



**Original Article**

# Prevalence and Risk Factors of Dementia and Caregiver's Knowledge of the Early Symptoms of Alzheimer's Disease

Ni Wayan Suriastini<sup>1</sup>, \*Yuda Turana<sup>2</sup>, Bondan Supraptillah<sup>1</sup>, Teguh Yudo Wicaksono<sup>1</sup>, Endra Dwi Mulyanto<sup>1</sup>

<sup>1</sup>SurveyMETER, Yogyakarta, Indonesia

<sup>2</sup>Department of Neurology, School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia / Alzheimer's Indonesia, Jakarta, Indonesia

## ABSTRACT

**Background/Purpose:** The numbers of people with dementia in Indonesia is projected to rise significantly. Nonetheless, there is no valid data describing the prevalence of dementia. This is the first study to obtain the prevalence, the risk factors of dementia and to describe the caregiver's knowledge of the early symptoms of Alzheimer's Disease (AD).

**Methods:** This is a cross-sectional study using a structured questionnaire in 1,976 elderlies and 1,415 caregivers. This study was conducted in all regencies of Yogyakarta, Indonesia. Dementia diagnosis was based upon Mini-Mental State Examination (MMSE) scores, the presence of difficulties on Instrumental Activities of Daily Living Scale (IADL) and AD8 score  $\geq 2$ . We determined the risk factors and the knowledge of dementia in the elderly group and their caregivers by ability in recognizing the ten signs of dementia through direct interview.

**Results:** The prevalence of dementia in the elderly was 20.1%. The risk factors of dementia were older age, female gender, low education, history of stroke, and unemployment. Only less than 12% of the 1,415 caregivers were able to recognize memory-loss as an important early feature of AD.

**Conclusion:** The prevalence rate of dementia in Yogyakarta was high and the risk factors were older age, female gender, low education, history of stroke, and unemployment. The knowledge of early symptoms of dementia in the elderly population and the caregivers were extremely poor in this study.

ISSN 2663-8851/Copyright © 2020, Asian Association for Frailty and Sarcopenia and Taiwan Association for Integrated Care. Published by Full Universe Integrated Marketing Limited.

## \*Correspondence

Dr. Yuda Turana

Department of Neurology,  
 School of Medicine and  
 Health Sciences, Atma  
 Jaya Catholic University of  
 Indonesia, Jakarta, Indonesia

E-mail:

yuda.turana@atmajaya.ac.id

Received 7 November 2018

Accepted 1 February 2020

## Keywords

Caregiver, dementia,  
 knowledge, prevalence, risk  
 factors.

## 1. INTRODUCTION

Increasing longevity and declining fertility rate have shifted age distribution in Indonesian population. The proportion of the elderly population was 7.6% in 2010 and is projected to reach 10% by 2020.<sup>1</sup> The total population of the elderly aged 65 years and above in 2015 in Yogyakarta Province was 374,116 people.<sup>2</sup>

Life expectancy continues to increase globally, resulting in the escalation of elderly population.<sup>3,4</sup> Asia, a continent with the biggest population (60%) in the world, is experiencing a very rapid increase of aging population, compared to Western countries.<sup>5</sup>

The prevalence of age-related health problems like dementia will increase as aging process continues.

It has been established that there is an exponential relationship between the incidence of dementia and old age. By combining several studies, the incidence of dementia would double with every 6.3-year increase in age, from 3.9 per 1,000 people at 60-64 years of age to 104.8 per 1,000 people at above 90 years of age.<sup>6</sup>

The prevalence of dementia in Asian countries varies from 2% to 13%, with age, female gender, and low education being the major risk factors.<sup>7,8</sup> The high epidemiology variability in Asian countries may be caused by the diverse diagnostic criteria being used. In addition, differences in the educational level of respondents may also influence the results twice as much.<sup>7-9</sup>

World Alzheimer Report in 2015 also showed that Asia has the highest number of people suffering dementia at 22.9 million, compared to Europe (10.5 million) and America (9.4 million).<sup>9</sup> Data presented by Alzheimer Disease International estimates a further increase of dementia in Asia. For example, in 2015, 1 million Indonesian people are expected to be affected by dementia, and this number will increase to almost 2 million people by 2030, and nearly 4 million people by 2050.<sup>9</sup>

At present, there has not been any reliable data on the prevalence rate of dementia in Indonesia. The province of Yogyakarta is known to harbor the largest elderly population in Indonesia (12%).<sup>10</sup> Our research is the first landmark study in Indonesia that provides evidence and statistics on the prevalence of dementia based on a relatively large sample from this province.

