

# Examining the Pathways Between Self-Awareness and Well-Being in Mild to Moderate Alzheimer Disease

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**Objective:** *To investigate the relationship between awareness of memory loss and psychological well-being in a nonclinically depressed sample of participants with mild to moderate Alzheimer disease (AD). **Methods:** Study participants (N = 104) enrolled through Columbia University Medical Center and the University of Pennsylvania completed clinical and cognitive assessments. Participants were rated with regard to their degree of awareness of memory deficits and completed questionnaires relating to their psychological well-being, including mood and quality of life (QOL). Mediating models were used to establish the relationship between awareness, depression, and QOL and to examine potential mediators of awareness and depression, including psychological distress, objective memory deficits, and negative self-ratings. **Results:** There was a direct association between awareness of memory deficits and depressed mood but not awareness and QOL. However, there was an indirect association between awareness and QOL through depression. Neither psychological distress, memory deficits, nor negative self-ratings mediated the relationship between awareness and depression. **Conclusion:** Awareness is associated with depressed mood in nonclinically depressed participants with mild to moderate AD. However, depressed mood does not appear to reflect the direct psychological reaction to awareness of memory loss. Moreover, awareness has only an indirect association with QOL via depressed mood. These results suggest that preserved awareness does not have a direct negative impact on overall psychological well-being in AD. (Am J Geriatr Psychiatry 2015; 23:1297–1306)*

**Key Words:** Awareness, depression, quality of life

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Supplemental digital content is available for this article in the HTML and PDF versions of this article on the journal's Web site ([www.ajgponline.org](http://www.ajgponline.org)).

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<http://dx.doi.org/10.1016/j.jagp.2015.05.005>

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## INTRODUCTION

Disordered awareness of memory loss is a common feature of Alzheimer disease (AD) dementia, even at its earliest stages.<sup>1,2</sup> Disordered awareness makes patients less likely to comply with treatment,<sup>3</sup> increases caregiver burden,<sup>2,4</sup> and impairs decision-making capacity.<sup>3,5</sup> Consequently, interventions to improve awareness of cognitive and functional deficits may have potential value. However, preserved awareness may negatively affect key patient-reported outcomes related to psychological well-being, potentially increasing depressive symptoms and reducing perceived quality of life (QOL). This study sought to investigate the relationship between awareness of memory loss and psychological well-being.

There is a strong link between depression and reduced QOL in dementia,<sup>6–11</sup> and both have been associated with preserved awareness.<sup>12–21</sup> However, it is unknown whether memory awareness influences these aspects of well-being, well-being influences memory complaints, or even if they occur simultaneously and independently.<sup>22</sup> Researchers and clinicians need to know the answer to these questions to inform strategies for managing and enhancing key patient reported outcomes in the lives of persons with AD. This will be increasingly important as disease modifying treatments are being developed that, if effective, will keep individuals at mild stages of dementia for longer periods of time.

The first goal of this study was therefore to outline the pathways between awareness, depression, and QOL. Redundant metrics of these constructs may obscure the underlying relationships. For example, QOL ratings generally address patient perception of a variety of facets of life, including mood.<sup>23</sup> Moreover, measures of depression often query a range of cognitive complaints. Distinguishing the measurements of QOL, depression, and awareness in a single mediation model within a large sample of individuals with AD may help clarify the extent and nature of their associations.

The second goal of this study was to examine three specific models by which awareness may be associated with depressed mood. The first model posits that awareness of cognitive decline results in psychological distress surrounding specific cognitive

failures, which then leads to more general feelings of sadness and hopelessness.<sup>12,13,15</sup> The second model posits that individuals with more depressive symptoms experience more severe memory problems and thus report such problems to a greater degree.<sup>24–26</sup> Finally, the third model posits that depressed mood leads to a higher endorsement of complaints in general (cognitive or otherwise), subsequently resulting in increased memory complaints (regardless of the true level of awareness). We evaluate the applicability of these models as well as the overall association between awareness, depressed mood, and QOL in a nonclinically depressed sample of individuals with mild to moderate AD.

