JOURNAL OF PUBLIC HEALTH FOR TROPICAL AND COASTAL REGION (JPHTCR)
Journal homepage: http:/ejournal2.undip.ac.id/index.php/jphtr/index
ISSN : 2597-438

Risk Factors Associated with Disability among Elderly with Stroke in Indonesia: A Secondary Data Analysis of 2018 National Basic Health Research

Anisa Dwi Lutfi Yanti[1*], Yunita Dyah Puspita Santik[1]
[1]Public Health Department, Faculty of Sports Science, Semarang State University, Indonesia
*Corresponding Author E-mail: anisadwily@students.unnes.ac.id

Abstract
Introduction: According to the 2018 Basic Health Research (Riskesdas), the highest prevalence of stroke occurs among the elderly group. On the other hand, the proportion of disability among the elderly with stroke was highest compared to the elderly with another disease. Disabled elderly resulted in a high burden of care. This study aimed to analyze the risk factors associated with disability among the elderly with stroke in Indonesia.
Methods: This cross-sectional study uses secondary data from Riskesdas 2018. The sample was all elderly aged ≥60 years in Indonesia that participated in the Riskesdas 2018 who diagnosed with stroke by a doctor and met the inclusion criteria (2439 samples). This study employed chi-square and logistic regression.
Results: The risk factors associated with disability among the elderly with stroke were older age, having a low education level, living in a rural area, not being obese, having a mental emotional disorder, having no smoking history, and less physical activity. Multivariate analysis showed that less physical activity (PR=18.097; 95%CI=7.306-44.825), low level of education (PR=3.555; 95%CI=1.616-7.823), mental emotional disorders (PR=1.942; 95%CI=1.262-2.988) were the risk factors of disability among elderly with stroke. Being obese (PR= 0.578; 95%CI=0.345-0.970), having a joint disease (PR=0.546; 95%CI=0.311-0.958), and having a smoking history (PR=0.461; 95%CI=0.280-0.759) were the protective factors of disability among elderly with stroke.

Conclusion: Physical rehabilitation and mental-emotional disorder treatment have important roles in preventing disability among the elderly with stroke

Keywords: Disability, Activities of Daily Living, Stroke, Risk Factors

Article History: Received: 29th August 2022, revised: 30th September 2022, accepted: 28th December 2022

Introduction

Stroke remains the second leading cause of death (11.6% of total deaths) and the third leading cause of early death and disability combined (5.7% of total Disability-Adjusted Life Years (DALYs)) globally in 2019. From 1990 to 2019, the absolute number of incident strokes increased by 70%, deaths from stroke increased by 43%, and DALY stroke increased by 32%.[1] About

70% of strokes, 87% of deaths and disabilities due to strokes occur in low and middle income countries. Over the last four decades, the incidence of stroke in low and middle income countries increased to more than doubled.[1,2]

Stroke is the number one cause of death and disability in Indonesia.[3] Stroke causes of the high mortality, disability, and economic consequences for post-stroke care.[3,4] According to National Health Insurance (JKN) data in 2018, stroke was the third largest health care cost (2.56 trillion rupiah)[2] and of course it becomes an economic burden for the productive age group to caring the elderly stroke sufferers with disability. Elderly with disabilities certainly need a caregiver or personal nurse for the rest of their life who helps the elderly to carry out their daily activities.[5] Caring for elderly people with strokes and disabilities is not an easy thing because of the burdens felt by families including physical, psychological and financial burdens.[5,6]

The 2013-2018 Basic Health Research (Riskesdas) data shows that the prevalence of stroke at nationally has increased (7%-10.9%).[7,8] Importantly, the highest prevalence of stroke occurs among the elderly group.[8] The proportion of disability in the elderly aged ≥ 60 years based on the disease suffered shows that stroke patients have a higher proportion of disability in all classifications of disability levels compared to people with other diseases, namely heart disease, diabetes, rheumatism, and injuries.[9] The proportion of the incidence of disability in the elderly aged ≥ 60 years with stroke consists of total dependency disability of 13.95%, severe dependence disability of 9.4%, moderate dependence disability of 7.1%, mild dependence disability of 33.3%, independent by 36.3%.[9] The occurrence of disability in the elderly is due to functional capacity that decreases with age.[10] In addition, if the decreases of functional capacity is accompanied by a stroke, the elderly will have more at risk of disability.[11]

A study on stroke from a public health perspective in 2018, suggested that stroke causing high burden of morbidity, up to 50% of stroke patients have chronic disability.[4] As many as 50% of stroke patients have hemiplegia and hemiparesis, fatigue, and instability of posture and balance which causes difficulty in walking and performing daily activities. Six months after stroke, the disorder may persist and result in long-term disability.[12]

