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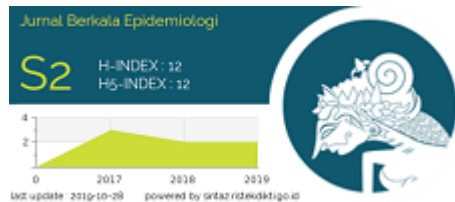
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## ORIGINAL RESEARCH

# THE EFFECT OF SMOKING BEHAVIOR ON STROKE CASES IN SURABAYA CITY

*Pengaruh Perilaku Merokok dengan Kejadian Stroke di Kota Surabaya*

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### ABSTRACT

**Background:** Stroke is a disease condition caused by the sudden stopping of the blood supply to the brain, either because of a blockage or ruptured blood vessels. The prevalence of stroke in Indonesia based on Basic health research in 2013 was 7% and increased in 2018 to 10.9%. **Purpose:** This research aims to determine the effect of smoking behaviour on the prevalence of stroke in Surabaya, Indonesia. **Methods:** It was a cross-sectional study. The study population included all visitors to nerve poly at Haji Hospital Surabaya. Data were collected from respondents through interviews and patient medical record data from August to September 2019. Univariate and bivariate analyses were done to identify the association between smoking and stroke incidence. **Results:** A total of 187 people participated in the study. The majority of them were aged  $\geq 55$  years (78.16%), with 55.17% being male. There is 32.18% active smoker and 28.74% passive smoker for stroke patients. There is an association of the type of non-filter cigarettes with the prevalence of stroke  $p = 0.01$ ,  $PR = 4.02$ ; 95%  $CI = 1.38-11.67$ ), and duration of exposure  $\geq 30$  years ( $p = 0.01$ ,  $PR = 7.84$ ; 95%  $CI = 2.75-22.32$ ) **Conclusion:** there is an influence of types of non-filter cigarettes and exposure time  $\geq 30$  years with the incidence of stroke in the city of Surabaya.

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### ABSTRAK

**Latar belakang:** Stroke adalah kondisi penyakit yang disebabkan oleh terhentinya suplai darah ke otak secara tiba-tiba, baik karena penyumbatan maupun pecahnya pembuluh darah. Prevalensi stroke di Indonesia berdasarkan Riset Kesehatan Dasar tahun 2013 adalah 7 % dan meningkat pada tahun 2018 menjadi 10,9 %. **Tujuan:** Penelitian ini bertujuan untuk mengetahui pengaruh perilaku merokok dengan kejadian stroke di kota Surabaya, Indonesia. **Metode:** Jenis penelitian cross sectional. Populasi penelitian adalah seluruh pengunjung poli saraf di RS Haji Surabaya. Data dikumpulkan melalui wawancara dengan responden dan data rekam medis pasien, dimulai dari Agustus hingga September 2019. Analisis univariat dan bivariat dilakukan untuk mengetahui hubungan antara merokok dan kejadian stroke. **Hasil:** Sebanyak 187 orang berpartisipasi dalam penelitian ini, mayoritas berusia  $\geq 55$  tahun (78,16%) dengan 55,17% berjenis kelamin laki-laki, terdapat 32,18% perokok aktif dan 28,74% perokok pasif pada penderita stroke. Ada hubungan antara jenis rokok non filter dengan prevalensi stroke  $p = 0,01$ ,  $PR = 4,02$ ; 95%  $CI = 1.38-11.67$ ), dan lama pajanan  $\geq 30$  tahun ( $p = 0.01$ ,  $PR = 7.84$ ; 95%  $CI = 2.75-22.32$ ) **Kesimpulan:** Ada pengaruh jenis rokok non filter dan lama pemaparan  $\geq 30$  tahun dengan kejadian stroke di Kota Surabaya

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## INTRODUCTION

Stroke is a disease condition caused by the sudden stopping of the blood supply to the brain, either because of a blockage or ruptured blood vessels (World Health Organization, 2018). In 2019, ischemic heart disease and stroke were the leading causes of DALYs worldwide in the 50-74 year age group and 75 years and over (Abbatati et al., 2020).

