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The Impact of COVID-19 Pandemic on Cognitive Function in Older Adults with Dementia: A Systematic Review

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Abstract

Background: The prevalence of dementia rises with the increasing life expectancy and elderly population. Due to the COVID-19 pandemic, it is challenging for caregivers to help carry out their daily activities and provide cognitive stimulants to slow down the deterioration. Therefore, this research aims to determine the impact of the COVID-19 pandemic on cognitive function in older people with dementia.

Methods: This systematic review sought and reviewed observational studies data taken from various databases such as PubMed, EBSCOHost, Google Scholar, and ScienceDirect starting from January to November 2022—using COVID-19, dementia, cognitive function, and elderly along with their synonyms as keywords.

Results: As many as 11 literatures with a total of 3132 participants were obtained to be reviewed. Ten out of 11 pieces of literature showed a deterioration in the cognitive function of older people with dementia due to the COVID-19 pandemic. In comparison, one piece of literature showed an improvement in cognitive function that was not significant.

Conclusion: The cognitive function of older people with dementia appears to deteriorate when compared between before and after the COVID-19 pandemic. This can be seen as a decrease in MMSE, MoCA, or both scoring results. However, due to confounding variables not being accounted for in the pieces of literature reviewed, it is impossible to pinpoint the Covid-19 pandemic as the exact reason for this deterioration.

Keywords: COVID-19; cognitive function; dementia; elderly

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Introduction

Globally, the world's elderly population is increasing with longer life expectancy. By 2050, older people in Indonesia will reach 23% of the total population, with a life expectancy of around 77.6 years.[1] With that, an increase in the prevalence of degenerative diseases that can affect cognitive function will also follow. Cognitive function is the ability to obtain and process information to decide. An ability that gradually will decline with age.[2,3] One of the degenerative diseases in cognitive function is dementia, which can be progressive and chronic. The prevalence of people in Indonesia with dementia in 2016 was 1.2 million and is predicted to reach 4 million in 2050.[4] Patients with dementia will experience changes in behavior, poor memory, mood changes, difficulty in communicating, isolating themselves from social interaction, and various other symptoms that can hinder patients in their daily activities. Which is why in its treatment, people with dementia, especially the elderly ones, frequently need more attention.[5,6] This is difficult to do amid the current situation, namely the coronavirus disease 2019 (COVID-19) pandemic.[6]

The COVID-19 pandemic has been a major global health problem due to the number of cases internationally. After going on for two years, the number of cases nationwide has reached 6 million, with a total death of 156 thousand people.[7] Symptoms of COVID-19, such as fever, cough, weakness, headache, ageusia, anosmia, shortness of breath, and so on, are found to be more severe in the elderly; therefore, self-isolation and avoiding direct contact is necessary to prevent worsening.[8] However, these two solutions can cause difficulties for the elderly to communicate with their families directly, eventually causing stress and pressure to

increase.[9] A study by Rainero, et al. showed that 55.1% of the participants experienced a deterioration in cognitive function.[10] While using the MMSE and MoCA screening tools, a study by Gan, et al. also resulted in the same thing, which is a significantly decreased cognitive ability. Thus, the COVID-19 pandemic indirectly plays a role in worsening cognitive function in older people with dementia.[11]

Even so, until now, the impact of the COVID-19 pandemic on cognitive function in older people with dementia is still not yet known with certainty. However, several studies conducted state that the COVID-19 pandemic has the potential to cause cognitive decline in older people with dementia. Therefore, it is necessary to write a systematic review on this topic to assess and confirm the impact of the COVID-19 pandemic on the cognitive function of older people with dementia qualitatively since a systematic review on this topic has yet to be conducted.

Methods

Search strategy

This systematic review sought and reviewed data taken from observational studies discussing the impact of the COVID-19 pandemic on cognitive function in older people with dementia, starting from January to November 2022—using COVID-19, cognitive function, dementia, and elderly along with their synonyms as keywords in various databases such as PubMed, EBSCOHost, Google Scholar, and ScienceDirect (table 1). The literature obtained will then go through a screening process using the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) strategy to eliminate literature that does not meet predetermined criteria, is irrelevant, or is a duplicate.