The World Health Organization's International Classification of Functioning, Disability, and Health mentions that the effects of the stroke matter in the "body structure and function dimension" and in the "activity and participation dimension". Effects of body structure and function (known as "impairments"), such as hemiplegia, spasticity, and aphasia, are the major neurological disorders caused by stroke. Activity limitations (also referred to as "disabilities") are manifested by reduced ability to carry out daily activities, such as dressing, bathing, or walking. The magnitude of the level of disability is generally influenced by the severity of the stroke but not completely.[13] Other factors that affect the disability based on several previous studies[14,15,11,16,17] are intrinsic motivation and mood, adaptability and coping, severity and type of medical comorbidities, medical stability, intensity and type of rehabilitation training, low social support, neuropsychiatry factors (depression and cognitive impairment), sociodemographics (older age and lower level of education), and poor stroke management (history of previous and recurrent strokes, complications, and onset >3 hours).

With Riskesdas 2018 data showing the highest prevalence of stroke occurs among the elderly group, the proportion of disability among elderly who suffer stroke was highest compared to sufferers of other non-communicable diseases, and then the disable elderly make a burden of care for the productive age group, it is necessary to conduct research that analysis and describes the risk factors associated with the disability among elderly with stroke in Indonesia. Knowledge of risk factors of disability will increases the alertness and

awareness of medical personnel to conduct real efforts to reduce the number of post-stroke disabilities.

Methods

Riskesdas is one of the community-based national-scale health research conducted every five years by the Health Research and Development Department (Balitbangkes), Ministry of Health of the Republic of Indonesia. The process of collecting health-specific data on Riskesdas is carried out by data collectors with an educational background of at least a Diploma in Health. The data that has been collected by the surveyors will be checked for the integrity and correctness of the data by regional level technicians. Then the data will digitized and sent to the Balitbangkes data management section. This cross-sectional study uses secondary data from Riskesdas 2018. The data in this study is the result of submitting a data request to Balitbangkes and then the data is obtained by researchers in an electronic file format.

The population in this study were all Indonesian population aged ≥ 60 years, having been diagnosed with stroke by a doctor, and participated in the Riskesdas 2018. The sample in this study were all the population that met the inclusion criteria. Inclusion criteria in this study were population who filling out the 2018 Riskesdas questionnaire (both household and individual questionnaires), having complete data on disability/physical disability questionnaire, age, gender, marital status, education level, domicile, hypertension status, diabetes status, heart disease status, joint disease status, chronic kidney failure disease status, obesity status (data on height and weight), intensity of control in stroke sufferers, depression, emotional mental disorders, smoking, drinking consumption alcohol, and physical activity.

The researcher obtained 4162 subjects data of elderly people with strokes at the individual level. Before being analyzed, the data needs to process of cleaning, category editing, coding, and processing. The data cleaning process aims to ensure that all subjects meet the inclusion criteria and exclude subjects who are missing in one of the variables. It is known that 1723 subjects have incomplete data and the final data amount is 2439 subject samples.

The dependent variable in this study was disability status of stroke patients, divided into two: subjects with disabilities and subjects without disabilities. Disability status is described as a condition that indicates that elderly stroke survivors are dependent on daily activities as measured by the Barthel Index of Activities of Daily Living (ADL). Subjects are called having a disability if they have a Barthel Index score < 20. Subjects without disabilities were subjects with a Barthel Index score = 20 (independent on daily activities, without ADL dependence).

The assessment of disability status in the elderly uses the Barthel Index because it can measure the functional independence of the elderly in carrying out ten basic daily activities including defecation control, urination control, self-care ability or grooming, use of the toilet, dressing, eating and drinking, moving from chair to bed and vice versa, mobility on flat ground, up and down stairs, and bhating. In addition, the Barthel Index also has the function of assessing the progress of respondents with chronic diseases before and after therapy and determining how much care assistance is needed for elderly aged ≥60 years.[9]

The independent variables in this study were age, sex, marital status, education level, place of residence, hypertension, diabetes, heart disease, joint disease, chronic kidney failure disease, obesity status, intensity of re-control, depression status, emotional mental disorder status, history of smoking, history of consumption of alcoholic beverages, and physical activity.

Age is categorized into two groups, the age of 60-71 years and ≥72 years. The marital status is categorized into two groups, namely not having partner and having partner. The category of not having a partner includes not yet married and divorced. The education level variable is categorized into

two groups, namely low and high. The low category includes never/never attended school; did not finish elementary school; graduated from elementary school; finished junior high school. The high category includes graduating from senior high school; graduating from diploma; graduating from university. Place of residence is categorized into two groups, urban and rural.