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## METHODS

### Participants

One hundred four individuals with probable AD were recruited through Columbia University Medical Center Department of Neurology (N = 49) and the University of Pennsylvania Memory Center (N = 55). Diagnoses of AD were made according to the Neurologic Disorders and Stroke–Alzheimer’s Disease and Related Disorders Association criteria. All participants were reimbursed for participation. Patients with probable AD and a score of 17 or greater on the Mini-Mental State Exam<sup>27</sup> were included. Individuals with a significant history of or ongoing major psychiatric condition were excluded from the study, as were individuals with history of head injury, stroke, and other neurologic illnesses that might impact cognition and/or the presentation of AD.

### Procedures

All studies were approved by the institutional review boards at both medical centers. All individuals provided informed consent before participation.

### Measures

Each measure was selected and modified as described below to eliminate redundancy in the assessment of each construct. All scales demonstrate good reliability across multiple measurements (see [Supplemental Table 1](#), available online).

### Awareness

Clinical rating of awareness began with a brief interview in which examiners asked participants to discuss their current memory abilities. A score from 1 to 4 was assigned using a modified version of the Anosognosia Rating Scale,<sup>28</sup> where 4 = *full awareness* (spontaneous complaint or ready admission of memory loss along with the recognition that the loss is abnormal for age), 3 = *moderate awareness* (spontaneous admission of memory loss; however, loss is discussed in the context of “normal” age-related changes; no discussion of diagnosis), 2 = *shallow awareness* (inconsistent or transient recognition of memory loss or uncertainty regarding memory loss; patients may acknowledge inconsequential memory loss), and 1 = *no awareness* (denial of any memory impairment). Responses were audio recorded and scored before completing the remainder of the battery. Scores were finalized after a consensus meeting with an additional rater after the visit.

### Depressive Symptoms

Geriatric Depression Scale (GDS)<sup>29</sup> is a self-report tool that has been validated as an appropriate measure in patients with mild to moderate AD.<sup>30</sup> Participants were prompted to endorse those items they have experienced in the past week (e.g., Do you often feel helpless?). For the purposes of this study, we created a 23-item anhedonic subscore (GDSa) to eliminate redundancy between depression and awareness scores. Specifically, we removed four items on the GDS that assess cognitive complaints (e.g., Do you feel you have more problems with memory than most?). Moreover, we conservatively removed three additional items related to concern for future well-being (e.g., Do you frequently worry about the future?) to ensure these were not related to awareness of a neurodegenerative process.

### Quality of Life

The Quality of Life in Alzheimer’s Disease Scale<sup>10</sup> is a 13-item measure of overall QOL specifically developed for assessing patients with dementia. It has been shown to be a reliable and valid measure for assessing subjective QOL.<sup>10</sup> Each of 13 areas was rated using a four-point scale from poor to excellent. The primary dependent variable was the single item

on the questionnaire pertaining to the participant’s life as a whole. This item was selected to 1) reduce redundancy across measures, because some items in the scale could be argued to assess our other constructs of interest, mood, and awareness, and 2) account for the fact that individuals might rate certain specific aspects of their life negatively despite having an overall positive perception of their life as a whole, and vice versa.

### Distress

Distress surrounding specific cognitive difficulties was measured as a potential mediator of the association between awareness and depressive symptoms more generally. The Global Distress Index (GDI) derives from the Cognitive Difficulties Scale (CDS),<sup>31</sup> a 39-item questionnaire that asks subjects to reflect on “everyday inefficiencies, lapses of attention or memory and related functions that people notice about themselves.” The questionnaire uses a five-point Likert scale from 0 (never) to 4 (very often). The GDI is paired with the CDS to assess participant distress in relation to each of the 39 cognitive difficulties queried. Distress is rated on a five-point Likert scale from 0 (not at all) to 4 (very much), with high scores indicating severe distress regarding the cognitive difficulty. The measure was given to both the participant and to a reliable informant to complete about the patient. An adjusted GDI score was used in analyses to account for the total number of reported cognitive difficulties such that distress scores were not necessarily higher for those who endorsed a greater number of cognitive difficulties (total GDI/number of cognitive difficulties reported = adjusted GDI). Adjusted GDI was included as a mediator in Models 2A and 2B to examine the extent to which depression reflects the psychological reaction to cognitive failures.

