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Modifiable risk factors for dementia in Indonesia: Results from STRiDE project

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Abstract

Background & Objective: Indonesia's ageing population and increasing number of people living with dementia poses significant challenge to the health system. Better understanding of factors related to dementia prevalence is needed to mitigate risk, improve care, and ultimately reduce the incidence of dementia. In this study, we aimed to describe associations between potential risk factors and dementia in Indonesia. *Methods:* A cross-sectional study, part of the Strengthening Responses to Dementia in Developing Countries (STRiDE) project, was conducted in two provinces in Indonesia, Jakarta and North Sumatra between September and December 2021. A total of 2,110 older adults and their informants completed questionnaires covering cognitive and functional status, socioeconomic, medical and lifestyle factors. Models for each potential modifiable risk factor were created and then adjusted by age, sex and literacy. Prevalence ratios (PRs) were calculated for each risk factor. *Results:* In the adjusted models, lower education, lower occupational attainment, unmanaged diabetes, stroke, head trauma within the past 5 years, hearing loss, and chronic obstructive airway disease were all associated with higher prevalence of dementia in Indonesia. Current smoking, historic depression and high blood pressure were associated with higher dementia prevalence, but not statistically significant.
Conclusion: Improving socioeconomic status (i.e., education and employment) and reducing health-related risk factors may be viable solutions to reduce the high prevalence rates of dementia in Indonesia. Further longitudinal research is needed to confirm direction of effect and causality.

Keywords: Dementia, Indonesia, Jakarta, North Sumatra, risk factor, modifiable.

INTRODUCTION

The global population is experiencing rapid growth of older adults. There were 703 million people aged 65 years or over in 2019 and this number is projected to reach 1.5 billion in 2050.[1] This growth will be mainly driven by low- and middle-income countries such as Indonesia. One of the implications of an aging population is the increase in people living with dementia and other age-related illnesses. Globally there are currently about 50 million people with dementia, and the number is expected to triple by 2050.[2] Recent modelling has estimated that there may be 768,000 (95% UI 656,000 to 895,000) people with dementia in Indonesia.[3] However, this figure does not reflect intriguing evidence that dementia prevalence could be much higher in Indonesia than other international estimates.[4-6]

The increase in the number of people with dementia will have significant health and social impacts which need to be anticipated at an individual, community and a population level. In the absence of a cure for dementia, it is important to identify potentially modifiable risk factors so that effective public health messages and strategies can be developed. Current evidence suggests that about 40% of dementia might be prevented by controlling risk factors throughout life.[7] The life-course approach to achieve optimum health has been implemented by the Ministry of Health in Indonesia by providing health initiatives which are maintained through an integrative care system from conception to old age.[8-10]

Global findings on potentially modifiable risk

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factors for dementia may not necessarily match those in Indonesia, which has unique and diverse demographic and socioeconomic characteristics. For example, although indicators of overall health status in Indonesia have improved significantly over the last three decades, risk factors for noncommunicable diseases (NCDs), such as high blood pressure, high cholesterol, obesity and smoking, are increasing. This increasingly complex epidemiological pattern is a real challenge for the health system in Indonesia.[11,12] To date, data about risk factors for dementia in Indonesia have come from several regional-scale studies. These studies use different methodologies and settings (urban vs rural; hospital vs population, etc).[5,6]

Better understanding about modifiable risk factors for dementia in Indonesia is needed so prevention programs can be designed that would fit the local context. In addition, since there is an intersection between risk factors for dementia and other NCDs, previously established prevention programs for NCDs in Indonesia, such as *CERDIK* from Ministry of Health may also be strengthened and extended as a primary prevention strategy for dementia.[13] *CERDIK* includes *Cek kesehatan rut*in (Routine health examination), *Enyahkan asap rokok* (Eliminate cigarette smoke), *Rajin aktivitas fisik* (Regular physical activity), *Diet seimbang* (Balanced diet), *Istirahat cukup* (Adequate rest), *Kelola stres* (Stress management). To further enhance this prevention program, localized evidence regarding risk factors for dementia is needed.

The aim of this study is to identify associations between potentially modifiable risk factors and prevalence of dementia in Indonesia.