There is a long-standing misconception among family members in Indonesia in regards to dementia. Many family members or the general population perceived memory loss and cognitive impairment as a part of a normal aging process.<sup>11</sup> Research by Luzny J, et al. showed that the average time between patients' memory complaints and their admission to the facility for their first inpatient due to dementia was 7.1 years ( $\pm 3.7$  years). Most patients with dementia did not receive outpatient care before on their memory disorder (56.2%).<sup>12</sup> In a survey conducted by Homma in adults aged >20 years old, 45.6% of the respondents did not consider dementia as a disease, and 46.0% believed that dementia was caused by many factors.<sup>13</sup> This lack of awareness of the dementia symptoms among the caregivers creates a substantial challenge in detecting this debilitating disease. The knowledge of early symptoms of dementia in the elderly and the caregivers are essentials in addition to understand the risk factors. Our research objectives are to investigate the prevalence of dementia, its risk factors and to describe the caregiver's knowledge on the symptoms of AD.

## 2. METHODS

We used a cross-sectional design for this research and collected information from individuals aged  $\geq 60$  years including their caregivers and family members between December 2015 to January 2016. A multi-stage random sampling method was used, and the 2010 population census was our sampling source. The village was explicitly set as the primary sampling unit (PSU). In the initial phase of sampling, we randomly selected 100 villages (PSU) with probability proportional to size (PPS) in all five regencies in Yogyakarta (each regency has an average of 88 villages). For the measurement, we used the total population collected from the 2010 population census, at the village level. After selection, we proceeded with the second phase of selecting households using simple random sampling (SRS). We listed all households in the village samples and randomly selected 20 households by SRS-in which we only selected households with elderly. For each household that was excluded-i.e. households without elderly - another household was chosen randomly as a replacement. In this research, we obtained samples from 1,500 households consisting of 1,976 elderly and 1,415 caregivers. The regional ethical committee approved the research and written informed consent was obtained.

The data collection consisted of socio-demographic characteristics (educational level, employment status, residence and household characteristics), self-reported health and social participation, cognitive assessment and caregiver's knowledge of the ten symptoms of dementia. The covariate was age, sex, dummy urban/rural, education, dummy district/city location of the respondent, and expenditure. Expenditure was assessed based on the average household expenditure each month. Households with expenditure category of <25 percent were included in lower expenditure. Hypertension, stroke, and employed/unemployed status were noted. We checked whether, hypertension, diabetes mellitus (DM), and stroke were self-reported or if the condition was diagnosed by doctor/paramedic/nurse/midwife.

We included subjects aged  $\geq 60$  years old and who were willing to participate. Dementia criteria was based on DSM V criteria that there is a significant evidence of cognitive decrease in one or more cognition domains based on individual complaints or reliable informants in the absence of delirium or mental disorders.<sup>14</sup> We assessed using AD8 to obtain information from reliable informants.<sup>15</sup> Cognitive impairment were screened with MMSE.<sup>16</sup> To confirm impairment in daily activities, we performed Instrumental Activity of Daily Living (IADL) in all subjects.<sup>17</sup>

Caregivers were defined as people  $\geq 18$  years old

who assisted in performing daily activities. If the elderly had no troubles in their daily functions, the caregivers were defined as household members or non-household members  $\geq 18$  years of age who were well-informed of the respondent's psychological condition. The knowledge about the symptoms of AD was assessed using Indonesian version of "ten sign symptoms of AD" questionnaire.<sup>18</sup> For statistical analysis, we used univariate analysis, chi-square and logistic regression for multivariate analysis.

### 3. RESULTS

The mean age of the elderly in this research was  $71.0 \pm 8.3$  years old. The prevalence of dementia in this research was 20.1%. The prevalence rate was higher in specific groups: female (22.0%), Gunung Kidul regency residence (29.4%), not attending school (34.9%), history of stroke (50%), and unemployed (31.8%) (Table 1).