### Memory

Philadelphia Repeatable Verbal Learning Test<sup>32</sup> is a list-learning task in which participants are required to learn nine words over the course of five trials. The primary dependent variable was delayed recall after approximately 30 minutes. Memory was included as a mediator in Model 3, which examined the extent to which depression lowers memory, thereby heightening memory complaints (i.e., awareness).

**TABLE 1. Demographic Information and Awareness Levels**

Variable	Mean (SD) or % (N)
Age	77.55 (8.03)
Education	15.38 (2.84)
Female	65.4% (68)
White	92.3% (96)
African American	7.7% (8)
Non-Hispanic Ethnicity	98.1% (102)
Awareness levels	
Full awareness	21.2% (22)
Moderate awareness	35.6% (37)
Shallow awareness	33.7% (35)
No awareness	9.6% (10)

### General Self-Ratings

Using a brief rating scale,<sup>33</sup> participants were asked to judge themselves in comparison with others their age on four abilities (walking, using hands and fingers, sitting still and quietly, and controlling emotions). Ratings were based on a five-point Likert scale from 1 (very impaired) to 5 (excellent). Participants' ratings of these abilities (not necessarily expected to be reduced in AD) were included in Model 4 to examine the extent to which negative self-assessment in general may mediate the association between depressive symptoms and awareness.

### Data Analysis

Total scores were pro-rated from the mean score for the GDSa, GDI, and CDS if a participant was missing < 20% of individual items (<6 on GDSa and <7 on CDS/GDI). Fifteen subjects and 10 informants received an imputed total score on one of the measures. The totals for these subjects were computed from the average of the remaining items. One-way analyses of variance and  $\chi^2$  tests were used to evaluate differences in variables across sites. Pearson correlation coefficients were used to examine correlations between demographic variables and the main variables of interest.

### Mediation Analyses

We tested four mediation models using path-analytic approaches developed by Hayes.<sup>34</sup> For each mediation model we estimated the total, direct, and indirect effects of a predictor on the outcome variable through the selected mediator. See [Supplemental Digital Content](#), IBM Corp, Armonk, NY available

**TABLE 2. Cognition, Mood, and QOL**

Measure	N	Range	Mean (SD)
Mini-Mental State Exam	104	17–30	24.19 (2.64)
GDS	104	0–21	4.90 (4.40)
GDSa	104	0–18	3.06 (3.38)
Patient Cognitive Difficulties Scale	90	39–138	74.64 (20.11)
Patient GDI	90	0–104	25.70 (23.65)
Adjusted patient GDI	90	0–3.07	1.03 (0.74)
Informant Cognitive Difficulties Scale	86	43–165	109.51 (25.37)
Informant GDI	86	0–117	43.65 (25.71)
Adjusted informant GDI	86	0–3.20	1.39 (0.70)
QOL, total score	103	25–51	41.27 (5.10)
QOL, "How would you describe your life as a whole?"	103	2–4	3.28 (0.62)

online, for a detailed description of the mediation analyses and the calculation of effect sizes using the  $\kappa^2$  statistic.

## RESULTS

Descriptive demographic and clinical information are presented in [Tables 1](#) and [2](#). The only demographic variable that correlated with awareness was age ( $r(102) = -0.27, p = 0.01$ ). There were no associations between demographic variables and depression or QOL. No variable differed by site. Inclusion of age as a covariate in the mediation models did not change results, and therefore unadjusted results are presented.

### Mediation Analyses

[Table 3](#) and [Figures 1–4](#) contain the unstandardized regression coefficients and 95% confidence intervals (CIs) for all analyses described below.