METHODS

Study design and participants

This was a cross-sectional study, as part of STRiDE project, conducted in two provinces in Indonesia, Jakarta and North Sumatra from September and December 2021. The details of STRiDE project can be found elsewhere.[14] We randomly selected districts and subdistricts within each province to list eligible participants and then randomly selected older adults from the list. We included participants aged 65 years or older, able to speak Bahasa Indonesia and with an informant that could provide information about the older adult. We excluded participants that lived in care or nursing homes.

Measures

Dementia ascertainment

Diagnosis of dementia was based on an algorithm—the 10/66 short schedule[15] which was developed to be used in epidemiological studies of dementia in low-income and middle-income settings and has been used in previous studies with good diagnostic accuracy.[16-18] The 10/66 short schedule consists of the Community Screening Instrument for Dementia (CSI-D) instrument[19], the 10-word list learning task with delayed recall from the Consortium to Establish a Registry for Alzheimer's Disease (CERAD)[20] and the EURO-D, a self-report measure of depressive symptoms.[21] The algorithm therefore considers cognitive and function impairment, whilst also factoring depression as a comorbidity. Within Indonesia, the algorithm has demonstrated good concurrent validity against measures of cognition, functional impairment and dementia screening tools.[14]

Modifiable risk factors

1) Questions from the 10/66 toolkit[22] pertaining to health, included history of depression, stroke, high blood pressure, head trauma, hearing loss, diabetes, heart trouble (e.g., heart attack, angina, heart failure, valve disease), tuberculosis (TB), and chronic obstructive airway disease (COAD).
2) Socioeconomic factors: We included level of education, highest occupational attainment and living environment (urban/suburban/rural). Highest occupational attainment was broadly grouping into skill level based on the International Labour Organization. (High skill level – managers, professionals and technicians; Medium skill level – clerical service and sales workers, skilled agricultural and trade workers, plant and machine operators, and assemblers; Low skill level – Elementary occupations).[23] There were other categories for participants who did not align with the occupations provided ("Other", anecdotally this includes homemakers) or those that never worked.
3) Smoking status was measured by a single item about current or historic use tobacco or nicotine products, aligning with the item within the Australian National University – Alzheimer's Disease Risk Index – Short form.[24]

All of the instruments used were available in Bahasa Indonesia and were translated and cross-culturally adapted.[25,26]

Procedure

The interviews of the older adult and their informant were completed by a pair of interviewers who visited them in their house at a time that was convenient for both. The interviewers were recruited with criteria of: having a minimum 12 years of education, preferably with health background of education, in good health, good verbal communication skills, and ability to work in a team. They then were given a formal training on the general standard operating procedure, the tool administration, selecting participants, informed consent and data management. Data collection was completed with a strict health protocol considering it was completed during the COVID-19 pandemic. All participants provided informed consent before the interview and completed a standardized set of questionnaires, spanning cognition, health, wellbeing and lifestyle. The data were entered directly into REDCap using its mobile app.[27,28]

Ethical approval was obtained from The Medical Ethics Committee of Atma Jaya Catholic University of Indonesia (01/12/KEP-FKIKUAJ/2020) and Faculty of Medicine Universitas Sumatera Utara number 862/KEP/USU/2020.

Data analysis

Descriptive data were reported for risk factors (frequency, percentage) by dementia (based on the 10/66 short algorithm). We created models for each independent variable. Models were not created for variables in which the direction of effect was ambiguous. For example, current physical activity habits whilst captured is likely to be influenced by cognitive impairment, rather than the other way round.[29] Prevalence ratios (PRs) were calculated for each risk factor, reported with robust errors (Wald 95% Confidence Intervals). Each model was then adjusted by age, sex and literacy to control for potentially confounding effects.

RESULTS

Participant characteristics

We recruited 2216 participants and there were 2,110 older adults in whom the final diagnostic algorithm could be applied. The details of the recruitment strategy and procedures can be