In the analysis (logistic regression), we controlled several socio-economic variables. We separated the sample by gender as both had different characteristics. From the male subjects, we found that there was a strong association between age and dementia even after controlling for other variables. Among the male subjects, individuals aging 80-84 years old and  $\geq 90$  years old were more likely to develop dementia ( $p=0.000$ ). The likelihood was 2-4 times higher in comparison to our reference group (age 60-64 years old). Males with history of stroke were 3.7 times more likely to suffer dementia. Educational level was inversely related to dementia ( $p=0.001$ ). Individuals who completed 8 years of primary school had a lower likelihood of dementia (0.3-0.5 lower than individuals without formal education). We also discovered a variation in the likelihood of dementia across different regencies. The elderly living in Gunung Kidul regency were 2.3 times more likely to suffer from dementia compared to those living in Bantul (i.e. reference regency). After controlling for variables associated with employment status, we still found evidence of the low likelihood of dementia among working male subjects (Table 1).

The multivariate analysis of the female group suggested that risk factors of dementia were different from those in males (Table 1). The likelihood of dementia was significantly higher for females aged  $\geq 65$  years old. Those who completed at least primary school were less likely to be diagnosed with dementia. Residing in Gunung Kidul regency was associated with higher likelihood of dementia. Interestingly, the odd ratio of dementia for females living in Gunung Kidul regency was two times higher than males living in the same area (OR for female=4.8; OR for male=2.3). In contrast to the male subjects, the correlation between income and dementia among females was statistically significant: female subjects

who worked were less likely to acquire dementia. Similar to the male subjects, history of stroke was also a risk for dementia in females ( $p=0.000$ ).

In the caregiver group, the mean age was  $60.3 \pm 16.4$  years old, most of the caregivers were males (50.9%), not attending school (29.7%), and living in urban areas (56.8%). Our results indicate poor knowledge on the early symptoms of dementia among caregivers. Looking at the distribution on knowledge of 10 early symptoms of Alzheimer's Disease (AD), we discovered that only 5.3% of non-dementia elderly acknowledged memory loss as part of dementia and less than 12% caregivers were able to recognize "the ten signs" as a part of the disease both in caregivers group with or without people with dementia (Table 2). We did not find any trend in the relationship between educational level and age with caregiver's knowledge in the symptoms of dementia (Table 3).

### 4. DISCUSSION

World Alzheimer Report estimated in 2015 that 46.8 million people were living with dementia across the globe. The prevalence of dementia in people aged  $\geq 60$  years in North Africa and the Middle East was between 5.75 to 8.67%.<sup>19</sup> Our study in Yogyakarta Province showed a higher prevalence of dementia (20.1%) compared to other countries. In this study, most of the subjects were low-educated and reside in rural areas.

The prevalence of dementia in our study was higher in female subjects. Female's longer lifespan as well as hormonal changes might be one of the contributing factors. The rapid decrease in estrogen level could play an important role.<sup>20</sup> Our multivariate analysis provides strong evidence that female risk factors for dementia were different in many dimensions despite several similarities. Likewise, a Swedish cohort demonstrated a higher incidence of dementia in females than males among all age groups, with the greatest difference seen in those over 90 years old.<sup>21</sup> Older age, low educational level, living in rural/remote areas like Gunung Kidul regency, history of stroke, and unemployment were the risk factors for dementia in both genders. Our findings are consistent with the research by Guerchet, et al. that age, female gender, hypertension, low weight, living alone, and low educational level had significant effects on dementia cases.<sup>22</sup>

Our study objectively demonstrated that the prevalence rate of dementia in rural/remote areas such as Gunung Kidul regency was higher compared to other areas. Differences of dementia prevalence was caused by differences in the topography in each area. Most part of Gunung Kidul regency are rural areas, compared with Bantul and other regencies. Agriculture is the main occupation and there are not many employment opportunities to stimulate

cognitive or working memory. This finding was also supported by Nunes B, et al. by showing that the prevalence of cognitive disorder in rural areas was higher than in urban areas.<sup>23</sup> Different lifestyles, health awareness, and health conditions might contribute to the high prevalence of dementia. Moreover, the urban population is more likely to be educated, and therefore engage in various brain-stimulating activities compared to their rural counterpart. A research by Jelastopulu, et al. revealed a higher percentage of

dementia in low educated people who lived in rural areas compared to similar population living in urban areas.<sup>24</sup> Comparable to our results, Jia J, et al. also stated that a notably higher prevalence of dementia and AD was found in rural areas than in urban ones, and education might be an important reason for the urban-rural differences.<sup>25</sup>