#### Model 1: Awareness, Depression, and QOL

Model 1 is shown in [Figure 1](#). Awareness of memory loss significantly predicted depressive symptoms (path a),  $t(101) = 6.53, p = 0.02$ , and depressive symptoms predicted QOL (path b),  $t(100) = -4.82, p < 0.001$ . There was no direct effect of awareness on QOL (path c'),  $t(100) = -0.11, p = 0.91$ . However, there was a significant indirect effect of awareness on QOL through depression, indirect effect: 0.07, bootstrap CI:  $-0.16$  to  $-0.01$ , with a medium to large effect size,  $\kappa^2 = 0.11$ . To test the specificity of this model (i.e., the extent to which

TABLE 3. Results of Mediation Models

Model	Predictor	Mediator	Outcome	Path a			Path b			Path c' (Direct Effect)			Indirect Effect		
				$\beta$	SE	t(df)	$\beta$	SE	t(df)	$\beta$	SE	t(df)	$\beta$	SE	95% CI
1	Aware	Depression	QOL	0.86 <sup>a</sup>	0.36	2.37 (101)	-0.08 <sup>b</sup>	0.02	-4.82 (100)	-0.01	0.06	-0.11 (100)	-0.07 <sup>c</sup>	0.04	-0.16 to -0.01
2A	Aware	PR Distress	Depression	0.08	0.09	0.94 (88)	1.01 <sup>a</sup>	0.46	2.18 (87)	1.06 <sup>d</sup>	0.39	2.73 (87)	0.08	0.11	-0.07 to 0.41
2B	Aware	IR Distress	Depression	0.28 <sup>b</sup>	0.08	3.41 (84)	0.24	0.55	0.44 (83)	1.06 <sup>a</sup>	0.41	2.42 (83)	0.07	0.16	-0.27 to 0.37
3	Depression	Memory	Awareness	0.04	0.05	0.83 (95)	0.10 <sup>a</sup>	0.05	2.01 (94)	0.07 <sup>d</sup>	0.03	2.79 (94)	0.004	0.007	-0.005 to 0.02
4	Depression	Self-Ratings	Awareness	-0.27 <sup>b</sup>	0.07	-3.84 (102)	0.01	0.03	0.30 (101)	0.07 <sup>a</sup>	0.03	2.34 (101)	-0.003	0.01	-0.02 to 0.02

Notes: Path a represents the unstandardized coefficient from regressing the predictor on the mediator; Path b refers to the effect of the mediator on the outcome after controlling for the effect of the predictor; and Path c' refers to the direct effect of the predictor on the outcome after controlling for the effect of the mediator. The indirect effect reflects the product of Path a and Path b, and a significant indirect effect indicates some mediating effect. SE: standard error; PR: patient rated; IR: informant rated.

<sup>a</sup>p < 0.05.  
<sup>b</sup>p < 0.001.  
<sup>c</sup>Significant at least at p < 0.05; statistical software did not distinguish p < 0.05.  
<sup>d</sup>p < 0.01.

significant results are maintained when the predictor and outcome variables are reversed), we entered depression as the predictor and awareness as the mediator in an alternative model. Although depression did have a direct effect on QOL,  $t(100) = -4.82$ ,  $\beta = -0.08$ ,  $p < 0.001$ , the relationship was not mediated by awareness (indirect effect:  $-0.0004$ , bootstrap CI:  $-0.01$  to  $0.01$ ,  $\kappa^2 = 0.003$ ).

**Models 2–4: Mediators of the Relationship Between Awareness and Depression**

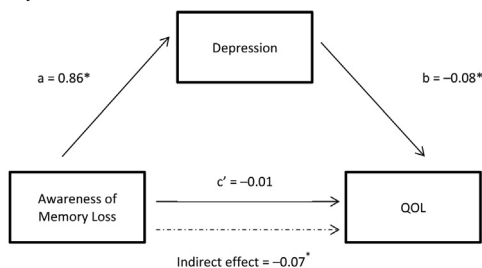
Model 2: distress over cognitive failures. Figure 2 shows Models 2A and 2B. Awareness of memory loss did not predict patient-reported distress over cognitive failures (path a),  $t(88) = 0.30$ ,  $p = 0.35$ , although patient distress did predict depression scores (path b),  $t(87) = 2.18$ ,  $p = 0.03$ . The direct effect of awareness on depression scores remained significant,  $t(87) = 2.73$ ,  $p = 0.008$ , but the effect was not mediated by patient distress over cognitive failures, indirect effect:  $0.08$ ,  $\kappa^2 = 0.02$ . Patient's awareness of memory loss predicted the informant's ratings of the patient's distress over cognitive failures (path a),  $t(84) = 3.40$ ,  $p = 0.001$ . However, the caregiver's reports about the patient's distress did not predict depressive symptoms (path b),  $t(83) = 0.44$ ,  $p = 0.66$ . The direct path between awareness and depression remained significant when informant-rated distress was included as a mediator,  $t(83) = 2.42$ ,  $p = 0.02$ , but the mediating effect was nonsignificant, indirect effect:  $0.07$ ,  $\kappa^2 = 0.02$ .