The variables of hypertension, diabetes, heart disease, joint disease, chronic kidney failure were determined based on whether or not the subject had been diagnosed with the disease by a doctor. Specifically, chronic kidney failure disease status is described as a history of the respondent being diagnosed by a doctor, suffering from chronic kidney failure (minimum kidney pain for 3 consecutive months). The obesity variable was measured using the BMI value and to be obese if the BMI $\geq$ 25 [18]. Variables The intensity of control of stroke patients to health care facilities is divided into two: sometimes or never, and routine. Depression status was measured using the Mini International Neuropsychiatric Interview.[19,8] Mental emotional disorder status was measured using the Self Reporting Questionnaire (SRQ) which consisted of 20 criteria for emotional mental disorders, if the respondent answered "Yes" to at least six questions so it was categorized as having an emotional mental disorder.[8] The physical activity variable is the habit of doing heavy and or moderate physical activity in a week, which is carried out continuously for at least 10 minutes each time do it.

After process of cleaning data, data will be categorized and coded per each variable based on the Riskesdas questionnaire. Then, data will be analysis use a data processing application. The data analysis process included univariate analysis, bivariate analysis using the chi-square test, and multivariate analysis using the logistic regression test. Univariate analysis was used to see the characteristics and frequency distribution of variables. Bivariate analysis used chi-square to determine the relationship between the independent variable and the dependent variable, and then logistic regression to determine the effect of several independent variables simultaneously on the dependent variable.

Results

Table 1 shows the basic characteristics of the remaining 2439 subjects. The incidence of disability was 3.9% (95/2439). The subjects were predominantly male, had a partner (husband/wife alive, had low education, and lived in urban areas. Most of the subjects had hypertension, had no diabetes, had no heart disease, had no joint disease, had no chronic kidney disease, and had no obesity. A total of 56.3% subjects were sometimes or never follow-up the stroke to health services. Most of the subjects had depression and had no emotional mental disorders. Most of the subjects had no history of smoking, had no alcohol consumption, and had sufficient physical activity habits.

Table 1. Distribution of characteristics and clinical features of the subjects

	Total	Persentase (%)
Incidence of Disability in Elderly Stroke Patients		
Yes	95	3.9
No	2344	96.1
Total	2439	100
Age		
$\geq$72 years old	628	25.7
60-71 year old	1811	74.3
Total	2439	100

Table 1.(Continued)

Gender		
Female	1101	45.1
Male	1338	54.9
Total	2439	100
Marital status		
Had no partner (hushband/wife)	758	31.1
Had partner (hushband/wife)	1681	68.9
Total	2439	100
Education Level		
Low	1869	76.6
High	570	23.4
Total	2439	100
Place of Residence		
Urban	1336	54.8
Rural	1103	45.2
Total	2439	100
Hypertension Status		
Yes	1693	69.4
No	746	30.6
Total	2439	100
Diabetes Mellitus Status		
Yes	358	14.7
No	2081	85.3
Total	2439	100
Heart Disease Status		
Yes	278	11.4
No	2161	88.6
Total	2439	100
Joint Disease Status		
Yes	613	25.1
No	1826	74.9
Total	2439	100
Chronic Kidney Failure Disease Status		
Yes	43	1.8
No	2396	98.2
Total	2439	100
Obesity Status		
Yes	860	35.3
No	1579	64.7
Total	2439	100
Repeat Control Intensity		
Sometimes and or never control	1372	56.3
Control routine	1067	43.7
Total	2439	100
Depression Status		
Yes	1343	55.1
No	1096	44.9
Total	2439	100
Emotional Mental Disorder Status		

Table 1. (Continued)

Yes	670	27.5
No	1769	72,5
Total	2439	100
Smoking History		
Yes	942	38.6
No	1497	61.4
Total	2439	100
History of Alcohol Consumption		
Yes	32	1.3
No	2407	98.7
Total	2439	100
Physical Activity		
Not enough	1216	49.9
Enough	1223	50.1
Total	2439	100

Table 2 shows the bivariate analysis indicated that age, education level, place of residence, obesity, emotional mental disorder, smoking history, physical activity was significantly related (p-value $\leq$ 0.05) with the disability among elderly with stroke in Indonesia. While the variables of gender, marital status, hypertension**,** diabetes mellitus**,** heart disease**,** joint disease**,** kidney failure chronic**,** intensity of repeat control, depression**,** and history of consumption alcoholic beverages showed no significant relationship (p-value > 0.05) with the disability among elderly with stroke in Indonesia.

