicians who wonder about the risks and advantages of spousal attendance during neuropsychological testing. Since it did not significantly decrease or increase anxiety and depression in patients, our recommendation is that clinicians willing to evaluate anxiety and depression should simply take into account the wish of patients regarding the attendance of their spouses. The same observation can be made about the assessment of general cognitive abilities, episodic memory, working memory, inhibition and flexibility. However, spousal attendance should be considered more carefully when clinicians wish to assess verbal fluency in patients. As demonstrated by our analysis, AD patients tend to demonstrate higher

verbal fluency when tested alone compared to when spouses attend the assessment. Clinicians may therefore prefer to test verbal fluency when patients are alone, as long as both patients and spouses agree.

To understand the influence of spousal attendance on verbal fluency in patients, it would be interesting to shed light on the decline in linguistic abilities in AD. While AD is mainly associated with memory decline (El Haj et al., 2016; McKhann et al., 2011), linguistic decline is also a main characteristic of the disease (Verma & Howard, 2012). Among the most commonly observed language deficits, AD patients tend to demonstrate word-finding difficulties (McKhann et al., 2011), repetitive verbalization (i.e., increase in repetitive responses) (Bayles, Tomoeda, McKnight, Helm-Estabrooks, & Hawley, 2004; Lozachmeur, Gallouj, & El Haj, 2019; Marczyński & Kertesz, 2006), as well as a tendency to produce words and utterances that convey little or no meaning (Almor, Kempler, MacDonald, Andersen, & Tyler, 1999; Cuetos, Arango-Lasprilla, Uribe, Valencia, & Lopera, 2007; El Haj, Clément, Fasotti, & Allain, 2013). Importantly, AD is characterized by a decline in verbal fluency (Hodges & Patterson, 1995; Verma & Howard, 2012). All these changes result in poor linguistic production in patients. To overcome such difficulties, spouses may tend to help by leading the patients' discourse (e.g., providing the correct answers when patients are interviewed). Patients may thus tend to rely on spouses in situations that require significant verbal production, which may explain the lower verbal fluency when they are tested alone. While this explanation is plausible, it should be considered with caution as our study design did not include a measurement of communication style in the tested dyads.

The communication dynamics in the dyad may explain the differences in patients' verbal fluency when tested alone, compared to when spouses attend the assessment. This issue may be further addressed by future research in light of the "relationship continuity" framework (Chesla,

Martinson, & Muwaswes, 1994; Riley, Evans, & Oyeboode, 2018). This framework defines the dynamics of a dyad in dementia, in terms of whether the spouse experiences the relationship as a continuation of the pre-morbid relationship (i.e., relationship continuity), or as a radically changed and different one (i.e., relationship discontinuity). Compared to relationship continuity, relationship discontinuity may be associated with higher distress and negative emotional reactions in spouses (Walters et al., 2010). It would be interesting to test whether this distress influences the cognitive performances and, more specifically, the verbal abilities of patients. Our study was, however, more focused on patients' distress than on that of spouses. *Although our study has assessed distress with the HADS, this instrument may not fairly capture the state levels of mood and anxiety, which should be considered by future replications. Another potential limitation of our study is the small sample size, which increases the risk of Type II statistical errors, although the Cohen's d as related to the t-students were mostly fair and some Cohen's d were even large.*

To summarize, this paper offers an empirical assessment of a long-standing question about the effects of spousal attendance on the performances of patients in memory clinics. By addressing the issue of the effects of spousal attendance on the cognitive performances of patients, we believe that our study may provide valuable guidance to clinicians and help them to take the dynamics of dyads into consideration during neuropsychological assessments.

Acknowledgments

This study was supported by the LABEX (excellence laboratory, program investment for the future) DISTALZ (Development of Innovative Strategies for a Transdisciplinary approach to Alzheimer disease).

Conflict of Interest

The authors declare no conflict of interest.

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Table 1

Performances of patients in presence or absence of spouses

Task		Spouses' presence	Spouses' absence	
General Cognitive functioning	Mini-Mental State Examination	21.48 (1.59)	21.74 (1.63)	$p = .28$
Episodic memory	Grober and Buschke	4.74 (1.90)	5.03 (1.52)	$p = .37$
Working memory	Forward span	4.61 (1.26)	4.94 (1.15)	$p = .23$
	Backward span	3.65 (1.11)	3.74 (1.09)	$p = .32$
Verbal fluency	Verbal fluency	12.10 (4.21)	16.88 (5.04)	$p < .001$
Inhibition	Stroop	61.29 (9.81)	58.39 (9.80)	$p = .16$
Shifting	Plus-minus	10.27 (7.18)	9.82 (5.47)	$p = .76$
Anxiety	Hospital Anxiety and	7.81 (3.41)	7.35 (2.46)	$p = .41$
Depression	Depression Scale	10.52 (3.03)	10.19 (2.79)	$p = .26$

Note. Standard deviations are given between brackets; performance on the Mini-Mental State Examination was the number of correct responses (out of 30); performance on the Grober and Buschke task was the number of correct responses (out of 16); performance on the forward and backward spans was the number of correctly repeated digits; scores on the Stroop and Plus-Minus task refer to reaction time; the maximum score on the anxiety or depression scale was 21 points;