Table 1: Participants characteristics

Characteristics	All participants (n=2,110)	
	n	%
Age, mean ± SD	71.7 ± 5.43	
Age groups		
65-69 years	1,017	48.2
70-74 years	612	29.0
75-79 years	292	13.8
80-84 years	137	6.5
85-89 years	40	1.9
90 years and older	12	0.6
Sex		
Male	853	40.4
Female	1,257	59.6
Site		
Jakarta	1,063	50.4
North Sumatra	1,047	49.6
Education		
None	310	14.7
Some (did not complete primary)	476	22.6
Primary	622	29.5
Secondary	299	14.2
Tertiary	372	17.6
Missing	31	1.4

found elsewhere.[14] The characteristics of study participants are shown in Table 1. Most were female (59.6%), aged between 65-69 years (48.2%), and had primary level of education (29.5%). Using the 10/66 short diagnostic algorithm, there were 562 participants (26.6%) identified to have dementia. There was some indication that socioeconomic factors were associated with dementia. Lower educational attainment was associated with increased dementia compared to those with tertiary level education ($p<0.05$). Whilst participants who worked in lower skilled professions, including those who had never worked, was associated with dementia compared to higher skill occupations ($p<0.05$). Rurality was not associated with increased prevalence of dementia. All associations were robust after controlling for age, sex and literacy.

There were a number of health factors that were associated with higher prevalence of dementia after adjusting for age, sex and literacy. These factors included unmanaged diabetes (i.e., untreated diabetes), stroke, head trauma within the past 5 years, hearing loss, chronic obstructive airway disease (COAD) and smoking habit ($p<0.05$). In the unadjusted models, current smokers, people with high blood pressure ($p=0.06$) and people with historic depression were associated with higher dementia prevalence, but these associations did not remain significant following adjustment. Heart trouble and TB were not found to be associated with dementia in both unadjusted and adjusted models ($p>0.05$).

The crude PRs and adjusted PRs for each risk factor are shown in Table 2.

DISCUSSION

In this study we sought to understand the risk factors of dementia in Indonesia, using a random sample of older adults from two provinces. This study found potentially modifiable risk factors for dementia in Indonesia, including socioeconomic factors (low education attainment and occupation status), and health-related factors (stroke, high blood pressure, head trauma within the past five years, hearing loss, and COAD). Many of the risk factors identified in this study are similar to those found globally[7] and in different regions in Indonesia.[5,6,30]

Socioeconomically, our findings reveal that lower educational attainment and lower-skilled occupation were associated with an increased risk of dementia. The association between low education level with increased risk of dementia has been a consistent finding across multiple previous studies in Indonesia[5,31] and globally.[7,32] In the present sample, 17.6% had tertiary education, which is in line with estimates of adult (24-64-year-old) tertiary education rates in Indonesia (16%).[33] Such education levels are well below the G20 average (38%), potentially highlighting that promoting higher education could be an important strategy to reduce the risk of dementia in Indonesia. Participants with "lower" skilled occupations (including, those who never worked or "other" occupations) had a higher prevalence compared to those with higher skilled jobs. These findings reflect previous research in Indonesia in which no occupation was significantly associated with an increased risk of dementia compared to those with professional occupations (OR= 2.18, 95% CI = 1.04–4.61).[5] Both education and occupational attainment represent life experiences that may contribute to cognitive reserve[34], which compensates the clinical manifestation of dementia by utilizing compensatory and alternative cognitive strategies.[35] Disentangling education and occupational status can be difficult, but we should recognize that higher occupational complexity does not appear to compensate for a lack of educational attainment.[36]

Our study found health-related risk factors for dementia, including stroke, head trauma, diabetes (within the past 5 years), hearing loss, and COAD. These findings are consistent with a global report on dementia risk factors.[7] Many of these findings have been reported before in a smaller (n=345), hospital-based case-control study in Jakarta which reported that depression, hearing loss, history of smoking, hypertension and diabetes mellitus were associated with dementia and particularly the vascular dementia subtype.[30] Our findings that unmanaged diabetes, but not managed diabetes were associated with dementia prevalence, highlights some risk factors could potentially be mitigated through treatment. Similar observations can be observed with smoking habits. Current smoking was associated with dementia compared to those who never smoked, whilst the same association was not reported for those who are former smokers. Comparable to our results, a meta-analysis found an increased risk of dementia in current smokers (RR 1.30 95% CI 1.18-1.45) while former smokers did not show a higher risk of dementia (RR 1.01 95%CI 0.96-1.06).[37] It should be noted that we did not observe this effect following model adjustment.

