

## ChatGPT and Alzheimer's Disease

# 1 **Fact Check: Assessing the Response of ChatGPT to Alzheimer's Disease Statements with** 2 **Varying Degrees of Misinformation**

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## ChatGPT and Alzheimer's Disease

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41 **Main text – 1845**

42 **Tables – 1, Figures - 2**

43

### 44 **Impact Statement**

45 There are many statements regarding Alzheimer's disease (AD) diagnosis, management, and  
46 treatment circulating on the Internet, each exhibiting varying degrees of accuracy, inaccuracy, and  
47 misinformation. Large language models are a popular topic currently, and many patients and  
48 caregivers may turn to LLMs such as ChatGPT to learn more about the disease. This study aims  
49 to assess ChatGPT's ability to identify and address AD myths with reliable information. We certify  
50 that this work is novel.

### 51 **Key Points**

52 - Geriatricians acknowledged the potential value of ChatGPT in mitigating misinformation in  
53 Alzheimer's Disease

54 - There remain nuanced cases where ChatGPT explanations are not as refined or appropriate.

55 - Why does this matter? Large language models such as ChatGPT are very popular nowadays  
56 and patients and caregivers often may use them to learn about their disease. The paper seeks to  
57 determine whether ChatGPT does an appropriate job in moderating understanding of  
58 Alzheimer's Disease myths.

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## ChatGPT and Alzheimer's Disease

60 **Keywords:** Alzheimer's Disease, Misinformation, Large Language Models, ChatGPT

61

62 **Abstract**

63 **Background**

64 There are many myths regarding Alzheimer's disease (AD) that have been circulated on  
65 the Internet, each exhibiting varying degrees of accuracy, inaccuracy, and misinformation. Large  
66 language models such as ChatGPT, may be a useful tool to help assess these myths for veracity  
67 and inaccuracy. However, they can induce misinformation as well. The objective of this study is  
68 to assess ChatGPT's ability to identify and address AD myths with reliable information.

69 **Methods**

70 We conducted a cross-sectional study of clinicians' evaluation of ChatGPT (GPT 4.0)'s  
71 responses to 20 selected AD myths. We prompted ChatGPT to express its opinion on each myth  
72 and then requested it to rephrase its explanation using a simplified language that could be more  
73 readily understood by individuals with a middle school education. We implemented a survey  
74 using Redcap to determine the degree to which clinicians agreed with the accuracy of each  
75 ChatGPT's explanation and the degree to which the simplified rewriting was readable and  
76 retained the message of the original. We also collected their explanation on any disagreement  
77 with ChatGPT's responses. We used five Likert-type scale with a score ranging from -2 to 2 to  
78 quantify clinicians' agreement in each aspect of the evaluation.

79 **Results**

80 The clinicians (n=11) were generally satisfied with ChatGPT's explanations, with a mean  
81 (SD) score of 1.0( $\pm$ 0.3) across the 20 myths. While ChatGPT correctly identified that all the 20  
82 myths were inaccurate, some clinicians disagreed with its explanations on 7 of the myths.

## ChatGPT and Alzheimer's Disease

83 Overall, 9 of the 11 professionals either agreed or strongly agreed that ChatGPT has the potential  
84 to provide meaningful explanations of certain myths.

### 85 **Conclusions**

86 The majority of surveyed healthcare professionals acknowledged the potential value of  
87 ChatGPT in mitigating AD misinformation. However, the need for more refined and detailed  
88 explanations of the disease's mechanisms and treatments was highlighted.