Table 2. Factors associated with the incidence of disability among elderly with stroke in Indonesia by bivariate analysis

	disability		**No-disability**		**total**		**p-value**	**PR (95%CI)**
	N	**%**	**N**	**%**	**N**	**%**		
Age								
≥72 years old	37	5.9%	591	94.1%	628	100%	0.004	1.840 (1.230 – 2.751)
60-71 year old	58	3.2%	1753	96.8%	1811	100%		
Gender								
Female	51	4.6%	1050	95.4%	1101	100%	0.109	1.409 (0.949-2.092)

Table 2. (Continued)

Male	44	3.3%	1294	96.7%	1338	100%		
Marital status								
Had no partner (hushband/wife)	38	5%	720	95%	758	100%	0.071	1.478 (0.990-2.209)
Had partner (hushband/wife)	57	3.4%	1624	96.6%	1681	100%		
Education Level								
Low	88	4.7%	1781	95.3%	1869	100%	0.000	3.834 (1.786-8.231)
High	7	1.2%	563	98.8%	570	100%		
Place of Residence								
Urban	42	3.1%	1294	96.9%	1336	100%	0.045	0.654 (0.440 – 0.973)
Rural	53	4.8%	1050	95.2%	1103	100%		
Hypertension Status								
Yes	74	4.4%	1619	95.6%	1693	100%	0.086	1.553 (0.964-2.502)
No	21	2.8%	725	97.2%	746	100%		
Diabetes Mellitus Status								
Yes	15	4.2%	343	95.8%	358	100%	0.869	1.090 (0.635-1.870)
No	80	3.8%	2001	96.2%	2081	100%		

Table 2. (Continue

Heart Disease Status								
Yes	14	5%	264	95%	278	100%	0.379	1.344 (0.773-2.337)
No	81	3,7%	2080	96.3%	2161	100%		
Joint Disease Status								
Yes	16	2.6%	597	97.4%	613	100%	0.075	0.603 (0.355-1.024)
No	79	4.3%	1747	95.7%	1826	100%		
Chronic Kidney Failure Disease Status								
Yes	3	7%	40	93%	43	100%	0.512	1.817 (0.599-5.511)
No	92	3.8%	2304	96.2%	2396	100%		
Obesity Status								
Yes	20	2.3%	840	97.7%	860	100%	0.004	0.490 (0.301—0.796)
No	75	4.7%	1504	95.3%	1579	100%		
Repeat Control Intensity								
Sometimes and or never control	52	3.8%	1320	96.2%	1372	100%	0.843	0.940 (0.633-1.397)
Control routine	43	4%	1024	96%	1067	100%		
Depression Status								

Table 2. (Continued)

Yes	62	4.6%	1281	95.4%	1343	100%	0.053	1.533 (1.013-2.321)
No	33	3%	1063	97%	1096	100%		
Emotional Mental Disorder Status								
Yes	45	6.7%	625	93.3%	670	100%	0.000	2.376 (1.604—3.520)
No	50	2.8%	1719	97.2%	1769	100%		
Smoking History								
Yes	22	2.3%	920	97.7%	942	100%	0.002	0.479 (0.299—0.766)
No	73	4.9%	1424	95.1%	1497	100%		
History of Alcohol Consumption								
Yes	1	3.1%	31	96.9%	32	100%	1.000	0.800 (0.115-5.564)
No	94	3.9%	2313	96.1%	2407	100%		
Physical Activity								
Not enough	90	7.4%	1126	92.6%	1216	100%	0.000	18.104 (7.382 – 44.396)
Enough	5	0.4%	1218	99.6%	1223	100%		

Analysis of age obtained a p-value $\leq$ 0.05 which indicates there is a relationship between age and disability amomg elderly with stroke with an PR of 1.840 (95% CI = 1.230 – 2.751), meaning that elderly with stroke aged $\geq$72 years old have a risk of 1.840 times are more likely to be disability compared to elderly with stroke at the age of

60-71 years. Significantly, education level is associated with the incidence of disability among elderly with stroke (PR=3.834; 95%CI=1.786-8.231). Elderly stroke survivor with low education level have a risk of 3.834 times are more likely to be disability compared to elderly stroke survivor with high education level.

Analysis of place of residence obtained a p-value ≤ 0.05 which indicates there is a relationship between place of residence and disability amomg elderly with stroke with an PR of 0.654 (95% CI=0.440 – 0.973), meaning that elderly with stroke living in urban areas have a risk of 0.654 times to be disability. Significantly, obesity status is associated with the incidence of disability among elderly with stroke (PR=0.490; 95%CI=0.301—0.796). Elderly stroke survivor with obesity have a risk of 0.490 times to be disability.