The PEO method (People, Exposure, Outcome) is also used to facilitate the search. Where "P" is the study population (participants over 60 years who are diagnosed with dementia); "E" is the exposure applied (the COVID-19 pandemic); and "O" is the outcome (the impact of the COVID-19 pandemic on cognitive function in older people with dementia). This method was later developed into the question, "What is the impact of the COVID-19 pandemic on cognitive function in older people with dementia?" to guide the search and creation of this systematic review further.

Eligibility criteria

Inclusion criteria: (i) the study design used is an observational study (ii) publication must start from March 2020 at a minimum; (iii) the literature must be in English; (iv) the literature can be accessed in full text; (v) the subjects of the literature are older people aged ≥60 years old who are diagnosed with dementia; (vi) the literature assesses the impact of the COVID-19 pandemic on cognitive function in older people with dementia. Exclusion criteria: (i) incomplete structure of the literature; (ii) the literature does not state or use internationally validated assessment tools; (iii) data from the literature is not complete enough to be processed.

Quality assessment

The quality of the literature is analyzed to assess the risk of bias and implementation of the research using the National Heart, Lung, and Blood Institute (NHLBI) Quality Assessment Tool for Cohort and Cross-Sectional Studies, which has a cut-off of 58.21% or 8 points. The results of the analysis were then divided based on the number of points into 3 classifications, namely poor/high (0-4), fair/moderate (5-10), and good/low (11-14).[12]

Ethical approval

No ethical approval is needed for this systematic review.

Results and Discussion

Search results

A search using the specified keywords managed to get as much as 1341 literature, 1009 of which were eliminated because they were duplicates. While the remaining 332 were selected based on the title, abstract, and predetermined criteria, leaving 11 pieces of literature to be analyzed for their quality. Details of the screening process can be seen in figure 1.

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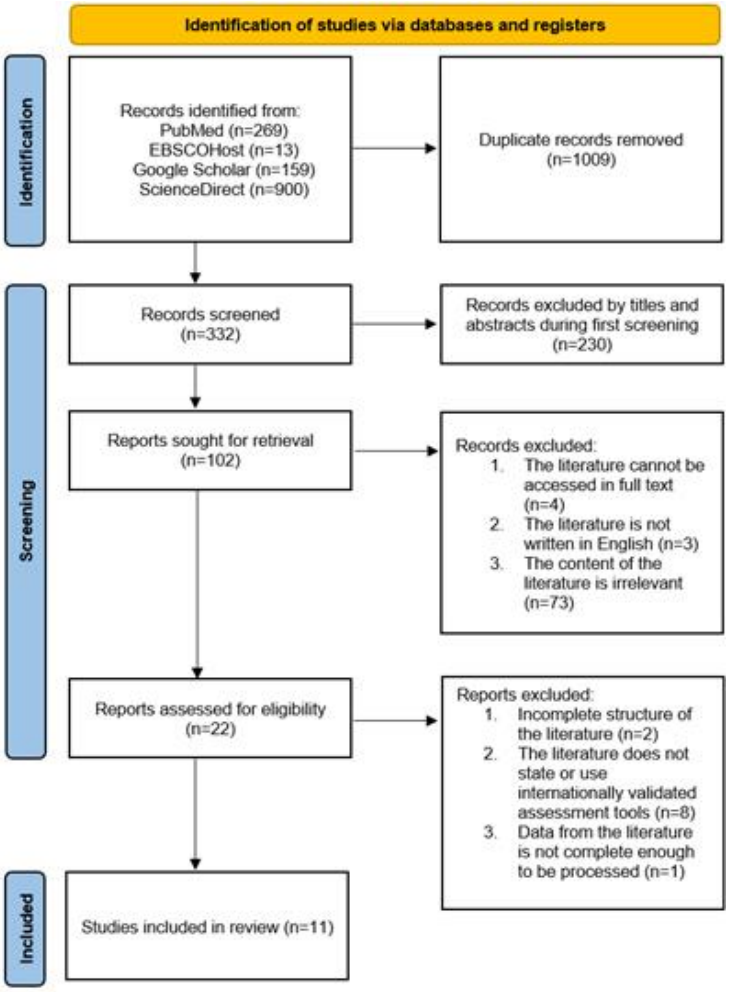

