

Fwd: PLEASE REVISE_5723

5 messages

adinda rahma <adinda.rahma.triyaniarta-2019@fkm.unair.ac.id>
To: Santi Martini <santi-m@fkm.unair.ac.id>

Tue, May 17, 2022 at 9:53 PM

Assalamualaikum bu Santi, berikut email yang saya terima dari jurnal kesmas. Terima kasih

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Date: Rab, 27 Apr 2022 pukul 10.17

Subject: PLEASE REVISE_5723

To: <adinda.rahma.triyaniarta-2019@fkm.unair.ac.id>

Dear Adinda Rahma Triyaniarta,

Thank you for submitting your revision. The article has been reviewed. Please do some revisions as attached.

Please also fill out the author response form.

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Revision can be sent to Editor through your submission system in AUTHOR VERSION no later than May 18, 2022.

Thank you.

Best Regards,
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Santi Martini <santi-m@fkm.unair.ac.id>
To: adinda rahma <adinda.rahma.triyaniarta-2019@fkm.unair.ac.id>

Tue, May 17, 2022 at 10:57 PM

Terima kasih...Dinda.

Apakah bisa dikirimkan juga email konfirmasi ketika submit?

Wass.,

Santi Martini
Faculty of Public Health
Universitas Airlangga (www.fkm.unair.ac.id)
Surabaya INDONESIA

Preventing disease, Prolonging Life, and Promoting Health
through the Organized Efforts of Society *****

[Quoted text hidden]

Santi Martini <santi-m@fkm.unair.ac.id>

Tue, May 17, 2022 at 11:03 PM

To: adinda rahma <adinda.rahma.triyaniarta-2019@fkm.unair.ac.id>

Adinda,


Berikut manuskrip yang disubmitkan ya. Silakan cek revisi saya. Tks

Wass.,

Santi Martini
Faculty of Public Health
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Preventing disease, Prolonging Life, and Promoting Health
through the Organized Efforts of Society *****

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adinda rahma <adinda.rahma.triyaniarta-2019@fkm.unair.ac.id>
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Wed, May 18, 2022 at 8:44 PM

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Terima kasih.



#5723 Review

Summary REVIEW EDITING

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To: adinda rahma <adinda.rahma.triyaniarta-2019@fkm.unair.ac.id>

Wed, May 18, 2022 at 8:52 PM

OK....tqvm....Dinda.

[Quoted text hidden]

Determinants of Type-2 Diabetes Mellitus in Passive Smokers

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Abstract

Type-2 Diabetes Mellitus (T2DM) leads to complications to other diseases. The modifiable risk factors for T2DM are overweight, physical activity, hypertension, unhealthy diet and smoking. This study aims to analyse the determinants of T2DM incidence in passive smoker among some factors. This research was conducted at X Hospital in Surabaya and was conducted in September - April 2020. These variables were univariate, bivariate, and multivariate. Case samples were T2DM sufferers and passive smokers, while control samples were non-T2DM sufferers and passive smokers, 52 respondents per group, total respondents were 104.. Variables that were statistically significant related to the incidence of T2DM in passive smokers were age >45 years,

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24 level of education not attending primary school, less physical activity, and hypertension. The
25 variable that had no statistically significant related with the incidence of T2DM in passive
26 smokers were gender, occupation, sedentary lifestyles, income, and genetic. The multivariate
27 analysis showed that age is a major factor contributing to T2DM incidence in passive smokers at
28 X Hospital in Surabaya in 2019. It can be concluded that age is the most dominant risk factor of
29 T2DM incidence in passive smokers

30 **Keywords: Passive smoker, determinants, type-2 diabetes mellitus**

31

32 **Introduction**

33 Type-2 diabetes mellitus (T2DM) has been counted for about 90% of all cases of diabetes. In
34 Type-2 DM, there is decreased ability of insulin to stimulate glucose uptake by peripheral tissues
35 and to inhibit glucose production by the liver, and this is defined as insulin resistance.¹ The cause
36 of insulin resistance is often due to obesity and lack of physical activity and aging. Another event
37 that lead to T2DM is pancreatic cell dysfunction, cells will show a disturbance in the first phase
38 of insulin secretion, where insulin secretion fails to compensate for insulin resistance. If not
39 treated properly, there will be damage to pancreatic cells. This will occur progressively and will
40 cause insulin deficiency, so that eventually patients require exogenous insulin. If pancreatic cells
41 cannot produce insulin secretion immediately and quickly to compensate for insulin resistance,
42 fasting hyper glycemia and diabetes will appear.² Diabetes Mellitus can cause complications to
43 other diseases, such as blindness, heart attack, stroke, kidney failure and leg amputation.³
44 According to the World Health Organization, arterial hypertension and T2DM are the two most
45 common cardiovascular risk factors in the global population. Despite the single roles as
46 independent cardiovascular risk factors, hypertension and T2DM often coexist in the same
47 patient. This coexistence multiplies the patient's risk of experiencing major acute cardiovascular

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48 events and accelerates the development of chronic heart and kidney failure.⁴ Diabetes Mellitus
49 and the complications can be managed and prevented, especially when detected early. It's even
50 better to take precautions by making lifestyle changes, such as improving diet and physical
51 exercise.