Model 3: memory. Figure 3 displays Model 3. Depression did not predict memory performance, (path a),  $t(95) = 0.83$ ,  $p = 0.41$ . However, there was a significant positive relationship between memory performance and awareness (path b),  $t(94) = 2.01$ ,  $p = 0.05$ , such that those with higher memories also had better awareness of memory loss. The direct effect of depression on awareness (path c') was also significant,  $t(94) = 2.79$ ,  $p = 0.006$ , but was not mediated by memory, indirect effect:  $0.004$ ,  $\kappa^2 = 0.01$ .

Model 4: negative self-ratings. Model 4 is shown in Figure 4. Depressive symptoms predicted general (noncognitive) self-ratings, (path a),  $t(102) = 3.8$ ,  $p < 0.001$ ; however, negative self-ratings did not predict memory awareness, (path b),  $t(101) = 0.30$ ,  $p = 0.76$ . The direct path between depressive symptoms and awareness was significant,  $t(101) = 2.34$ ,

**FIGURE 1.** Unstandardized regression coefficients for (a) the effect of awareness of memory loss on depression,  $t(101) = 2.37, \beta = 0.86, p = 0.02$ ; (b) the effect of depression on QOL after controlling for awareness,  $t(100) = -4.82, \beta = -0.08, p < 0.001$ ; and (c') the effect of awareness of memory loss on QOL after controlling for depression,  $t(100) = -0.11, \beta = -0.007, p = 0.91$ . Indirect effect represents the product of  $a*b$ , bootstrap CI:  $-0.16$  to  $-0.01$ . \*Significant at least at  $p < 0.05$ ; statistical software did not distinguish  $p < 0.05$  when estimating indirect effects.

Model 1: Does awareness of memory loss increase depressive symptoms, and interfere with quality of life?



$p = 0.02$ , but negative self-ratings did not exert a mediating effect, indirect effect:  $-0.003, \kappa^2 = 0.01$ .

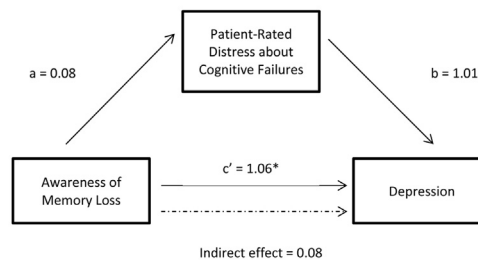
## DISCUSSION

Among patients with AD, disordered awareness of memory loss is a prevalent yet incompletely understood symptom. Although evidence suggests that disordered awareness is detrimental for decision-making capacity and therefore threatens patients' autonomy and independence,<sup>3</sup> intact awareness has been associated with higher depression and lower QOL. However, the link between awareness and psychological well-being has been inconsistent, and its basis is not understood. Using mediation models, we investigated the pathways between awareness and key patient-reported outcomes of psychological well-being.