Globally, stroke remained the second-leading cause of death (11.60% [10.80–12.20] of total deaths) and the third-leading cause of death and disability combined (5.70% [5.10–6.20] of total DALYs) in 2019 (Feigin et al., 2016). More than 795,000 people each year in the United States have a stroke, with about 610,000 of these being a new stroke or first stroke. In the last four decades, the incidence of stroke has doubled in low and middle-income countries. Meanwhile, the incidence of stroke has decreased by 42% in high-income countries. Stroke is a cause of high mortality in low and middle-income countries compared to high-income countries (Laily, 2017).

Stroke is the second leading cause of death in Indonesia after ischemic heart disease (World Health Organization, 2018). In 2016, the

cerebrovascular disease was the second leading cause of disability in Indonesia after ischemic heart disease (Mboi et al., 2018). The number of stroke patients in Indonesia in 2018 based on doctors' diagnoses has increased from 7% to 10.90% over the past five years (Ministry of Health RI, 2018).

Risk factors for stroke are almost the same as risk factors for coronary heart disease and other vascular diseases. Effective stroke prevention intervenes in modifiable risk factors by implementing a healthy lifestyle. The risk factors for stroke caused by implementing unhealthy lifestyles are smoking, low physical activity, unhealthy eating patterns, and central obesity. The practice of a healthy lifestyle is effective prevention in reducing deaths from stroke in some low-income countries (World Health Organization, 2018).

Globally, 90.50% of the stroke burden (measured in DALYs) was attributable to the modifiable risk factors analyzed, including 74.20% of which were attributable to behavioral factors, such as smoking, poor diet, and low physical activity. Moreover, this 72.40% of cases were also caused by metabolic factors (high SBP, high BMI, high fasting plasma glucose, high total cholesterol, and low glomerular filtration rate, and 33.40% of

them were also caused by environmental factors (air pollution and lead exposure) (Feigin et al., 2016).

Smoking is a risk factor for stroke (Khairatunnisa & Sari, 2017). According to World Health Organization (2018), 65% of deaths of people with cardiovascular disease are caused by cigarette consumption. Smoking kills 225,720 people every year. Indonesia is the country with the third-largest number of smokers globally after China and India. Deaths from smoking occur on average 15 years earlier than the life expectancy of someone who does not smoke. Generally, smoking-related diseases will last for a long time, which is around 15-20 years after the smoking behavior begins. The epidemic of smoking-related diseases and deaths from smoking in the future can continue to increase. The prevalence of smoking in Indonesia is 29.30%. Based on sex, the smoking prevalence of men is higher than women. In 2013 the smoking prevalence of adult men increased from 65.80 to 66%. The proportion of smoking in women has also increased from 4.10% to 6.70% over the past five years (Ministry of Health RI, 2018).

The smoking habit in the community is one of Indonesia's health problems (Ministry of Health RI, 2018). According to WHO, tobacco is a product that causes more than 7 million deaths each year. The diseases caused by smoking with the highest number of deaths are stroke (World Health Organization, 2019). This is confirmed by previous research that shows a significant influence between smoking habits and the incidence of stroke (Simbolon, Simbolon, & Ringo, 2018).

Research conducted by Imanda, Martini, & Artanti (2019) shows that smoking will increase the risk of stroke by 1.67 times compared to people who do not smoke. The risk of death from stroke in someone who smokes will increase with the number of cigarettes smoked and the duration of smoking. Types of clove cigarettes (non filter) are the most often used in Indonesia. The number of *kretek* (non-filter) cigarette users is 8.10 million higher compared to users of the type of white cigarette (filter) product, which is 3.80 million (Ministry of Health RI, 2018). Research conducted previously shows that the type of cigarette affects the incidence of stroke (Imanda, 2018). In this research, the researchers focused on more variables associated with cigarettes, such as the type of cigarette, duration of exposure to cigarette smoke, the age of early smoking and the number of cigarettes. This research aims to look at the effect of smoking behavior on the incidence of stroke in Surabaya.

## METHODS

This research was analytic observational research using a *cross-sectional study*. This research was conducted at Surabaya Haji General Hospital in 2019. This research was conducted in August 2019 until September 2019.

The population in this research was all poly nerve visitors in Surabaya Haji General Hospital with 1,909 people in 2019. Halves of poly nerve visitors in Surabaya Haji General Hospital became the sample in this research. The model in this research was based on the Lemeshow, Hosmer, Klar, & Lwanga (1990) formula. It was used to a cross-sectional study sample of 187 respondents. The sampling technique used was *systematic random sampling*. The inclusion criteria in this research were the willingness to be part of the research and the ability to communicate well. The dependent variable is the prevalence of stroke.