Vascular disease is another risk factor for developing cognitive impairment in several studies.<sup>26-29</sup> Our study

**Table 1.** Prevalence and risk factors of dementia.

Variable	n	Prevalence	OR <sup>1</sup>	p <sup>1</sup>	OR <sup>2</sup>	p <sup>2</sup>	OR <sup>3</sup>	p <sup>3</sup>
<b>Total</b>		<b>20.1</b>						
<b>Age (mean±SD)</b>		<b>71.0±8.3</b>						
60-64 (R)	498	7.0	-	-				
65-69	417	9.4	1.209	0.462	0.886	0.444	2.139	0.074
70-74	405	22.5	2.669	0.000	1.504	0.183	5.797	0.000
75-79	286	21.7	2.300	0.001	0.906	0.791	5.769	0.000
80-84	215	38.6	3.839	0.000	2.121	0.035	7.466	0.000
85-89	101	49.5	6.220	0.000	1.875	0.145	17.098	0.000
90+	54	70.4	12.403	0.000	4.040	0.022	31.800	0.000
<b>Sex</b>								
Male (R)/Female	900/1,076	17.9/22.0	1.297	0.023				
<b>Year of Education</b>								
Not attending school (R)	592	34.6	-	-	-	-	-	-
1-5 years	422	20.6	0.858	0.382	1.074	0.804	0.674	0.127
6-8 years	450	13.1	0.491	0.000	0.463	0.013	0.488	0.013
9-11 years	192	8.3	0.292	0.000	0.405	0.027	0.071	0.001
>11 years	320	9.7	0.319	0.000	0.268	0.001	0.283	0.005
<b>Regency/City</b>								
Bantul (R)	402	20.9	-	-	-	-	-	-
Gunung Kidul	415	29.4	3.341	0.005	2.326	0.030	4.863	0.000
Kulon Progo	411	18.7	1.387	0.440	1.434	0.327	1.566	0.210
Sleman	374	16.8	0.956	0.151	0.608	0.138	1.450	0.209
Yogyakarta City	374	13.9	0.729	0.011	0.552	0.098	0.950	0.882
<b>Expenditure</b>								
1. <25 percent (R)	521	20.4	-	-	-	-	-	-
2. 25-<50 percent	500	19.0	1.025	0.890	0.647	0.123	1.372	0.208
3. 50-<75 percent	508	21.7	1.567	0.016	0.730	0.277	2.536	0.000
4. ≥75 percent	447	17.9	1.548	0.044	0.851	0.624	2.204	0.009
<b>Hypertension</b>								
No hypertension (R)/Hypertension	1,375/601	19.4/22.0	0.890	0.430	0.765	0.281	0.973	0.890
<b>Stroke</b>								
No stroke (R)/Stroke	1,896/80	18.9/50.0	4.898	0.000	3.782	0.001	7.180	0.000
<b>Diabetes</b>								
No Diabetes (R)/Diabetes	1,860/116	20.1/19.8	1.606	0.086	1.702	0.233	1.600	0.196
<b>Work status</b>								
Not work (R)/Work	885/1,091	31.8/10.6	0.301	0.000	0.221	0.000	0.048	0.000
<b>MMSE Score (mean±SD)</b>	1,976	22.0±6.1						
<b>AD8 Score (mean±SD)</b>	1,976	2.8±2.3						
<b>IADL Score (mean±SD)</b>	1,976	4.8±2.0						

<sup>1</sup>Multivariate regression on all subjects; <sup>2</sup>Multivariate regression on male subjects; <sup>3</sup>Multivariate regression on female subjects; R: reference.

revealed that half of the subjects diagnosed with dementia had a history of stroke. Gorelic, et al. stated that about one-third of stroke survivors were found to have significant degree of cognitive impairment within the first months after the incidence.<sup>30</sup> Several studies suggested that stroke might trigger various pathologies including those attributed to subcortical vascular dementia, multi-infarct dementia, and infarct dementia.<sup>31-33</sup>

The risk of dementia increases 6 times at five years after the incidence stroke. Moreover, the risk of dementia increases as early as five years before and continues more than 11 years after a stroke incidence, with the highest risk occurs within one year after the stroke incidence.<sup>34,35</sup> Stroke affects the hippocampus and white matter of the brain, thereby contributing to the pathogenesis of post-stroke cognitive impairment.<sup>36</sup>