Analysis of emotional mental disorder status obtained a p-value ≤ 0.05 which indicates there is a relationship between emotional mental disorder status and disability among elderly with stroke with an PR of 2.376 (95% CI=1.604—3.520), meaning that elderly stroke survivor with emotional mental disorder have a risk of 2.376 times are more likely to be disability compared to elderly stroke survivor with no emotional mental disorder. Significantly, smoking history status is associated with the incidence of disability among elderly with stroke (PR=0.479; 95%CI=0.299—0.766). Elderly stroke survivor with smoking history have a risk of 0.479 times to be disability.

Analysis of physical activity obtained a p-value ≤ 0.05 which indicates there is a relationship between physical activity and disability amomg elderly with stroke with an PR of 18.104 (95% CI=7.382 – 44.396), meaning that elderly stroke survivor with less physical activity have a risk of 18.104 times are more likely to be disability compared to elderly stroke survivor with enough physical activity.

Furthermore, the variables with p-value <0.25 were analyzed using a logistic regression test (“backward LR” methods) to determine the variable which affects the disability among elderly with stroke in Indonesia.

Multivariate analysis **(Table 3)** showed that after controlling for other variables, physical activity (PR=18.097; 95%CI=7.306-44.825), level of education (PR=3.555; 95%CI=1.616-7.823), smoking history status (PR=0.461; 95%CI=0.280-0.759), emotional mental disorder status (PR=1.942; 95%CI=1.262-2.988), joint disease status (PR=0.546; 95%CI=0.311-0.958), and obesity status (PR=0.578; 95%CI=0.345-0.970) were significant affected the incidence of disability among elderly with stroke in Indonesia (p-value < 0.05).

Table 3. Factors associated with the incidence of disability among elderly with stroke in Indonesia by multiple logistic regression analysis

Characteristics	p-value	aPR	95% CI
Physical activity: not enough	0.000	18.097	7.306-44.825
Education level: low	0.002	3.555	1.616-7.823
Smoking history: yes	0.002	0.461	0.280-0.759
Emotional mental disorder status: yes	0.003	1.942	1.262-2.988
Joint diseases status: yes	0.035	0.546	0.311-0.958

Table 3.(Continued)

Obesity status: yes	0.038	0.578	0.345-0.970

Based on adjusted prevalence ratio, less physical activity, low level of education, had mental emotional disorders were significant for increased disability risk (aPR>1) and these variables were the risk factors of disability among elderly with stroke. Had smoking history, had joint disease status, and being obese were not significant for increased disability risk (aPR<1) and these variables were the protective factors of disability among elderly with stroke.

Discussion

Based on the bivariate analysis, there was a significant relationship between age with disability among elderly with stroke. The prevalence ratio (PR) result was 1.840 (CI 95%= 1.230 – 2.751), shows that older age have 1.84 times for increase the risk of disability among elderly with stroke. The result was in line with the study on post-stroke patients in China[11] which stated that older age was correlated with the incidence of long-term disability in stroke patients and older age have a 1.06 times greater risk of the disability. Decreased body abilities (motor and sensory functions as well as cognitive function) are compensation for increasing age, when coupled with the burden of stroke which further weakens body functions, it will result in slower recovery of limb dysfunction in older patients and may cause permanent disability.[15,20]

After controlling for other variables, low education level was significant affected and increased the incidence of disability among elderly with stroke (PR=3.555; 95%CI=1.616-7.823). Elderly stroke survivor with low education level have a risk of 3.555 times higher to be disability compared to elderly stroke survivor with high education level. This result is in line with a study in China[11] which stated that higher education was correlated with less disability in stroke patients. Higher education is possible to have better social support resources to get maximum care and treatment after stroke. Highly educated stroke survivors are more likely to receive less stigma, become more aware of stroke outcomes, and are more likely to adhere to treatment, as well as actively participate in physical rehabilitation.[21]

Based on the bivariate analysis, there was a significant relationship between place of residence with disability among elderly with stroke. The prevalence ratio (PR) result was 0.654 (CI 95%= 0.440 – 0.973), shows that living in urban can reduce the risk of disability among elderly with stroke. This result was in line with previous research[22] which states that stroke survivors who lived in urban areas had better quality and and accessibility to health facilities than stroke survivors who live in rural areas.

After controlling for other variables, there was a significant relationship between obesity status with disability among elderly with stroke The adjusted prevalence ratio (aPR) result was 0.578 (CI 95%= 0.345-0.970), shows that being obese was the protective factor of disability among elderly with stroke. This result was not in line with a studies in the United States[23] which stated that obesity was correlated with limitations in baseline ADL in stroke survivors. A research[24] states that not only are overweight and obesity correlated with disability and quality of life in stroke patients, but being underweight is also correlated with

disability with a higher risk than overweight and obesity. A systematic review [25] stated that it is not only initial body weight at stroke onset, but more important to note is the dynamics of weight change which appears to be a strong indicator of poor outcome (including disability and death) after stroke. The results indicate that being obese as a protective factor of disability among the elderly with stroke may be due to the role of the dynamics of weight change in stroke patients which was not examined in this study. Further research is needed to determine the relationship and scientific explanation regarding the relationship between underweight, overweight (obesity), and weight change status to the incidence of disability in stroke patients.