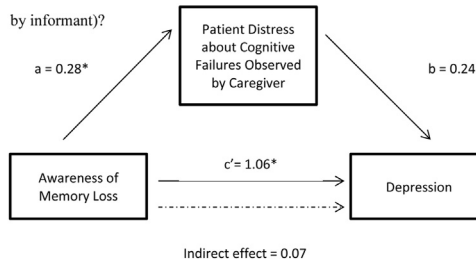
Among participants with mild to moderate AD, we confirmed the well-established link between depression and QOL<sup>9,21,35,36</sup> and demonstrated a direct association between awareness and depression. The latter finding, consistent with some<sup>12-20</sup> but not all<sup>2,28,37-44</sup> earlier investigations, is compelling because we used nonoverlapping measures to assess these constructs, ensuring the association was not driven by redundancy in the assessment of

**FIGURE 2.** Top panel (Model 2A) shows unstandardized regression coefficients for (a) the effect of awareness of memory loss on patient-reported distress over cognitive failures,  $t(88) = 0.937, \beta = 0.08, p = 0.35$ ; (b) the effect of patient-reported distress on depression after controlling for awareness,  $t(87) = 2.18, \beta = 1.01, p = 0.03$ , and (c') the direct effect of awareness of memory loss on depression after controlling for the effect of patient-reported distress over cognitive failures,  $t(87) = 2.73, \beta = 1.06, p = 0.008$ . Indirect effect represents the product of  $a*b$ , bootstrap CI:  $-0.07$  to  $0.41$ . Bottom panel (Model 2B) shows unstandardized regression coefficients for (a), the effect of awareness of memory loss on patient's distress over cognitive failures as reported by caregiver,  $t(84) = 3.41, \beta = 0.28, p < 0.001$ ; (b) the effect of caregiver-reported patient distress on depression after controlling for awareness,  $t(83) = 0.44, \beta = 0.24, p = 0.66$ ; and (c') the direct effect of awareness on depression after controlling for caregiver-reported patient distress,  $t(83) = 2.42, \beta = 1.06, p = 0.02$ . Indirect effect represents the product of  $a*b$ , bootstrap CI:  $-0.27$  to  $0.37$ . \*Significant at least at  $p < 0.05$ ; statistical software did not distinguish  $p < 0.05$  when estimating indirect effects.

Model 2A: Does depression reflect the psychological reaction to cognitive failures (as reported by participant)?



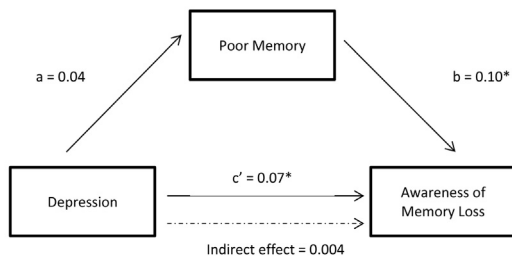
Model 2B: Does depression reflect the psychological reaction to cognitive failures (as reported by informant)?



each construct (e.g., cognitive complaints in the context of the mood assessment). Consideration of the discrepancies across earlier studies reveals two key variables that likely influence whether an association is seen between awareness and depression. First, the severity of depression appears to be a

**FIGURE 3.** Unstandardized regression coefficients for (a) the effect of depression on memory performance,  $t(95) = 0.83$ ,  $\beta = 0.04$ ,  $p = 0.4$ ; (b) the effect of memory performance on awareness of memory loss after controlling for depression,  $t(94) = 2.01$ ,  $\beta = 0.1$ ,  $p = 0.05$ ; and (c') the effect of depression on awareness of memory loss, after controlling for memory performance,  $t(94) = 2.79$ ,  $\beta = 0.07$ ,  $p = 0.006$ . Indirect effect represents the product of  $a*b$ , bootstrap CI:  $-0.005$  to  $0.03$ . \*Significant at least at  $p < 0.05$ ; statistical software did not distinguish  $p < 0.05$  when estimating indirect effects.

Model 3: Does depression lead to reduced memory and therefore higher complaints about memory (i.e., awareness)?



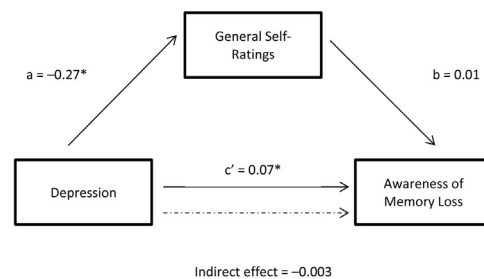
driving factor, with no associations reported between awareness and depression in the context of major depressive disorder.<sup>28,37,39,45</sup> This could reflect the fact that major depressive disorder is likely associated with a number of genetic, biologic, and/or environmental variables that wash out more subtle associations between mood and awareness.