In our research, we did not find any significant relationship between hypertension and diabetes mellitus with dementia. This result is similar with other studies showing that the two factors are

still controversial as a risk factor for dementia.<sup>37-40</sup> Diabetes mellitus is not associated with dementia in large clinicopathological study.<sup>39</sup>

In this study, elderlies who were still actively working had a lower risk of dementia compared to those who did not work. Working is considered as social and cognitive activities. Research by Marioni, et al. shows that factors such as increased involvement of social, physical, or intellectual activities are associated with a reduced risk of dementia.<sup>41</sup>

We found that the knowledge of early symptoms of dementia in caregivers in this study was poor. Surprisingly, only less than 12 percent of caregivers could identify memory loss as a symptom of dementia. Similar results with the studies in other countries have revealed the level of knowledge and understanding of dementia is in the general population.<sup>42</sup> Caregivers who have better insights on the early symptoms of dementia contribute in making early diagnosis by seeking medical consultation.<sup>43</sup> They can provide early warning to family members and health workers by observing the early symptoms.

The caregivers' knowledge is also important in the decision making to provide care for the elderlies.<sup>44,45</sup> A study by Chodos et al. showed that caregivers' sufficient knowledge is positively correlated with the level of compliance that supports the quality of care for the elderly.<sup>46</sup> Knowledge and awareness among family members are important to detect the symptoms and seek medical advice.<sup>47</sup>

Werner's research explained

**Table 2.** Elderly and caregiver's knowledge of the symptoms of AD.

10 signs of Alzheimer's Disease	Elderly without AD (n=1,578)	Caregiver for Elderly without AD (n=1,123)	Caregiver for Elderly with AD (n=292)
	%	%	%
1. Memory loss	5.3	9.6	9.9
2. Challenge in planning or solving the problem	4.4	8.6	5.8
3. Difficulty in completing familiar tasks	4.9	5.3	5.1
4. Confusion with time and place	5.4	6.1	5.5
5. Trouble understanding visual images and spatial relationship	10.3	14.9	16.1
6. Problems with words in speaking	5.3	9.3	7.9
7. Misplacing things	3.5	6.1	4.5
8. Decreased or poor judgment	3.9	6.7	3.8
9. Withdrawal from social activities	7.2	13.6	8.9
10. Changes in mood and personality	9.2	15.2	12.7

**Table 3.** Caregiver's knowledge of the symptoms of AD based on age and educational level.

	Age (n=1,415)							Caregiver Educational Level (n=1,415)			
	18-24 n=17 (1.2%)	25-29 n=20 (1.4%)	30-34 n=67 (4.7%)	35-39 n=96 (6.8%)	40-49 n=192 (13.6%)	≥50 n=1,023 (72.3%)	No schooling n=421 (29.7%)	1-5 years n=297 (21%)	6-8 years n=321 (22.7%)	9-11 years n=144 (10.2%)	>11 years n=232 (16.4%)
	%	%	%	%	%	%	%	%	%	%	%
1. Memory loss	17.7	10.0	6.0	12.5	7.8	9.9	11.6	10.4	9.7	6.9	6.9
2. Challenge in planning or solving the problem	0.0	10.0	9.0	7.3	10.4	7.7	9.0	7.7	9.4	9.0	4.3
3. Difficulty in completing familiar tasks	0.0	10.0	4.5	5.2	5.2	5.4	6.2	4.0	6.2	4.9	4.3
4. Confusion with time and place	0.0	10.0	9.0	4.2	8.3	5.6	5.2	5.7	5.6	8.3	6.9
5. Trouble understanding visual images and spatial relation	11.8	15.0	19.4	18.8	14.6	14.7	15.7	15.2	14.6	19.4	12.1
6. Problems with words in speaking	17.7	5.0	14.9	7.3	9.4	8.6	7.8	12.1	9.0	9.7	6.5
7. Misplacing things	0.0	0.0	13.4	6.3	4.7	5.7	5.5	5.4	6.5	7.6	4.7
8. Decreased or poor judgment	5.9	0.0	10.5	7.3	8.9	5.3	5.2	6.7	5.9	7.6	6.0
9. Withdrawal from social activities	23.5	30.0	13.4	14.6	14.1	11.6	14.5	14.1	11.5	11.8	9.5
10. Changes in mood and personality	17.7	25.0	9.0	15.6	18.2	14.1	13.5	15.5	14.6	18.1	13.8

that low educational level of caregivers contributes to their poor knowledge on signs and symptoms of AD.<sup>48</sup> interestingly, our results were slightly different compared with Werner's. We found that even in caregivers who were relatively high-educated and become caregiver for elderly with dementia did not necessarily have better knowledge in recognizing the 10 early signs of AD. The research has also shown that poor knowledge about dementia will increase stress on the caregivers.<sup>49</sup>