The independent variables in this research were the type of cigarette, the duration of exposure, the initial smoking age, and the number of cigarettes. Types of cigarettes variable were obtained from interviews and categorized as a filter, non-filter and non-smoking types. The type of cigarette was determined by the number of cigarettes used most often or >50% of the total cigarettes consumed per week. Duration of exposure variable was obtained from interviews and categorized as duration of exposure <30 years, ≥30 years and not exposed to cigarette smoke. The duration of exposure was calculated from the calculation of the last year minus the first year of smoking in active smokers and the previous year minus the first year of exposure to cigarette smoke.

The initial age of smoking variable was obtained from interviews and categorized as age ≤15 years, 16-20 years, > 20 years and not smoking. The initial period for smoking was obtained when the respondent first smoked cigarette smoke even in one puff. The number of cigarettes variable obtained from interviews and categorized as <12 cigarettes, ≥12 cigarettes and not smoking. The number of cigarettes is calculated from the average number of cigarettes smoked by the respondent in a day. The category of no smoking is an individual who has never smoked in his life. The category not exposed to cigarette smoke is individuals who do not smoke and are not exposed to cigarette smoke in their homes and environments.

The data used are primary and secondary. Primary data were obtained from respondents through interviews, while secondary data used patient medical record data. This research has

passed the ethical test conducted by the RSUD ethics committee Dr. Soetomo Surabaya number 0727/KEPK/X/2017. Data analysis was performed using univariate analysis in frequency distribution and bivariate analysis using the chi-square test.

## RESULTS

This research shows that most respondents with the incidence of a stroke aged  $\geq 55$  years, as many as 68 respondents (78.16%). Most respondents are male, namely 48 respondents (55.17%). Most respondents have a high school education level of 27 respondents (31.03%). The majority of respondents are working, as many as 74 respondents (85.06%). Most respondents earn <Rp. 3,700,000 every month, which are 47 respondents (54.02%). Most respondents were not exposed to cigarette smoke as many as 34 respondents (39.08%). Respondents who did not have a stroke are at most <55 years old, as many as 93 respondents (93%). The majority of women are 72 respondents (72%). Most of the respondents are working, namely 96 respondents (96%). Most respondents were passive smokers, namely 42 respondents (42%) (Table 1).

Based on the results in Table 2, this research shows that most respondents who experienced a stroke were non-smoking respondents, as many as 59 respondents (67.82%). In the type of non-filter cigarettes variable obtained  $p$ -value of 0.01 <0.05 with a PR value (*prevalence ratio*) of 4.02 (95% CI = 1.38-11.67). It means that the type of non-filter cigarette is a risk factor for stroke. Respondents who smoke non-filter cigarettes have a 4.02 times greater risk of suffering a stroke than respondents who do not smoke. In the type of filter cigarette, the  $p$ -value is 0.84 > 0.05 with a PR value (*prevalence ratio*) of 1.08 (95% CI = 0.49-2.44). It means that filter cigarettes are not a risk factor for stroke.

In the duration of exposure variable  $\geq 30$  years, the  $p$ -value obtained was 0.01 <0.05 with a PR value (*prevalence ratio*) of 7.84 (95% CI = 2.75-22.32). It means that exposure of 30 years is a risk factor for stroke. Respondents who were exposed to cigarette smoke for  $\geq 30$  years had a risk of 7.84 times greater for stroke incidence than those who were not exposed to cigarette smoke. In the duration of exposure variable <30 years the  $p$ -value of 0.07 > 0.05 was obtained with a PR value (*prevalence ratio*) of 0.54 (95% CI = 0.27-1.05). It means that exposure of <30 years is not a risk factor for stroke.

In the initial smoking age variable based on statistical tests found in the initial age of smoking variable  $\leq 15$  years, the  $p$ -value obtained was 0.10 >

0.05 with a PR value (*prevalence ratio*) of 2.18 (95% CI = 0.85-5.59). It means that the initial age of smoking  $\leq 15$  years is not a risk factor for a stroke in Surabaya. At the initial age of smoking 16-20 years, the  $p$ -value obtained was 0.74 > 0.05 with a PR value of 1.19 (95% CI = 0.43-3.27). It means that the initial age of smoking, 16-20 years is not a risk factor for a stroke in Surabaya. At the initial age of smoking > 20 years the  $p$ -value obtained was 0.18 > 0.05 with a PR value of 2.34 (95% CI = 0.66-8.38). It means that the initial age of smoking > 20 years is not a risk factor for a stroke in Surabaya.