Second, those studies that focus on the psychological and affective experience of depression (e.g., sad affect, depressed mood, dysthymia) find a positive association between awareness and depressed mood.<sup>12,13,15–18,46</sup> In contrast, most studies finding no association either use scales that include somatic symptoms (e.g., sleep, appetite, etc.) with questionable validity in older adults or use a broad measure of psychiatric symptoms with only a few items specific to depressed mood. For example, Troisi et al.<sup>47</sup> divided Hamilton Depression Rating Scale scores into intrapsychic and somatic subscales. Although somatic symptoms were unrelated to insight, psychological symptoms of depression were more severe among patients with preserved awareness.

Interestingly, we found no direct path between awareness and QOL, consistent with some<sup>6,9,11,21</sup> but not all<sup>8,48</sup> previous studies in mild AD. Discrepancies in earlier studies might be explained by a novel

**FIGURE 4.** Unstandardized regression coefficients for (a) the effect of depression on general self-ratings,  $t(102) = -3.84$ ,  $\beta = -0.27$ ,  $p < 0.001$ ; (b) the effect of general self-ratings on awareness of memory loss, after controlling for depression,  $t(101) = 0.30$ ,  $\beta = 0.01$ ,  $p = 0.76$ ; and (c') the effect of depression on awareness after controlling for general self-ratings,  $t(101) = 2.34$ ,  $\beta = 0.07$ ,  $p = 0.02$ . Indirect effect represents the product of  $a*b$ , bootstrap CI:  $-0.02$  to  $0.02$ . \*Significant at least at  $p < 0.05$ ; statistical software did not distinguish  $p < 0.05$  when estimating indirect effects.

Model 4: Does depression lead to higher complaints in general and therefore higher complaints about memory (i.e., awareness)?



finding in the current study, that of an indirect path between awareness and QOL through depressive symptoms, and the effect size of this association was medium to large. Thus, although memory awareness did not negatively influence peoples' perceptions of their "life as a whole," there was a relationship between the two constructs through depressive symptoms. Thus, it appears that depression, not awareness, is the key driver of QOL. This confirms the idea that efforts to alleviate depressive symptoms may bolster QOL in early AD<sup>6,9,21</sup> and suggests that awareness of one's symptoms in early AD does not lead directly to negative perceptions of one's QOL.

The second aim of the current study was to delve more deeply into the association between awareness and depressive symptoms by investigating the mechanisms that may underlie this relationship. Surprisingly, none of the hypothesized mechanisms were supported by mediation models. The first model posited that individuals' awareness surrounding cognitive decline could contribute to feelings of sadness and hopelessness.<sup>12,15</sup> Although there was an association between self-reported distress surrounding cognitive failures and depressed mood,

we found no evidence for an association between self-reported distress levels and awareness. The second model posited that patients with depressive symptoms experience higher degrees of memory impairment and thus estimate their memory ability as worse than those with few to no depressive symptoms. However, not only were depressive symptoms unrelated to memory performance, better memory was associated with higher awareness. The third model investigated whether endorsing complaints (memory or otherwise) is a symptom of depressed mood. This model, in line with Schema Theory and the notion of depressive realism,<sup>22</sup> posited that depressed patients experience negative beliefs regarding various aspects of their own self. Thus, AD patients with depressive symptoms may have negative estimations of themselves in general, whether in reference to cognitive or noncognitive abilities and not necessarily intact awareness. This theory has previously been proposed as a potential explanation for higher memory awareness in AD patients with clinical depression.<sup>49</sup> As such, higher awareness scores would be related to the psychological construct of “complaining behavior”<sup>24</sup> rather than to genuine awareness of impairment. However, the final mediation model revealed that although those with higher depressive symptoms reported greater impairment in noncognitive domains, individuals judged to be more aware of memory problems did not make more negative self-ratings in general. Although limited power to detect mediating effects in these models may be a consideration with a sample size of 104, the very small to small effect size of all indirect effects casts doubt on the applicability of these models even with a larger sample.