Our research showed that caregivers of all age group were more likely to assume that memory loss was a part of normal aging, the result was almost the same with systematic review by Cahill S et al. that knowledge of dementia was found to be poor, particularly in low-income to middle-income countries.<sup>50</sup>

We do acknowledge the limitations of our research. We did not perform physical examination or laboratory tests to exclude other vascular risk factors and the diagnosis of dementia had not been confirmed by doctors.

## 5. CONCLUSION

The prevalence of dementia in this study was high. The common risk factors were older age, low educational level, history of stroke, and unemployment. Elderly and caregiver's knowledge of the 10 early symptoms of AD was poor. Prevalence data and level of knowledge about AD should provide evidence-based information to all parties and should be clear enough to initiate an evaluation in order to increase awareness on symptoms, including early prevention and treatment of AD.

## CONFLICTS OF INTEREST STATEMENT

The authors declare that there is no conflicts of interest regarding the publication of this paper.

## Acknowledgements

This work is supported by the Knowledge Sector Initiative (Grant No. 0213782-G-2016-001) from Departement of Foreign Affairs and Trade (DFAT). We would like to thank to Firman Witoelar for his support throughout the design of this project.

## REFERENCES

1. Central Bureau of Statistics DI Yogyakarta. Population Projection by Age Group and Gender in D.I. Yogyakarta. Accessed on 11 June 2016 available at <http://yogyakarta.bps.go.id/linkTabelStatis/view/id/3>
2. Daerah Istimewa Yogyakarta Population Information. Population Statistic D.I. Yogyakarta: a Number of population productive based on age semester II 2015. (In Bahasa). Accessed on 16 October 2018 available at <http://kependudukan.jogjapro.go.id/>
3. Gulland A. Global life expectancy increases by five years. *BMJ*. 2016;**353**:i2883.
4. World Health Organization. Life expectancy. World Health Organization. Accessed on 8 November 2018 available at [http://www.who.int/gho/mortality\\_burden\\_disease/life\\_tables/situation\\_trends\\_text/en/](http://www.who.int/gho/mortality_burden_disease/life_tables/situation_trends_text/en/)
5. Goh VH. Aging in Asia: A cultural, socio-economical and historical perspective. *Aging Male*. 2005 Jun 1;**8**(2):90-6.
6. Prince M, Wimo AGM, Ali GC, Wu YT, Prina M. World Alzheimer Report 2015: the global impact of Dementia: an analysis of prevalence, incidence, cost and trends. London: Alzheimer's Disease International; 2015.
7. Catindig J-AS, Venketasubramanian N, Ikram MK, Chen C. Epidemiology of dementia in Asia: Insights on prevalence, trends and novel risk factors. *J Neurol Sci*. 2012;**321**(1):11-6.
8. C, Homma A, Mok VCT, Krishnamoorthy E, Alladi S, Meguro K, et al. Alzheimer's disease with cerebrovascular disease: current status in the Asia-Pacific region. *J Intern Med*. 2016;**280**(4):359-74.
9. Prince MJ. World Alzheimer Report 2015: The Global Impact of Dementia. 2015. Accessed on 8 November 2018 available at <https://www.alz.co.uk/research/world-report-2015>
10. Anorital, Muliati S, Khadijah A, Sudrajat AY, Satyawirahardja R, et al. A Research of Elderly Health in Indonesia 2013. Balitbangkes Publishing Institute. 2014.
11. Glueckauf RL, Stine C, Bourgeois M, Pomidor A, Rom P, et al. Alzheimer's rural care Healthline: Linking rural caregivers to cognitive-behavioral intervention for depression. *Rehabilitation Psychology*. 2005;**50**:346-54.
12. Luzny J, Holmerova I, Wija P, Ondrejka I. Dementia Still Diagnosed Too Late-Data from the Czech Republic. *Iran J Public Health*. 2014;**43**(10):1436-43.
13. Homma A. Recognition and attitude towards age-associated. Dementia in the community. *Jpn J Gerontol*. 2001;**23**:340-51.
14. American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders, ed 5. Arlington, American Psychiatric Publishing, 2013.
15. Galvin JE., Roe CM., Coats MA, Moris JC. Patient's rating of cognitive ability: using the AD8, a brief informant interview, as a self-rating tool to detect Dementia. *Archives of Neurology*. 2007;**64**(5):725-730.
16. Turana Y, Handayani YS. Mini-Mental State Examination (MMSE) normative value: based on age and level of education. *Medika*. 2011;**37**(5):307-10. (in Bahasa) see supplementary <https://www.mdpi.com/2075-4418/5/4/615>
17. Lawton, MP, Brody, EM. Assessment of older people: Self-maintaining and instrumental activities of daily living. *Gerontologist*. 1969;**9**(3):179-86.
18. Alzheimer's Indonesia. Ten Sign of Alzheimer's Dementia (In Bahasa). Accessed on 7 August 2019 available at <https://www.alzi.or.id/10-gejala-awal-demensia-alzheimer/>
19. Alzheimer's Disease International. World Alzheimer Report in 2015: The Global Impact of Dementia an Analysis of Prevalence, Incidence, cost and Trends. 2015.
20. Janicki SC, Schupf N. Hormonal Influences on Cognition and Risk for Alzheimer Disease. *Curr Neurol Neurosci Rep*. 2010 Sep;**10**(5):359-66.
21. Fratiglioni L, Viitanen M, von Strauss E, Tontodonati V, Herlitz A, Winblad B. Very old women at highest risk of Dementia and Alzheimer's disease: incidence data from the Kungsholmen Project, Stockholm. *Neurology*. 1997;**48**:132-8.
22. Guerchet M, Mouanga AM, M'belesso P, Tabo A, Bandzouzi B, Paraïso MN, et al. Factors associated with Dementia among elderly people living in two cities in Central Africa: the EDAC multicenter study. *J Alzheimers Dis*. 2012;**29**(1):15-24.