After controlling for other variables, emotional mental disorder was significant affected and increased the incidence of disability among elderly with stroke (PR=1.942; 95%CI=1.262-2.988). Elderly stroke survivor with emotional mental disorder have a risk of 1.942 times higher to be disability compared to elderly stroke survivor with no emotional mental disorder. This result was in line with previous research [26], which mention that the mental emotional status were predictors of the incidence of disability among stroke survivors. Stroke patients who experience mental disorders will tend to be angry and tired of carrying out various kinds of health care. This situation is distressing for patients and their caregivers, and negatively affects of the patient's quality of life. Unfortunately, these emotional disturbances are invisible and therefore often go unnoticed by health professionals.[27]

After controlling for other variables, there was a significant relationship between smoking history status with disability among elderly with stroke The adjusted prevalence ratio (aPR) result was 0.461 (CI 95%= 0.280-0.759), shows that had smoking history was the protective factor of disability among elderly with stroke. This result was not in line with research by [28] which said that smoking is related to disability at 3 months and 1 year after stroke. Smoking is one of the most common preventable risk factors for cerebrovascular disease. The composition of cigarettes are toxic materials for the body. Continuing to smoke after a stroke is associated with a higher risk of stroke recurrence and the emergence of other cardiovascular disease.[28] Recurrent strokes are generally more disabling than initial strokes.[28] In addition, stroke survivors who smoke also have a greater increased risk of death than death from cancer.[29] The results of this study indicate that had smoking history is a protective factor of disability among the elderly with stroke may be due to the effects of passive smoking which were not examined in this study.[30]

After controlling for other variables, there was a significant relationship between joint disease status with disability among elderly with stroke The adjusted prevalence ratio (aPR) result was 0.546 (CI 95%= 0.311-0.958), shows that had joint disease was the protective factor of disability among elderly with stroke. This research was not in line with research in England[31] which states that musculoskeletal symptoms are common in people with stroke and have a significant additional effect on the disability of stroke sufferers. The difference in the results of this study due to the joint disease status which not the direct cause and there are more important factors such as the severity of the joint disease[32,32] which were not examined in this study. Further research is needed regarding the relationship between joint disease status and the incidence of disability in elderly stroke patients by considering the variables of the severity of joint disease.

After controlling for other variables, physical activity was the most influential variable in the increased the incidence of disability among elderly with stroke (PR=18.097; 95%CI=7.306-44.825). Elderly stroke survivor with less physical activity have a risk of 18 times are more likely to be disability compared to elderly stroke survivor with enough physical activity. This result was in line with a study by [33] which stated that lack of physical activity predicts a higher risk of dependence both before and after stroke onset. Physical activity before and after stroke will accelerate recovery on the outcome of the extremity function during post-stroke care.[34] The American Hearth Association Scientific Statement by [13] states that exercise or physical activity in post-stroke patients is based on the premise that the benefits outweigh the risks. In order to avoid muscoletal injuries and sudden cardiac death, it is recommended that all stroke survivors undergo a preexercise evaluation (complete medical history and physical examination, usually including graded exercise testing with ECG monitoring) before they initiate an exercise program. A review article [12] advised elderly with stroke to carry out regular and continuous physical activity in the rehabilitation phase in order to prevent a decrease in extremity motor function so as not to cause long-term disability.

Conslusion

Based on the analysis, the risk factors associated with disability among elderly with stroke were older age, had low education level, lived in rural area, not obese, had mental emotional disorder, had not smoking history, and less physical activitiy. After controlling for other variables, the risk factors that affect the incidence of disability among elderly with stroke in order of priority were less physical activity, low level of education, and had mental emotional disorders. Being obesity, had joint disease, and had smoking history were the protective factors of disability among elderly with stroke. Physical rehabilitation and treatment for mental emosional disorders have an important roles to prevent disability among the elderly with stroke in Indonesia.

Ethics approval

This study was verified by Komite Etik Penelitian Kesehatan (KEPK) Fakultas Ilmu Keolahragaan, Universitas Negeri Semarang. The ethical clearance number was 201/KEPK/EC/2022. The ethical clearance approval date was May 9, 2022.