## ChatGPT and Alzheimer's Disease

### 89 **Introduction**

90 Over 80% of American adults now use the Internet to obtain health information.<sup>1</sup> This  
91 democratization has led to an increase in access to information as well as an escalation in the  
92 spread of health-related misinformation, posing severe challenges to public health and patient  
93 decision-making.<sup>2</sup> Broad or lay public awareness of a health issue or a disease, including  
94 Alzheimer's disease (AD), often coexists with certain misconceptions.<sup>3</sup> In this respect, there are  
95 widely accessed AD-related statements that have been posted online, each demonstrating varying  
96 degrees of accuracy, inaccuracy, and misinformation. While aware of the disease, many patients  
97 and caregivers, whether through experience or training, lack certain knowledge regarding its  
98 diagnosis and management.<sup>4</sup> Through public access to misinformation circulated and gathered  
99 from non-clinical sources, not only is AD often unfairly stigmatized but medical professionals  
100 are under consulted. This trend has led to some clinicians who treat AD to call for action to help  
101 distinguish fact from fiction.<sup>5</sup>

102 The emergence of large language models (LLMs) has created a new opportunity for  
103 people to search for relevant medical knowledge. LLMs comprise a complex neural network  
104 with billions of parameters estimated on large quantities of data. This platform and training  
105 process enables LLMs to capture and generate complex linguistic patterns and dependencies,  
106 thus supporting an ability to convey and express human-like text based on input prompts.<sup>6</sup> The  
107 commonly known LLMs, such as ChatGPT (or GPT-4<sup>7</sup>) developed by OpenAI have shown  
108 remarkable capabilities in language understanding and contextually relevant text generation.<sup>8-12</sup>  
109 However, LLMs are not infallible and do not exist outside of human culture, as such they can  
110 mirror the assumptions and prejudices inherent in their training data, leading to biases and  
111 misinformation in their responses, raising ethical and safety concerns.<sup>13</sup> Thus, to leverage LLMs

## ChatGPT and Alzheimer's Disease

112 to combat AD misinformation, it is necessary to examine their performance through verification  
113 with domain or subject matter experts. Notably, ChatGPT has been shown to effectively  
114 recognize myths in cancer,<sup>14</sup> but no study has shown its benefits in AD. Therefore, the objective  
115 of this study is to assess ChatGPT's ability to accurately address AD myths and provide reliable  
116 information.

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### Methods

120 We conducted a cross-sectional study of clinicians' evaluation of ChatGPT's opinion of  
121 20 AD myths (see Table 1). In this investigation, "myths" are understood as sets of ideas that  
122 become accepted and/or otherwise understood by communities according to dominant ideals that  
123 may themselves be based on varying degrees accuracies, inaccuracies, and misinformation. We  
124 explain how AD myths were selected and validated in the Supplemental Information (SI). The  
125 study took place between April 2023 and May 2023 and was deemed to not be human subjects  
126 research by the Vanderbilt University Medical Center Internal Review Board.

127 We prompted ChatGPT to generate an opinion for each myth and then rewrite the  
128 technical explanation using non-specialist terms such that recipients with a middle school  
129 education-level could understand it. We then developed and administered a survey to inquire  
130 about the degree to which clinicians agreed with the accuracy of each original explanation and  
131 the extent to which the rewritten (simplified) explanation was readable, and retained the  
132 information in the original.

133 Figure 1 provides a sample of the survey questions for Myth #3. The survey begins with a  
134 "To ChatGPT:" component to inquire about ChatGPT's opinion on the myth. Next, the survey

## ChatGPT and Alzheimer's Disease

135 asks the clinician if they are satisfied with ChatGPT's opinion. The clinician could express their  
136 disagreements with the ChatGPT's opinion through a binary 'yes/no' question, complemented by  
137 an optional text field to discuss the disagreements. The second "To ChatGPT:" component  
138 contains ChatGPT's rewritten explanation and two questions for the clinicians about their  
139 assessment of its information retention and readability. In the survey, these questions use a five-  
140 point Likert-type scale that ranged from either "Very Unsatisfied" or "Strongly Disagree" to  
141 "Very Satisfied" or "Strongly Agree". Each option was associated with an according integer  
142 score ranging from -2 to 2. As such, a positive score indicates that clinicians favor ChatGPT's  
143 explanation or rewriting.