23. Nunes B, Silva RD, Cruz VT, Roriz JM, Pais J, Silvia MC. Prevalence and pattern of cognitive impairment in rural and urban populations from Northern Portugal. *BMC Neurol*. 2010 Jun 11;**10**:42.
24. Jelastopulu E, Giourou E, Argyropoulos K, Kariori E, Moratis E, Mestousi A, et al. Demographic and Clinical Characteristics of Patients with Dementia in Greece. *Advances in Psychiatry*. 2014;**2014**:636151.
25. Jia J, Wang F, Wei C, Zhou A, Jia X, Li F, et al. The prevalence of Dementia in urban and rural areas of China. *Alzheimers Dement*. 2014;**10**(1):1-9.
26. Lopez OL, Jagust WJ, Dulberg C, Becker JT, DeKosky ST, Fitzpatrick A. Risk factors for mild cognitive impairment: in the cardiovascular health study cognition study. *Arch Neurol*. 2003;**60**:1394-99.
27. Tervo S, Kivipelto M, Hänninen T, Vanhanen M, Hallikainen M, Mannermaa A, et al. Incidence and risk factor for mild cognitive impairment: a population-based three years follow up study of cognitively healthy elderly subjects. *Dement Geriatr Cogn Disord*. 2004;**17**:196-203.
28. Gorelick PB., Scuteri A, Black SE, Decarli C, Greenberg SM, Iadecola C, et al. Vascular contributions to cognitive impairment and Dementia: a statement for healthcare professionals from the American heart association/American stroke association. *Stroke*. 2011;**42**(9):2672-713.
29. Milija D. Mijajlović, Aleksandra Pavlović, Michael Brainin, Wolf-Dieter Heiss, Terence J. Quinn, Hege B. Ihle-Hansen, et al. Post-stroke Dementia-a comprehensive review. *BMC Med*. 2017;**15**:11.
30. Gorelick PB, Nyenhuis D. Stroke and Cognitive Decline. *JAMA*. 2015;**7**;**314**(1):29-30.
31. Leys D, Henon H, Mackowiak-Cordoliani MA, Pasquier F. Poststroke Dementia. *Lancet Neurol*. 2005;**4**:752-9.
32. Altieri M, Di Piero V, Pasquini M, Gasparini M, Vanacore N, Vicenzini E, Lenzi GL. Delayed poststroke Dementia: a 4-year follow-up study. *Neurology*. 2004;**62**:2193-7.
33. Llan LM, Rowan EN, Firbank MJ, Thomas AJ, Parry SW, Polvikoski TM, et al. Long-term incidence of Dementia, predictors of mortality and pathological diagnosis in older stroke survivors. *Brain J. Neurol*. 2012;**134**:3716-27.
34. Guo X, Östling S, Kern S, Johansson L, Skoog I. Increased risk for dementia both before and after stroke: A population-based study in women followed over 44 years. *Alzheimer's Dement*. 2018;**14**(10):1253-60.
35. Huang CY, Li YC, Wang HK, Sung PS, Wang LC, Sun YT, et al. Stroke suggests increased risk of dementia. *Curr Alzheimer Res*. 2015;**12**(3):287-95.
36. Sun JH, Tan L, Yu JT. Post-stroke cognitive impairment: epidemiology, mechanisms and management. *Ann Transl Med*. 2014;**2**(8).