Figure 1. PRISMA selection strategy

Literature characteristics and quality assessment

The quality assessment results show that 8 literature have a fair/moderate risk of bias while the remaining 3 have a good/low bias risk (table 2). From eleven literature, 3132 participants originated from various countries (China, England, Japan, Argentina, Kuwait, Australia, Netherlands, Germany, Spain, Italy, and Greece). The majority are women with an average age of 70-79 years and various types of dementia. Except for 1976, of which the type of dementia is unknown. The research ranged from 4 months to 24 months by comparing the results of cognitive examinations before and during the COVID-19 pandemic.

Impact of COVID-19 pandemic on cognitive function in older people with dementia

Ten pieces of literature show a deterioration in cognitive function as a decrease in MMSE, MoCA, or both scorings because of the COVID-19 pandemic. Three of them, a study by Ismail, et al., Wei, et al., and Gan, et al. showed a significant decrease in cognitive function ($P<0.05$).[11,13,14] While Vislapuu, et al., showed an insignificant improvement in cognitive function. Presumably caused by the reduced number of participants who died from COVID-19 before the researchers had the chance to conduct another cognitive examination (table 3).[15]

Discussion

The results from the review support studies that have been done previously, wherein in the study by Rainero, et al. and Gan, et al., there was also a decrease in MMSE and MoCA scoring results by 55.1% of the total participants.10,11

Houben, et al. stated that the cause of this decline in cognitive function could be divided into two: the result of COVID-19 infection or the result of the pandemic itself. In COVID-19 infection, 3 things play a role in nerve cell damage and decreased cognitive function: a prolonged inflammatory response (cytokine storm), lack of oxygen supply, and the neurotropic characteristic of the SARS-CoV-2 virus.23 The mechanism is that when a prolonged inflammatory response occurs, levels of inflammatory cytokines will increase and cause the blood-brain barrier to become more permeable so that immune cells, the

SARS-CoV-2 virus, and cytokines such as IL-6 can infiltrate the brain. After arriving in the brain, the SARS-CoV-2 virus will infect the nerve tissue and trigger immune cells to destroy the infected area. The destroyed infected area will then become hypoxic.

As for the pandemic situation, Lee, et al. stated that feeling worried about being infected and restrictions on physical and social activities were suspected of contributing to the decline of cognitive function. The mechanism of both is still unclear, but several theories are currently in use. The first theory is that when carrying out social interactions, the brain undergoes changes and developments in ways of thinking that cannot be engineered; besides that, the performance of the cardiopulmonary system improves so that oxygenation to brain tissue increases and damage to cognitive function decreases.24 The second theory is stated in a study by Sroykham, et al., where anxiety and reduced physical and social activity increases the production of the hormone cortisol due to the stress response that appears. The increased cortisol hormone can then cause damage and atrophy of the hippocampal structure so that cognitive function decreases.

Conclusion

In conclusion, this systematic review found a decline in cognitive function in older people with dementia due to the COVID-19 pandemic. However, it is unclear whether the pandemic is the leading cause of this decline because the confounding variable data is currently unknown.

Future research should be carried out using a cross-sectional or cohort observational study design rather than a systematic review because the amount of literature is still relatively small to review. The cognitive assessment tool should also be uniform so that the data distribution is not too wide. Avoid participants from the hospital environment to prevent bias in the results.