In the number of cigarettes variable based on statistical tests found in the number of cigarettes <12 cigarettes  $p$ -value of 0.22 > 0.05 with a PR value (*prevalence ratio*) of 1.74 (95% CI = 0.71-4.24) was obtained. It means that the number of cigarettes <12 is not a risk factor for a stroke in Surabaya. In the number of cigarettes  $\geq 12$  cigarettes the  $p$ -value obtained was 0.16 > 0.05 with a PR value of 1.826 (95% CI = 0.78-4.26). It means that the number of cigarettes  $\geq 12$  cigarettes is not a risk factor for a stroke in Surabaya.

## DISCUSSION

### Outlook of Respondents Characteristics

One of the risk factors for stroke is age. As a person ages, the risk of having a stroke will increase. Stroke can cause death and permanent disability (Rahayu, 2016). Most respondents with stroke incidence aged  $\geq 55$  years. The results of this research are in line with the study conducted by Chrisna & Martini (2016) that says the majority of stroke patients occur in the age range of 51-75, namely as many as 25 respondents (78,10%). Stroke more often strikes the age >55 years. This statement is also proven by research conducted by Laily (2017), which shows that as many as 33 respondents (75%) stroke patients aged >55 years. Stroke is more likely to occur in the elderly. It is because a person with old age will experience degenerative changes in blood vessels. The slow pace of the process also depends on the lifestyle adopted (Badriyah, Amalia, & Suwarman, 2018). Deterioration of the blood vessel system in old age will increase. It causes the more a person ages, the greater the risk of stroke increases (Chrisna & Martini, 2016).

Characteristics of respondents by sex in this research were dominated by male. The results of this research are in line with Ningsih's research (2018) that male sex is affected more by stroke, as many as 46 respondents (63.90%). Another research conducted by Marbun, Juanita, & Ariani

(2016) also shows similar results as many as 56 respondents (65.88%) stroke patients were male. Basically, the incidence of stroke is caused by a disturbance in the blood vessels. Male patients have a smoking habit that can cause thickening and blockage of blood vessels. Blood vessels will be increasingly narrow, which can cause increased blood flow, thereby increasing the risk of stroke.

Characteristics of respondents based on their education are dominated by respondents with the latest high school education as many as 27 respondents (31.03%). This is supported by research of Marbun, Juanita, & Ariani (2016) which showed that most stroke patients are high school graduates, as many as 28 respondents (32.89%). The level of education can affect cognitive functions such as hearing, absorbing information, solving problems, behavior, and lifestyle (Hanum, Lubis, & Rasmaliah, 2017).

Characteristics of respondents based on employment are dominated by employed respondents, as many as 74 respondents (85.05%). It is supported by previous research that shows that most stroke patients are employed (Astuti, 2017). Study conducted by Ningsih (2018) stated that as

many as 62 respondents (86.14%) who suffered a stroke were employees. Someone who works has the potential to cause stress due to workload. High pressure will increase the risk of stroke (Kim, Choe, Kim, & Choi, 2018).

Characteristics of respondents based on income are dominated by respondents with income <Rp. 3,700,000, namely as many as 47 respondents (54.02%). It is supported by research conducted by Bariroh, Susanto, & Adi (2016), which shows that most respondents have low-income levels (56.60%). The research also states that a low level of income will affect the fulfilment of family needs, one of which is the fulfilment of daily nutrition.

This research indicates that most respondents who suffered a stroke were respondents who were not exposed to cigarette smoke, followed by respondents with active smokers and passive smokers. This research differs from previous research, which showed a higher proportion of active smokers than non-smokers (Ningsih, 2018). There are differences in the research results because the ratio of the number of male and female respondents is almost the same, so there are more respondents who do not smoke.