Availability of data and materials

The data used in this study comes from the Health Development Policy Agency, Ministry of Health of the Republic of Indonesia which can be accessed with certain requirements and procedures through www.litbang.kemkes.go.id

Acknowledegment

Thank you to the State University of Semarang for the support. Further, thank the Health Research and Development Agency, the Ministry of Health of the Republic of Indonesia for allowing the submission of the 2018 Riskesdas data application used in this study.

Funding

This study was self-funded by the authors. This study was conducted to obtain a Bachelor of Public Health degree at Semarang State University.

Author contribution

ADLY was responsible for analyzed data, designed and wrote the manuscript. YDPS helped to review the manuscript.

Reference

1. GBD 2019 Stroke Collaborators, “Global, regional, and national burden of stroke and its risk factors, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019,” *Lancet Neurol.*, vol. 20, no. 10, pp. 1–26, 2021, doi: 10.1016/S1474-

4422(21)00252-0.
2. Kemenkes RI, “Infodatin: Stroke Dont Be The One.” p. 10, 2019.
3. Direktorat Jenderal Pencegahan dan Pengendalian Penyakit Kementerian Kesehatan RI, “Kebijakan dan Strategi Pencegahan dan Pengendalian Stroke di Indonesia,” 2018.
4. E. S. Donkor, “Stroke in the 21st Century: A Snapshot of the Burden, Epidemiology, and Quality of Life,” *Stroke Res. Treat.*, 2018, doi: 10.1155/2018/3238165.
5. L. Rahmawati, “Pengalaman Keluarga dalam Merawat Lansia Pasca Stroke di Indramayu Family Experience in Treating The Elderly Post Stroke in Indramayu,” *J. Kesehat. Masy.*, vol. 7, no. 2, pp. 299–307, 2022.
6. E. Tania, “Depresi pada Lansia yang Menjadi Caregiver Pasien Pasca-Stroke,” *J. Kedokt. Meditek*, vol. 21, no. 56, pp. 1–15, 2015.
7. Kementerian Kesehatan RI Badan Penelitian dan Pengembangan, “Hasil Riset Kesehatan Dasar 2013,” 2013.
8. Kementerian Kesehatan RI Badan Penelitian dan Pengembangan, “Hasil Utama Riset Kesehatan Dasar 2018,” 2018.
9. Kementerian Kesehatan RI, *Laporan Nasional Riset Kesehatan Dasar 2018*. 2018.
10. Kemenkes RI, *Situasi Lanjut Usia di Indonesia*. 2016.
11. Y. Yang *et al.*, “The disability rate of 5-year post-stroke and its correlation factors: A national survey in China,” *PLoS One*, vol. 11, no. 11, pp. 1–9, 2016, doi: 10.1371/journal.pone.0165341.
12. A. Amin, R. Arafat, and R. Rachmawaty, “Physical activity in stroke patients: A scoping review,” *Jpurnal Community Empower. Heal.*, vol. 4, no. 1, pp. 1–8, 2021.
13. N. F. Gordon *et al.*, “Physical Activity and Exercise Recommendations for Stroke Survivors: An American Heart Association Scientific Statement from the Council on Clinical Cardiology, Subcommittee on Exercise, Cardiac Rehabilitation, and Prevention; the Council on Cardiovascula,” *Circulation*, vol. 109, no. 16, pp. 2031–2041, 2004, doi: 10.1161/01.CIR.0000126280.65777.A4.
14 Y. Y. Yao *et al.*, “Functional Disability After Ischemic Stroke: A Community-Based Cross-Sectional Study in Shanghai, China,” *Front. Neurol.*, vol. 12, no. August, pp. 1–8, 2021, doi: 10.3389/fneur.2021.649088.
15. Y. Lv, Q. Sun, J. Li, W. Zhang, Y. He, and Y. Zhou, “Disability status and its influencing factors among stroke patients in northeast china: A 3-year follow-up study,” *Neuropsychiatr. Dis. Treat.*, vol. 17, pp. 2567–2573, 2021, doi: 10.2147/NDT.S320785.
16. T. Ullberg, E. Zia, J. Petersson, and B. Norrving, “Changes in functional outcome over the first year after stroke: An observational study from the Swedish stroke register,” *AHA Stroke J.*, vol. 46, no. 2, pp. 389–394, 2015, doi: 10.1161/STROKEAHA.114.006538.
17. R. T. Pinzon and R. D. L. R. Sanyasi, “Complications as important predictors of disability in ischemic stroke,” *Universa Med.*, vol. 36, no. 3, pp. 197–204, 2017, doi: 10.18051/univmed.2017.v36.197-204.
18. Kemenkes RI, “Klasifikasi Obesitas setelah pengukuran IMT,” *http://p2ptm.kemkes.go.id/*, 2018. .
19. Sri Idaiani dkk, “Studi Kesehatan Jiwa Pada Beberapa Daerah Di Indonesia,” 2017.
20. W. D. Astuti and D. Budijanto, “Tingkat Disabilitas Fisik Berdasarkan Penyakit Degeneratif Yang Diderita Menurut Faktor Sosial Dan Demografi (Kajian Isu Publik dalam Formulasi Kebijakan Kesehatan),” *Bul. Penelit. Sist. Kesehat.*, vol. 12, no. 4, pp. 378–392, 2009.