37. Qiu B, Winblad QB, Fratiglioni L. The age-dependent relation of blood pressure to cognitive function and Dementia. *Lancet Neurology*. 2005;**4**(8):487-99.
38. Igase M, Kohara K, Miki T. The Association between Hypertension and Dementia in the Elderly. *Int J Hypertens*. 2012;**2012**:320648.
39. Matioli S, Suemoto CK, Rodriguez RD, Farias DS, Silva M, Leite P, et al. Association between diabetes and causes of Dementia: Evidence from a clinicopathological study. *Dement Neuropsychol*. 2017;**11**(4):406-12.
40. Ninomiya T, Ohara T, Hirakawa Y, Yoshida D, Doi Y, Hata J, Kanba S, Iwaki T, Kiyohara Y. Midlife and late-life blood pressure and Dementia in Japanese elderly: the Hisayama study. *Hypertension*. 2011;**58**(1):22-8.
41. Marioni RE, Lima CP, Amieva H, Brayne C, Matthews FE, Dartigues JF, Gadda HJ. Social activity, cognitive decline and Dementia risk: a 20-year prospective cohort study. *BMC Public Health*. 2015;**15**:1089.
42. WHO (2012) Dementia: A Public Health Priority. World Health Organization, Geneva.
43. Garvey G, Simmonds D, Clements V, O'Rourke P, Sullivan K, Gorman D, et al. Making Sense of Dementia: Understanding amongst Indigenous Australians. *International Journal of Geriatric Psychiatry*. 2011;**26**:649-56.
44. Robinson A, Eccleston C, Annear M, Elliott KE, Andrews S, Stirling C, et al. Who knows, who cares? Dementia knowledge among nurses, care workers, and family members of people living with Dementia. *J Palliat Care*. 2014 ;**30**(3):158-65.
45. Adamson J. Awareness and Understanding of Dementia in African/Caribbean and South Asian Families. *Health Soc Care Community*. 2001;**9**:391-6.
46. Chodosh J, Mittman BS, Connor KI, Vassar SD, Lee ML, DeMonte RW, et al. Caring for patients with Dementia: how good is the quality of care? Results from three health systems. *J Am Geriatr Soc*. 2007;**55**(8):1260-8.
47. Khonje V, Milligan C, Yako Y, Mabelane M, Borochoowitz KE, de Jager CA. Knowledge, Attitudes and Beliefs about Dementia in an Urban Xhosa-speaking Community in South Africa. *Advances in Alzheimer's Disease*. 2015;**4**(2):21-36.
48. Werner P. Correlates of family caregivers' knowledge about Alzheimer's disease. *Int J Geriatr Psychiatry*. 2001;**16**(1):32-8.
49. Sörensen S, Conwell Y. Issues in Dementia Caregiving: Effects on Mental and Physical Health, Intervention Strategies, and Research Need Am J Geriatr Psychiatry. 2011;**19**(6):491-6.
50. Cahill S, Pierce M, Werner P, Darley A, Bobersky A. A systematic review of the public's knowledge and understanding of Alzheimer's disease and Dementia. *Alzheimer Dis Assoc Disord*. 2015;**29**(3):255-7.