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145 In addition, we asked clinicians before and after the survey, "Do you agree that ChatGPT  
146 can be a useful tool to provide explanations and clarifications of misinformation about  
147 Alzheimer's disease?". This question also uses a five-point Likert-type-type scale ranging from  
148 "Strongly Disagree" to "Strongly Agree," with scores from -2 to 2. Each clinician was asked to  
149 review the responses for all 20 statements, which were presented in a randomized order to  
150 mitigate potential ordering effects. The complete survey for the assessment is provided in the  
151 Supplemental Information.

152 The clinicians were recruited from a convenience sample to complete the ChatGPT  
153 assessment survey in REDCap.<sup>16</sup> The set of clinicians included attending geriatricians, geriatric  
154 trainees, nurse practitioners, and physician assistants who primarily treat and care for geriatric  
155 patients from three medical centers (Vanderbilt University Medical Center, University of Illinois  
156 Chicago, Rush Medical Center). Survey respondents received an Amazon gift card with a  
157 monetary amount proportional to the number of responses completed.

## ChatGPT and Alzheimer's Disease

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### Results

We sent an email to 34 practitioners/clinicians who practice primarily in geriatrics, and 15 agreed to complete the survey. Finally, we received survey responses from 11 of them: six attending physicians, three geriatric trainee physicians, one nurse practitioner, and one physician assistant. Only one of these clinicians had used ChatGPT occasionally, nine clinicians had heard of it but never used it, and one other clinician had never heard of it.

Figure 2 illustrates the participants' evaluation of ChatGPT's opinions. Generally, among the 20 myths, the clinicians were satisfied with these explanations, with (mean [standard deviation] score of 1.0 [ $\pm 0.3$ ]). The majority of clinicians selected "Agree" or "Strongly Agree" for each statement (green in Figure 2). Some statements (e.g., statement #7, AD is not fatal) had more "Disagree" or "Strongly Disagree" responses (red in Figure 2).

With respect to the overall results of information retention in the rewritten explanations, 6% selected "Strongly Agree", 76% selected "Agree", and 9% selected "Disagree". No clinicians selected "Strongly Disagree". For readability, 7% selected "Strongly Agree", 74% selected "Agree", and 3% selected "Disagree". Again, none of the clinicians selected "Strongly Disagree". In both situations the mean Likert-type-type score was found to be 0.8. More detailed results are provided in the Supplemental Information.

When comparing the clinicians' assessment of ChatGPT's potential to clarify and explain misinformation about AD before and after reviewing the ChatGPT's responses, three (27%) shifted their responses from "Disagree" or "Neutral" to "Agree" or "Strongly Agree." In total, 82% of clinicians agreed or strongly agreed, 9% were neutral, and 9% disagreed or strongly disagreed.



## ChatGPT and Alzheimer's Disease

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### Discussion

This investigation suggests that ChatGPT exhibits a satisfactory ability to identify and explain misinformation about AD and to generate audience-specific readable explanations. Still several explanations were not entirely accurate. To gain insight into the scenarios where ChatGPT excelled, as well as those that posed a challenge, four statements can be used as examples: two with high total Likert-type scores, one with a high neutral Likert-type score, and another with a low Likert-type score.

#### **#5: Alzheimer's disease is a shameful diagnosis.**

Average Likert-type score: 1.6

AD often carries a social stigma that produces deleterious effects on the well-being of patients afflicted with the disease and their families. These attitudes often lead to delays in care-seeking, diagnosis, and accessing resources for treatment. The language learning model prefaces its statement by noting that it does not have a personal opinion. Because ChatGPT is not a 'person' this statement is technically true, however, it can be interpreted as amounting to a claim of objectivity. That said, ChatGPT expresses the opinion that AD is not a shameful diagnosis, and those affected should be treated with compassion, understanding, and support.<sup>17</sup> While no diagnosis should every be 'shameful', it is important to note that technically what makes a diagnosis "shameful" is the social context in which the disease is experienced and not the diagnosis itself. Its anticipated response echoes recent suggestions that ChatGPT and similar models can mirror empathy equivalent to a human's.<sup>18</sup> While it certainly cannot replace a clinician trained in the management of AD or caregiver communities of practice, working large

## ChatGPT and Alzheimer's Disease

202 language models may be one day be used to establish more personalized and potentially less  
203 stigmatized care.