Within our adjusted models, there were several notable differences from past literature. High blood pressure was not significantly associated

Table 2: Prevalence ratios (Wald adjusted Confidence Intervals) for dementia ascertained by the 10/66 short diagnostic algorithm (n=2,110). Prevalence ratios are reported unadjusted and adjusted for age, sex and literacy

Demographic		Missing		Incident dementia status		Unadjusted	Adjusted for age,
				No dementia	Dementia	PR (95% CIs)	sex and literacy. PR (95% CIs)
Socioeconomic status	Education attainment	31	Tertiary	331 (21.7%)	41 (7.4%)	Reference	
			Secondary	246 (16.1%)	53 (9.6%)	**1.61 (1.10 to 2.35)**	**1.55 (1.07 to 2.25)**
			Primary	449 (29.4%)	173 (31.3%)	**2.52 (1.84 to 3.46)**	**2.26 (1.66 to 3.08)**
			Some	329 (21.6%)	147 (26.6%)	**2.80 (2.04 to 3.86)**	**2.24 (1.62 to 3.08)**
			None	171 (11.2%)	139 (25.1%)	**4.07 (2.97 to 5.57)**	**2.12 (1.48 to 3.03)**
	Highest Occupation level (Based on skill)	93	High skill	151 (10.1%)	18 (3.4%)	Reference	
			Medium skill	173 (11.6%)	56 (10.6%)	**2.30 (1.40 to 3.76)**	**2.42 (1.50 to 3.89)**
			Low skill	615 (41.3%)	206 (38.9%)	**2.36 (1.50 to 3.70)**	**2.32 (1.50 to 3.59)**
			Other	213 (14.3%)	104 (19.7%)	**3.08 (1.94 to 4.90)**	**3.06 (1.96 to 4.78)**
			Never worked	336 (22.6%)	145 (27.4%)	**2.83 (1.79 to 4.47)**	**2.13 (1.36 to 3.33)**
Living environment	Area of living	32	Urban	1255 (82.2%)	444 (80.4%)	Reference	
			Suburban	71 (4.7%)	27 (4.9%)	1.05 (0.76 to 1.47)	0.88 (0.66 to 1.18)
			Rural	200 (13.1%)	81 (14.7%)	1.10 (0.90 to 1.35)	0.96 (0.79 to 1.17)
Health/ medical history	Historical Depression	35	No	1416 (93.0%)	500 (90.4%)	Reference	
			Yes	106 (7.0%)	53 (9.6%)	**1.28 (1.01 to 1.61)**	1.23 (0.99 to 1.54)
	Diabetes	30	No	1327 (87.0%)	491 (88.6%)	Reference	
			Yes - Unmanaged	10 (0.7%)	12 (2.2%)	**2.02 (1.37 to 2.98)**	**2.18 (1.50 to 3.18)**
			Yes - Managed	189 (12.2%)	51 (9.1%)	0.79 (0.61 to 1.02)	0.93 (0.72 to 1.19)
	Stroke	36	No	1460 (96.0%)	509 (92.0%)	Reference	
			Yes	61 (4.0%)	44 (8.0%)	**1.62 (1.28 to 2.06)**	**1.77 (1.38 to 2.27)**
	Heart trouble (general)	71	No	1403 (89.8%)	424 (88.9%)	Reference	
			Yes	159 (10.2%)	53 (11.1%)	1.07 (0.85 to 1.35)	1.13 (0.91 to 1.40)
	High Blood Pressure	46	No	890 (56.3%)	245 (50.6%)	Reference	
			Yes	690 (43.7%)	239 (49.4%)	**1.16 (1.00 to 1.34)**	1.14 (1.00 to 1.31)