Limitations

Research on the impact of the COVID-19 pandemic on cognitive function in older people with dementia is still relatively new, so it is difficult to find literature that discusses both. Most of the literature found, using current keywords, focuses more on discussing the relationship between the two in general and has yet to target a specific population. Apart from that, none of the eleven pieces of literature reviewed included participants' data regarding history of COVID-19 infection, history of habits, comorbidities, or sociodemographic. These four things have the potential to become confounding variables. Not displaying confounding variable data makes the cause of decreased cognitive function difficult to be determined with certainty. Furthermore, not all the cognitive assessment tools used are the same; most use MMSE, while some use MoCA or both. Therefore, the data obtained becomes difficult to compare with one another.

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Affendix

Table 1. Keywords and the Amount of Literature Obtained

Databases	Keywords	Results
PubMed	(((((("COVID 19"[MeSH Terms] OR "COVID"[Title/Abstract] OR "SARS -COV-2"[Title/Abstract]) AND "dementia"[MeSH Terms]) OR "mild cognitive impairment"[Title/Abstract] OR "cognitive function"[Title/ Abstract]) AND "aged"[MeSH Terms]) OR "older adults"[Title/Abstract])	269
EBSCOHost	COVID-19 OR SARS-COV-2 OR COVID AND dementia OR mild cognitive impairment OR cognitive function AND elderly OR older adults OR elders	13
ScienceDirect	COVID-19 OR SARS-COV-2 OR COVID AND dementia OR mild cognitive impairment OR cognitive function AND elderly OR older adults OR elders	159
Google Scholar	COVID-19 OR SARS-COV-2 OR COVID AND dementia OR mild cognitive impairment OR cognitive function AND elderly OR older adults OR elders	900

Table 2. Quality Assessment Results Using the NHLBI tool

No.	Authors (year)	Analysis														Total Score
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
1.	Ismail, *et al.* (2021)[13]	✓	✓	✓	✓	✓	X	✓	X	✓	✓	✓	X	NR	✓	10
2.	Wei, *et al.* (2022)[14]	✓	✓	✓	✓	✓	X	✓	X	✓	✓	✓	X	NR	✓	10
3.	Gan, *et al.* (2021)[11]	✓	✓	✓	✓	✓	X	✓	X	✓	✓	✓	X	✓	✓	11
4.	Smith, *et al.* (2020)[16]	✓	✓	✓	✓	✓	X	X	X	✓	✓	✓	X	NR	✓	9
5.	Tsapanou, *et al.* (2020)[17]	✓	✓	✓	X	X	X	✓	X	✓	✓	✓	X	✓	X	8
6.	Torboli, *et al.* (2021)[18]	✓	✓	✓	✓	✓	X	✓	X	✓	✓	✓	X	✓	✓	11
7.	Sorbara, *et al.* (2021)[19]	✓	✓	✓	NR	✓	X	✓	X	✓	✓	✓	X	✓	✓	10
8.	Kazawa, *et al.* (2022)[20]	✓	✓	✓	NR	✓	X	✓	X	✓	✓	✓	X	NR	✓	9
9.	Chen, *et al.* (2021)[21]	✓	✓	✓	✓	✓	X	✓	X	✓	✓	✓	X	✓	✓	11
10.	Manca, *et al.* (2022)[22]	✓	✓	✓	✓	NR	X	✓	X	✓	✓	✓	X	✓	✓	10
11.	Vislapuu, *et al.* (2021)[15]	✓	✓	✓	NR	✓	X	✓	X	✓	✓	✓	X	X	✓	9

Table 3. Characteristics of Literature

No.	Authors (Year)	Country(s)	Duration	Characteristics of the Study Subjects	Cognitive Assessment Tool used	Main Results
	Ismail, et al.[13] (2021)	Kuwait	8 months	The total number of participants is 36; type of dementia is not mentioned. Twenty-three are females (average age=71 y*).	MMSE*	Significant decline 1 month before = 17.3 ±3 7 months after = 13.9±3
	Wei, et al.[14] (2022)	Australia, Germany, Spain, and Netherlands	9 months	The total number of participants is 287 (FTD=125; AD=120; MD=25; DLB=5; VaD=5; PCA=3; NPH=2; PDD=1; WKS=1)*. A hundred and fifty-nine are females (average age=74 y).	MMSE	Significant decline 1 month before: FTD = 17.8±3.2 AD = 23.4±3 MD = 21±2.2 Other dementia = 19.8±2.1 8 months after: FTD = 16.1±3.2 AD = 22.3±3 MD = 17.7±2.2 Other dementia = 17.2±2.1