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205 **#3: All types of dementia are Alzheimer's disease.**

206 Average Likert-type score: 1.4

207 ChatGPT makes a very emphatic declaration, appropriately noting that this statement is  
208 incorrect. It notes that AD is the most common type but then demonstrates that not all types of  
209 dementia are AD by identifying other types of dementia, including vascular dementia, Lewy  
210 body disease (LBD), and frontotemporal dementia.<sup>20</sup> The distinctions are important as they may  
211 affect treatment decisions. For example, cholinesterase inhibitors are commonly effective in  
212 LBD but can often worsen frontotemporal dementia. Additionally, ChatGPT only mentions that  
213 symptoms of LBD can resemble Parkinson's disease but fails to distinguish that dementia with  
214 Lewy Bodies and Parkinson's disease dementia are two different diseases with different  
215 underlying etiologies, pathologies, and diagnostic criteria.<sup>21,22</sup>

216

217 **#1: Alzheimer's disease symptoms are a normal part of aging.**

218 Average Likert-type score: 0.9

219 One of the most common misconceptions of AD is that its symptoms are a common part  
220 of aging.<sup>23-25</sup> ChatGPT starts by stating that its symptoms are not considered part of normal  
221 aging. However, as one clinician noted, the phrasing seems to suggest that the cognitive decline  
222 of normal aging is part of the spectrum of AD, which should be clarified. The normative decline  
223 in brain reserve with aging is not discussed, nor are the dementia warning signs that help with  
224 differentiation. ChatGPT does not discuss distinctions between normal aging, mild cognitive

## ChatGPT and Alzheimer's Disease

225 impairment, and AD. Understanding what specific cognitive abilities are being tested requires  
226 more extensive evaluation.<sup>26</sup> Such nuance may not be communicated well by ChatGPT.

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228 **#7: Alzheimer's disease is not fatal.**

229 Average Likert-type score: 0.2

230 This statement produced the lowest Likert-type score tested. Alzheimer's is generally  
231 considered a terminal neurodegenerative disease that breaks down neurologic processes with a  
232 predominant loss of cognitive function. There is no cure, and in 2023, it was considered the  
233 seventh leading cause of death, with deaths from the disease more than doubling between 2000  
234 and 2019.<sup>27</sup> Additionally, many deaths linked to the disease are underreported.<sup>28</sup> ChatGPT notes  
235 that AD is not a direct cause of death but only contributes to complications, explicitly citing the  
236 inability to swallow, among other complications. This statement is misleading, as it may cause  
237 people with dementia and their caregivers to think ~~feel~~ that death can be avoided if they prevent  
238 complications.<sup>29</sup> As one provider noted, "This may be one of the biggest and most harmful  
239 fallacies in care for dementia." Still, ChatGPT correctly notes that the most common causes of  
240 death from AD are failure to thrive and infection.<sup>30</sup>

241

242 **Conclusion**

243 Like many diseases, AD, given its prevalence, is prone to misinformation communicated,  
244 a problem that is exacerbated and accelerated on online platforms. Though large language  
245 models, like ChatGPT, are not directly responsible for creating or propagating misinformation,  
246 their utilization may inadvertently amplify such misinformation due to potential biases or  
247 misinterpretations embedded within their training data. While ChatGPT can provide useful

## ChatGPT and Alzheimer's Disease

248 information for most readers, there could be more refined and detailed explanations of the  
249 disease's mechanisms and treatments.

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252

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254 collected the data. QS performed the analysis. KB, MD, KH, HM, VL, JP contributed data and  
255 helped interpret the results. TH and BM provided crucial edits. SH, QS, ZY wrote the paper.