21. Q. Liu, X. Wang, Y. Wang, C. Wang, X. Zhao, and L. Liu, "Association between marriage and outcomes in patients with acute ischemic stroke," *J. Neurol.*, vol. 265, no. 4, pp. 942–948, 2018, doi: 10.1007/s00415-018-8793-z.
22. J. Koifman *et al.*, "The association between rural residence and stroke care and outcomes," *J. Neurol. Sci.*, vol. 10, Feb. 2016, doi: 10.1016/j.jns.2016.02.019.
23. R. R. Bailey and M. Conroy, "Diabetes and obesity are associated with disability in community-dwelling stroke survivors: A cross-sectional study of 37,955 Behavioral Risk Factor Surveillance System respondents," *Top. Stroke Rehabil.*, vol. 00, no. 00, pp. 1–6, 2021, doi: 10.1080/10749357.2021.1904537.
24. Z. Liu *et al.*, "Adiposity and Outcome after Ischemic Stroke: Obesity Paradox for Mortality and Obesity Parabola for Favorable Functional Outcomes," *Stroke*, vol. 52, no. 1, pp. 144–151, 2020, doi: 10.1161/STROKEAHA.119.027900.
25. N. Scherbakov, U. Dirnagl, and W. Doehner, "Body weight after stroke lessons from the obesity paradox," *Stroke*, vol. 42, no. 12, pp. 3646–3650, 2011, doi: 10.1161/STROKEAHA.111.619163.
26. T. G. Liman, P. U. Heuschmann, M. Endres, A. Flöel, S. Schwab, and P. L. Kolominsky-Rabas, "Impact of low mini-mental status on health outcome up to 5 years after stroke: the Erlangen Stroke Project," *J. Neurol.*, vol. 259, no. 6, pp. 1125–1130, 2012, doi: 10.1007/s00415-011-6312-6.
27. J. S. Kim, "Post-stroke mood and emotional disturbances:Pharmacological therapy based on mechanisms," *J. Stroke*, vol. 18, no. 3, pp. 244–255, 2016, doi: 10.5853/jos.2016.01144.
28. M. S. sheikh Andalibi, M. T. Farzadfard, M. R. Azarpazhooh, and N. M. Mashhad, "Pre-stroke cigarette smoking are associated with stroke severity and post-stroke disability," *Int. J. Stroke*, vol. 13, no. 490, 2018, doi: 10.1177/1747493018789543.CITATIONS.
29. N. S. Parikh, M. Parasram, H. White, A. E. Merkler, B. B. Navi, and H. Kamel, "Smoking Cessation in Stroke Survivors in the United States: A Nationwide Analysis," *Stroke*, vol. 53, no. 4, pp. 1285–1291, 2022, doi: 10.1161/STROKEAHA.121.036941.
30. B. Li *et al.*, "'Smoking paradox' is not true in patients with ischemic stroke: a systematic review and meta-analysis," *J. Neurol.*, vol. 268, no. 6, pp. 2042–2054, 2021, doi: 10.1007/s00415-019-09596-3.
31. C. Hettiarachchi, A. Tennant, P. G. Conaghan, and B. Bhakta, "Prevalence and impact of joint symptoms in people with stroke aged 55 years and over," *J. Rehabil. Med.*, vol. 43, no. 3, pp. 197–203, 2011, doi: 10.2340/16501977-0648.
32. S. Nurhayati, "Analisis Faktor Risiko Kejadian Disabilitas Fisik Pada Lansia di Kecamatan Punung Kabupaten Pacitan," UNNES, 2014.
33. P. M. Rist, B. D. Capistrant, E. R. Mayeda, S. Y. Liu, and M. M. Glymour, "Rist et al. 2017 - Physical activity but not BMI predicts less disability before and after stroke," 2017.
34. M. Reinholdsson, A. Grimby-Ekman, and H. C. Persson, "Association between pre-stroke physical activity and mobility and walking ability in the early subacute phase: A registry-based study.," *J. Rehabil. Med.*, vol. 53, no. 10 (October), p. jrm00233, Oct. 2021, doi: 10.2340/jrm.v53.367.