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					Significant decline 3 months before: MMSE AD = 15.64±7.32 MD = 16.5±8.16
Gan, et al.[11] (2021)	Tianjin, China	15 months	The total number of participants is 205 (AD=131; MD=74). A hundred and three are females (average age=70 y).	MMSE dan MoCA*	MoCA AD = 11.76±6.84 MD = 12.6±7.54 12 months after: MMSE AD = 14.24±8.15 MD = 14.96±9.02
Smith, et al.[16] (2020)	England	11 months	The total number of participants is 45 (MD=21; DLB=19; AD=4; FTD=1). Thirty-three are males (average age=69 y).	MoCA	MoCA: AD = 10.65±7.41 MD = 11.47±8.18 Nonsignificant decline 8 months before = 21.9±3.2 3 months after = 18.4±3.2
Tsapanou, et al.[17] (2020)	Athens, Greece	5 months	The total number of participants is 204; type of dementia is not mentioned. A hundred and fifty-four are females (average age=79 y).	MMSE	Nonsignificant decline 1 month before = 19.7±2.1 4 months after = 18±2.1
Torboli, et al.[18] (2021)	Padova, Italy	±12 months	The total number of participants is 36; type of dementia is DLB. Nineteen are females (average age=75 y).	MMSE	Nonsignificant decline 6 months before = 25.13±3.5 6 months after = 23.2±3.5
Sorbara, et al.[19] (2021)	Buenos Aires, Argentina	4 months	The total number of participants is 324 (MD=158; AD=116; VaD=32; FTD=9; PDD=6; DLB=3). A hundred and ninety-one are females (average age=80 y).	MMSE	Nonsignificant decline 1 month before: MD = 22±1.5 AD = 20.7±1.8 VaD = 20±2.4 Other dementia =18.8±3.1 3 months after: MD = 20.9±1.5 AD = 19.3±1.8 VaD = 19.8±2.4 Other dementia = 18.6±3.1
Kazawa, et al.[20] (2022)	Japan	±24 months	The total number of participants is 1631; type of dementia and participants' gender is not mentioned (average age ≥65 y).	MMSE	Nonsignificant decline Before = 17.7±1.2 24 months after = 16±1.2

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					Nonsignificant decline 6 months before: MMSE AD = 13±7 MD = 24.5±4.8 DLB = 13.7±7 MoCA AD = 8.8±5.7 MD = 20.4±4.4 DLB = 9.9±5.9 12 months after: MMSE AD = 11.4±7.4 MD = 24±5.8 DLB = 10±6.9 MoCA AD = 7.8±5.9 MD = 20.1±5.5 DLB = 7.3±5.4
Manca, et al.[22] (2022)	London, England	±6 months	The total number of participants is 45 (AD=34; MD=5; DLB=3; PCA=2; CBD*=1). Twenty-five are males (average age=74 y).	MMSE	Nonsignificant decline Before = 21.26±3.37 6 months after = 20.93±3.37
Vislapuu, et al.[15] (2021)	Norway	5 months	The total number of participants is 105; type of dementia is not mentioned. Sixty-four are females (average age=81 y).	MMSE	Nonsignificant incline 4 months before = 20.8±2.4 1 month after = 21.3±2.8

*Years old (y); Mini-Mental State Examination (MMSE); Montreal Cognitive Assessment (MoCA); Frontotemporal dementia (FTD); Alzheimer's disease (AD); Mixed dementia (MD); Dementia with Lewy-Bodies (DLB); Vascular dementia (VaD); Posterior cortical atrophy (PCA); Normal pressure hydrocephalus (NPH); Parkinson's disease dementia (PDD); Wernicke-Korsakoff syndrome (WKS); Corticobasal degeneration (CBD).

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