**Table 1.**  
Distribution of Respondent Characteristics

Variable	Stroke		Non-Stroke		Total	
	n	%	n	%	n	%
<b>Age (Year)</b>						
< 55	19	21.83	93	93.00	112	59.89
≥ 55	68	78.17	7	7.00	75	40.11
<b>Sex</b>						
Male	48	55.17	28	28.00	76	40.64
Female	39	44.83	72	72.00	111	59.36
<b>Education</b>						
None	5	5.75	0	0.00	5	2.67
Elementary	26	29.89	9	9.00	35	18.72
Middle	11	12.64	14	14.00	25	13.37
High	27	31.03	40	40.00	67	35.83
University	18	20.69	37	37.00	55	29.41
<b>Employment</b>						
Employed	74	85.05	96	96.00	170	90.91
Unemployed	13	14.95	4	4.00	17	9.09
<b>Income</b>						
< 3,700,000	47	54.02	53	53.00	100	53.48
≥ 3,700,000	40	45.98	47	47.00	87	46.52
<b>Smoking Status</b>						
Active	28	32.18	21	21.00	49	26.20
Passive	25	28.74	42	42.00	67	35.83
Not smoking	34	39.08	37	37.00	71	37.97
<b>Total</b>	<b>87</b>	<b>100.00</b>	<b>100</b>	<b>100.00</b>	<b>187</b>	<b>100.00</b>

**Table 2.**

Relationship between Types of Cigarettes, Duration of Exposure, Initial Age of Smoking, and Number of Cigarettes with Stroke Incidence

Variable	Stroke Prevalence				PR	95%CI	p value
	Yes		No				
	n	%	n	%			
<b>Types of Cigarettes</b>							
Non Filter	15	17.24	5	5.00	4.02	1.38–11.67	0.01
Filter	13	14.94	16	16.00	1.09	0.49–2.44	0.84
Not Smoking	59	67.82	79	79.00	1.00	(reference)	
<b>Duration of Exposure (year)</b>							
≥ 30	31	35.63	5	5.00	7.84	2.75–22.32	0.01
< 30	22	2.29	52	52.00	0.54	0.27–1.05	0.07
Not Exposed	34	62.08	43	43.00	1.00	(reference)	
<b>Initial Age of Smoking (year)</b>							
≤ 15	13	14.94	8	8.00	2.18	0.85–5.59	0.10
16-20	8	9.20	9	9.00	1.19	0.43–3.27	0.74
> 20	7	8.04	4	4.00	2.34	0.66–8.38	0.18
Not Smoking	59	67.82	79	79.00	1.00	(reference)	
<b>Number of Cigarettes</b>							
< 12	15	17.24	11	11.00	1.74	0.71–4.24	0.22
≥ 12	13	14.94	10	10.00	1.83	0.78–4.26	0.16
Not Smoking	59	67.82	79	79.00	1.00	(reference)	
Total	87	100.00	100	100.00			

**Outlook of Cigarette Types**

This research shows that most smokers using non-filter cigarettes are 15 respondents (17.24%), and those who use filter cigarettes are 13 respondents (14.49%). This research is supported by a previous study, which showed that 25 stroke patients (39.06%) used non-filter type cigarettes (Wibowo, An, & Yanti, 2016). Non-filter cigarettes have a more significant potential for the entry of harmful substances cigarettes into the body than filter cigarettes. It is because non-filtered cigarettes do not have filters at the base of cigarettes (Simbolon, Simbolon, & Ringo, 2018).

**Outlook of Exposure Duration to Cigarette Smoke**

This research shows that most respondents have been exposed to cigarette smoke for ≥30 years, as many as 31 respondents (35.63%). This research is supported by a previous study. The proportion of people who are exposed to cigarette smoke ≥30 years is more as many as 23 respondents (34.90%) compared to those exposed to cigarette smoke for <30 years (Imanda, 2018). Tobacco smoke contains more than 4000 dangerous chemicals. Some of these ingredients can trigger endothelial dysfunction that accelerates the atherosclerosis process. Other research shows that 14.83% of people smoke before the age of 16, and 58.60% start

smoking at 16-20 years. The earlier the initial smoking age, the longer the person and the environment are exposed to cigarette smoke (Grapatsas et al., 2017). Exposure to cigarette smoke from other people also can cause adverse effects on health, including death. According to WHO, smokers have a long-term impact of losing ten years of life expectancy (World Health Organization, 2019).

**Outlook of Smoking Initial Age**

This research indicates that most respondents who had a stroke started smoking at age ≤15 years. This research is supported by previous research showing that most of the initial age respondents smoke at the age of 6-19 years (Imanda, 2018). Smoking behaviour at age <18 years has a 6.18 times greater chance than age >18 years (Juliansyah & Rizal, 2018). The younger a person smokes, the harder it is for someone to stop smoking. Smoking can have an impact on the incidence of atherosclerosis. It is caused by toxins in cigarettes accumulating in the body, thus increasing the hardening process of blood vessels walls (Susilawati & Nurhayati, 2018).