Head trauma	35	No	1490 (97.9%)	536 (96.9%)	Reference	
		Within the past 5 years	13 (0.9%)	12 (2.2%)	**1.81 (1.20 to 2.75)**	**1.86 (1.26 to 2.76)**
		More than 5 years	19 (1.2%)	5 (0.9%)	0.79 (0.36 to 1.72)	0.70 (0.25 to 1.97)
Hearing loss	17	No	1263 (82.3%)	394 (70.5%)	Reference	
		Yes	271 (17.7%)	165 (29.5%)	**1.59 (1.37 to 1.85)**	**1.38 (1.19 to 1.61)**
TB	28	No	1545 (97.2%)	467 (96.1%)	Reference	
		Within past 5 years	22 (1.4%)	12 (2.5%)	1.33 (0.84 to 2.11)	1.44 (0.95 to 2.19)
		More than 5 years	23 (1.4%)	7 (1.4%)	0.84 (0.46 to 1.69)	1.04 (0.52 to 2.05)
COAD	53	No	1428 (93.6%)	488 (89.4%)	Reference	
		Yes	83 (5.5%)	54 (10.6%)	**1.62 (1.31 to 2.00)**	**1.79 (1.46 to 2.21)**
Lifestyle factors	44	Smoking habit	No never	973 (64.2%)	404 (73.3%)	Reference
			Ex-smoker	274 (18.1%)	73 (13.2%)	0.97 (0.73 to 1.30)	0.95 (0.72 to 1.25)
			Yes	268 (17.7%)	74 (13.4%)	**1.36 (1.09 to 1.69)**	1.07 (0.82 to 1.39)

COAD = chronic obstructive airway disease, TB = tuberculosis.

with dementia following adjustment. However, this could be because we are unable to report on hypertension chronicity, which might be the more pertinent factor.[38] It is potentially for this reason why midlife hypertension has been a consistent finding across multiple cross-sectional and longitudinal observational studies.[31,39,40] Irrespective, there is evidence that treating hypertension may be beneficial. A recent meta-analysis that included 12 trials with more than 90,000 participants found that blood pressure lowering treatment with antihypertensive agents, compared with control, was significantly associated with decreasing the incidence of dementia or cognitive impairment over a mean follow up of 4.1 years.[41] The current study also did not find an association between historic depression and head trauma in adjusted models, which also deviates from previous literature. Depression has also been suggested as prodromal phase of dementia, as a consequence of cognitive deficit and also as part of dementia symptoms.[41-44] Therefore, the link between depression and dementia might be bidirectional, thus making a lack of association unexpected. To minimize reverse causality, we asked participants about depressive symptoms that existed prior to the past year, rather than assessing current symptoms. Difficulties in interpreting cross-sectional data in terms of risk, can also be observed within the head trauma data. Head trauma within the past 5 years was associated with dementia but the same association was not reported in more historic head trauma. We could interpret such findings by positing that people with dementia or prodromal dementia are at greater risk of falls. However, our findings did not account for the severity and reoccurrence of head trauma which may be pertinent to risk of dementia.[45-46]

The limitations of this study were: first, dementia within the study is based on the 10/66 short diagnostic algorithm. Whilst this algorithm has demonstrated good diagnostic accuracy, there have been instances of elevated prevalence rates that have been yet to be fully explored.[47] The algorithm may detect the earliest signs of dementia, may arguably not be appropriate in some cultures, or may have some education bias. Within the present study the tools underwent rigorous cross-cultural adaptation and adjusted for literacy within the models, thus minimizing these issues. Second, as highlighted above, the cross-sectional design means that ascertaining the direction of effect can be problematic. Third, the sample size of subgroups introduces increased uncertainty within PRs, as highlighted by wider confidence

intervals. As such, replication of analysis with a larger sample size is needed. Fourth, although we controlled for several confounding factors, we need to be vigilant that other factors might moderate associations reported here. For example, within our models we do not consider the effect of multimorbidity (i.e., the presence of multiple health conditions), which is associated with an increased risk of dementia.[48] Finally, we have a heterogeneity in terms of how risk factors are captured. In some instances, questions ask about receiving a diagnosis or seeing a doctor about a health condition, whereas others capture health conditions in terms of symptoms. The latter might be more culturally appropriate and more accurate within the Indonesian context, particularly if accessing healthcare is limited. However, it should be recognized that such symptom-based reporting may introduce its own bias.

In conclusion, this is the first observational study to explore a wide range of modifiable risk factors for dementia in Indonesia in a representative sample from urban and rural settings. Our findings demonstrate a range of modifiable risk factors associated with dementia in Indonesia, many aligning within global literature. Although the cross-sectional nature of the study limits our interpretation on causality and directions of effect, our research indicates that we should be trying to address these risk factors at an individual, society and population level. Improving cognitive reserve and managing health factors such as diabetes appear would appear to be key strategies. Creating a primary prevention strategy by promoting healthy lifestyle can be incorporated in other previously well-established prevention programs that are being implemented.

DISCLOSURE

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