Given that none of the three hypotheses explored was supported by mediation models, it is possible that current results at least partially reflect the specifics of our study sample and operational definitions of the constructs measured. It is also possible that other unmeasured factors account for the association between awareness and depressive symptoms. For example, existing work across a number of different clinical populations has pointed to a link between left hemisphere compromise and increased levels of depression<sup>50,51</sup> and a separate link between right hemisphere compromise and lower levels of awareness.<sup>15,28,47,52,53</sup> It is thus plausible that an early and disproportionate burden of right hemisphere

pathology in AD could have clinical manifestations, including lower levels of both awareness and depressive symptoms, whereas a disproportionate burden of left hemisphere pathology could underlie increased levels of both. It has also been posited that reduced awareness and depression occur independently but may converge to generate an “affective anosognosia”<sup>55</sup> such that patients who are unaware of memory impairment may also be unaware of depressive symptoms, particularly in the later stages of the disease.

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## CONCLUSIONS

We examined the extent to which and mechanisms by which awareness of memory symptoms in mild to moderate AD is associated with reduced psychological well-being. Findings support the association between memory awareness and depressed mood, but the data did not provide evidence that distress surrounding cognitive failures has a direct effect on mood. Moreover, preserved awareness only appears to co-occur with poor perceptions of QOL in the context of depressed mood. Taken together, results suggest that efforts to improve awareness for the sake of enhancing decision-making capacities, treatment compliance, and patient–family relationships would not sacrifice patients’ psychological well-being. Rather, a combined effort to preserve awareness and manage depressive symptoms in early AD may have the overall effect of enhancing a number of important clinical and practical outcomes related to autonomy and QOL.

## Limitations

A potential limitation of the current study was the cross-sectional nature of the mediation analyses. Such analyses have been shown to significantly underestimate or overestimate mediation parameters as compared with those generated by longitudinal data, and the direction of bias cannot be determined based on the cross-sectional results.<sup>54</sup> Certainly, longitudinal studies examining the development of depressive symptoms in relation to awareness of memory loss are needed to more fully understand the causal pathways and complex association between these constructs. However, the selection of time points for such a study would not be trivial. Both awareness



and mood are variables that can fluctuate within individuals and may fluctuate frequently between time points included in a longitudinal study. In this sense, the contemporaneous examination of these variables at least ensures that their co-occurrence is detected. The role of a given variable as a mediator in the current context is thus evaluated with regard to its expected relationship with the “predictor” and “outcome” at this single point in time. Future studies should also attempt to comprehensively examine the constructs of awareness and psychological well-being in a single model throughout the full spectrum of depressive symptoms as well as memory functioning. The current study may also have been limited by relatively low levels of depression in our participants who endorsed an average of 3 of 23 items on the GDSa. As such, we may have limited our ability to identify mediating variables. However, we did find an association between depressed mood and awareness, suggesting a sufficient range to detect associations. Finally, variable levels of self-awareness in individuals with dementia raise questions regarding the validity and reliability of self-report. The decision

to use self-reported measures of mood was driven by a desire to understand the patient’s psychological experience rather than the informant’s perspective of the patient’s experience. Another option would have been to use the informant’s report of mood or QOL; however, subtle symptoms of mood are not easily observable, and it is not necessarily the case that participants would share this information with informants. Moreover, reliability estimates for the scales included suggest that patients are largely stable in their reports over time.

*This study was supported by the Marilyn S. Ware Alzheimer Program and Dr. Cosentino’s Paul B. Beeson Career Development Award in Aging (K23 AG032899) funded jointly by the National Institute on Aging (NIA) and the American Federation of Aging Research. This study was also supported by NIA grants T32 AG000026 and K01AG035061. There are no conflicts of interest to report.*

*Presented in part at the annual meeting of the International Neuropsychological Society, Meeting 42, Seattle, Washington, 2/12/14-2/15/14 February 2014.*

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