**Outlook of Cigarettes Number**

The results of this research indicate that most respondents who have a stroke had the habit of

smoking <12 cigarettes per day. It is supported by previous research that as many as 82.78% of respondents smoke as many as 1-16 cigarettes per day (Simbolon, Simbolon, & Ringo, 2018). Other research also mentioned that 17 respondents (70.80%) smoked as many as 10-20 cigarettes per day (Tumeleng, Runtuwene, & Kembuan, 2015). According to World Health Organization (2019), smoking is a severe health problem. The increased risk of stroke does not significantly influence the number of cigarettes smoked each day. Someone who smokes one cigarette per day has 0.50 times the potential to suffer a stroke than someone who smokes 20 cigarettes per day.

#### **Relationship between Type of Cigarette and the Incidence of Stroke**

Based on statistical tests, there is an influence between types of non-filter cigarettes with the incidence of stroke. In contrast, the type of filter cigarettes was obtained  $p\text{-value} = 0.84 > 0.05$ , which means there is no influence between the kind of filter cigarettes with the incidence of stroke. Non-filter cigarettes have a risk of causing stroke four times greater when compared to not smoking. This research is supported by previous research, which states that the type of non-filter cigarettes affects the incidence of stroke and has a risk of 5.60 times more remarkable when compared with the value of OR = 5.60 (1.12–27.99) (Imanda, 2018).

#### **Relationship between Duration of Exposure and the Incidence of Stroke**

Based on statistical tests, there is an influence between the duration of exposure  $\geq 30$  years with the incidence of stroke, whereas the variable duration of exposure <30 years showed no effect between the duration of exposure <30 years with the incidence of stroke. The duration of exposure for  $\geq 30$  years is at risk of causing stroke 7.84 times greater when compared to respondents who are not exposed to cigarette smoke. This research is supported by research conducted by Imanda (2018) that says the duration of exposure for  $\geq 30$  years affects the incidence of stroke and has a risk of stroke 5.30 times greater than not exposed to cigarette smoke, with a PR value = 5.30 (1.47–18.94).

Cigarettes contain harmful substances to the body, such as tar, carbon monoxide, nicotine and other substances. These substances are dangerous if they last in the body for a long time because they can cause endothelial dysfunction to accelerate the process of *atherosclerosis* and increase the risk of stroke (Pan et al., 2019).

#### **Relationship between Initial Age of Smoking and the Incidence of Stroke**

This research indicates that the majority of respondents who had a stroke started smoking cigarettes at age  $\leq 15$  years. Based on statistical tests, it shows that the initial age of smoking  $\leq 15$  years is not a risk factor for the incidence of stroke in the city of Surabaya and the initial age of smoking 16-20 years and  $> 20$  years. This research has different results from previous studies that show that the initial age of smoking has a significant effect on the incidence of stroke; 6-19 years of initial smoking has a risk of stroke 5 five times greater than nonsmokers (Imanda, 2018). The difference is due to the ratio of male and female respondents, which is almost identical so that more respondents do not smoke.

#### **Relationship between the Number of Cigarettes and the Incidence of Stroke**

Based on statistical tests, it shows that consumption of cigarettes <12 per day is not a risk factor for stroke in Surabaya. It is consistent with previous research, which states that the relationship of the number of cigarettes smoked every day with an increased risk of stroke is not convincing. Some researchers conclude that the relationship between cigarettes and an increased risk of stroke has no significant relationship (Alhamid, Norma, & Lopulalan, 2018).

### **CONCLUSION**

There is an influence between the type of non-filter cigarettes and the duration of exposure  $\geq 30$  years with the stroke incidence. Types of filter cigarettes, duration of exposure <30 years, the initial age of smoking and the number of cigarettes variables did not affect the incidence of stroke in stroke patients in the city of Surabaya.

### **CONFLICT OF INTEREST**

The authors declare that there is no conflict of interest in this study.

### **AUTHOR CONTRIBUTIONS**

E.S.H. conducts the research, analyzes data, write articles. K.D.A provides suggestions and oversees the research. S.M provides suggestions and oversees research. S.W provides suggestions and oversees research. H.M provides suggestions and oversees research.

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