256

257 Sponsor's Role: Zhijun Yin helped with the design, methods, analysis, and preparation of paper.

258

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339 **Table 1. The 20 Alzheimer's disease myths used in this study.**

Index	Myth
1	Alzheimer's disease symptoms are a normal part of aging
2	Symptoms of memory loss must be Alzheimer's disease
3	All types of dementia are Alzheimer's disease
4	All Alzheimer's disease patients are disoriented, look confused, and act outside social norms
5	Alzheimer's disease is a shameful diagnosis
6	An at-home genetic test can tell me if I have (or will have) Alzheimer's disease
7	Alzheimer's disease is not fatal
8	Alzheimer's disease patients are close to death
9	Alzheimer's disease patients cannot get depressed
10	I will develop Alzheimer's disease if my parent has it
11	Only older people get Alzheimer's disease
12	Supplements found online can prevent or cure Alzheimer's disease
13	Specific diets can reduce the risk of Alzheimer's disease
14	Prescription medications can reverse the progression to Alzheimer's disease
15	Non-steroidal anti-inflammatory drugs (NSAIDs) can prevent Alzheimer's disease
16	Ginkgo biloba can prevent Alzheimer's disease
17	Hormone therapy prevents and treats Alzheimer's disease
18	Vaccines increase the risk of Alzheimer's disease
19	Aspartame increases the risk of Alzheimer's disease
20	Statins increase the risk of Alzheimer's disease

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## Biological

To (100%) see your status and to log out of this exam, see [Help](#) or [Logout](#).

**QUESTION** The diagram below shows Although Alzheimer's disease is the most common type of dementia, a great deal of research has been done on other types of dementia. Which of the following is NOT a type of dementia associated with the brain, which affect memory, thinking, personality, and other cognitive functions?

Some other common types of dementia include:

**vascular dementia.** The cells in the brain that form part of dementia are included by repeated block flow from stroke, which is also stroke or a series of small strokes.

**Creutzfeldt-Jakob disease** is characterized by the presence of abnormally shaped proteins called prion proteins in the brain. Diseases of dementia include frontotemporal dementia and Lewy body dementia, which are associated with dementia and Parkinson's disease.

**Frontotemporal dementia.** This type of dementia primarily affects the frontal and temporal lobes of the brain, which are major areas for personality, language, and memory.

**Lewy body dementia.** This is the second most common type of dementia in an individual, but it is a combination of Alzheimer's disease and Parkinson's disease.

There are also many other less common types of dementia, but conditions that can cause dementia include systems. It is important to monitor an individual's health for the long-term effects of various conditions and to seek appropriate treatment. The only diagnosis is the following choice.

1. Do you subscribe to the views provided by (100%)?

- Strongly Disagree  
 Disagree  
 Neutral  
 Agree  
 Strongly Agree

2. Do you agree with the views provided by (100%)?

- Yes  
 No

Please provide a comment:

To (100%) see your status and to log out of this exam, see [Help](#) or [Logout](#).

**QUESTION** Some dementia is caused by the brain's cells that make it hard for people to remember things, think clearly, or solve problems. Alzheimer's disease is the most common type of dementia. Which of the following is NOT a type of dementia associated with the brain, which affect memory, thinking, personality, and other cognitive functions?

Some other common types of dementia include:

**vascular dementia.** The vessels that the brain doesn't get enough blood. It can be caused by a big stroke or a series of small strokes.

**Creutzfeldt-Jakob disease.** This is the second most common type of dementia in an individual, but it is a combination of Alzheimer's disease and Parkinson's disease.

**Frontotemporal dementia.** This type affects the frontal and side parts of the brain that help control how we act, talk, and think.

**Lewy body dementia.** This is the second most common type of dementia in the same way as the other main dementia and Parkinson's disease.

There are also many other less common types of dementia, but conditions that can cause dementia include systems. It is important to monitor an individual's health for the long-term effects of various conditions and to seek appropriate treatment.

3. Do you agree with the researcher's views on the views provided by (100%)?

- Strongly Disagree  
 Disagree  
 Neither Agree nor Disagree  
 Agree  
 Strongly Agree

4. Do you agree with the researcher's views on the views provided by (100%)?

- Strongly Disagree  
 Disagree  
 Neither Agree nor Disagree  
 Agree  
 Strongly Agree

Strongly Disagree Disagree Neutral Agree Strongly Agree