52 In recent years, gender, which is male, has been regarded as a risk factor for the
53 development of type 2 diabetes. The reason that men are more prone than women to the
54 development of this disease is not known yet. The development of T2DM is the result of the
55 interaction between environmental factors and a strong genetic component. Environmental risk
56 factors known as influence of the development of T2DM include obesity, sedentary lifestyle,
57 birth weight, and stress.⁵ In addition, diabetes is also a disease with a high socioeconomic
58 pattern, favoring the beneficiary group, especially in developed countries. According to a
59 systematic review on socioeconomic positions and incidence of diabetes, low education is most
60 consistently associated with an increased risk of diabetes when compared to other socioeconomic
61 indicators, the knowledge and skills acquired through education determine the responsiveness to
62 health information.⁶

63 Physical activity is one of the risk factors of Diabetes Mellitus. Physical activity is body
64 movement produced by skeletal muscles that releases energy. Physical activity consists of
65 strenuous activity, moderate activity and light activity. Lack of physical activity is estimated to
66 be the main cause of around 21-25% of breast and colon cancer, 27% of diabetes, and about 30%
67 of the global burden of ischemic heart disease.⁷ In addition, smoking is also a risk factor for
68 diabetes. This is in line with a cohort study conducted by Kowall et.al, which found that being an
69 active smoker and a passive smoker increases the likelihood of developing type-2 diabetes
70 mellitus.⁸

71 Meanwhile, 28.11% of the population aged >10 years old in East Java are classified as
72 smokers with the intensity of smoking every day.⁹ With the increasing number of smokers, the
73 problem of passive smoking is also increasing. 85% of households in Indonesia are exposed to
74 cigarette smoke, with an estimated eight smokers dying from active smoking, one passive
75 smoker dying from exposure to other people's cigarette smoke.¹⁰ In passive smokers, exposure to
76 cigarette smoke can increase the risk of type-2 diabetes mellitus by several mechanisms that are
77 almost the same as those that occur in active smokers. This mechanism involves 5000 chemicals,
78 including 50 types of carcinogenic and toxic materials. Endothelial function disorders due to
79 smoking cause changes in blood circulation which result in decreased blood flow to skeletal
80 muscles which can lead to insulin resistance.⁸

81 Cigarette smoke can increase blood sugar levels. The effect of nicotine stimulates the adrenal
82 glands and can increase glucose levels.¹¹ Nicotine can also inhibit insulin secretion. The
83 mechanism of nicotine in inhibiting insulin secretion is when nicotine attaches to the nicotinic
84 acetylcholine receptor (nAChR) on pancreatic cells. Nicotine attached to these receptors causes
85 an increase in oxidative stress (ROS) in cells and which leads to changes in the function and
86 structure of cell mitochondria.¹² These changes will interfere with the ATP formation process in
87 secreting insulin, resulting in pancreatic cell apoptosis.¹³ Pancreatic cell apoptosis is the death of
88 cells in the pancreas so that the function of insulin secretion in the pancreas decreases and insulin
89 decreases in the body.¹⁴

90 Diabetes Mellitus is a serious problem in Indonesia and the world. Based on Riskesdas 2018,
91 East Java is one of the provinces with the fifth highest incidence of diabetes mellitus in
92 Indonesia, which is 2.6%. This number has increased when compared to the results of Riskesdas
93 2013 which was 2.1%. Surabaya as the capital of East Java province is the city with the highest

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94 number of diabetes cases, which is 3.4% in the 2018 Riskesdas results. From year to year the
95 number of diabetics in Surabaya continues to increase. Likewise with the prevalence of physical
96 activity. Based on the results of Riskesdas 2018, in East Java there were 61.5% of the population
97 with sufficient physical activity and 33.5% with less physical activity. This number illustrates an
98 increase when compared to the percentage of physical activity in Riskesdas 2013, which is
99 26.1% of the population doing less physical activity. The increasing number of smokers in
100 Indonesia results in tendency to increase the risk of developing T2DM. This study aims to
101 analyse the determinants of T2DM incidence in passive smoker among some factors, which are
102 age, sex, education, occupation, income, heredity, sedentary lifestyle, physical activity, and
103 hypertension.

104 **Method**

105 This research uses analytical observational research design with a case control approach. This
106 research was conducted in outpatient polyclinic and inpatient polyclinic at X Hospital in
107 Surabaya. The population of this study consisted of a case population of type-2 diabetes mellitus
108 and all patients who are passive smokers at X Hospital in Surabaya. While the control population
109 in this study were all non-patients with Type-2 DM and other smoking-related diseases at X
110 Hospital in Surabaya who are passive smokers. The sample of this study were all patients who
111 are classified as passive smokers at X Hospital in Surabaya. In this study, the sample was divided
112 into 2, namely: 1.) Case samples are patients with Type-2 Diabetes Mellitus and passive
113 smokers. 2.) The control sample is patients with no Type-2 DM and other smoking-related
114 diseases who are passive smokers.

115 The sampling technique used is simple random sampling. The inclusion criteria for this study
116 were patients diagnosed with type-2 diabetes mellitus or non-smokers with smoking-related

117 diseases at X Hospital in Surabaya who participated in the study. In addition, the second
118 inclusion criteria are that the respondent is a passive smoker who has a family member who
119 smokes or co-workers smoke at work every day. Based on research data, the total population is
120 obtained 400 people consisting of 300 population cases of smoking-related diseases and 100
121 people population control. The amount of the sample according to the research criteria, namely
122 patients with Type 2 DM in passive smokers as many as 159 people as the case population, while
123 non-patients with Type 2 DM in passive smokers as a control population as many as 52 people.
124 This amount is then adjusted by doing simple random sampling with lottery method to 159 case
125 population in order to obtain 52 respondents in accordance with the number of control samples.
126 The final sample for each group consists of 52 respondents and the total sample in this study is as
127 many as 104 respondents.

128 Data retrieval through secondary data. The data collected was then inputted and cleaned,
129 so that they could be analyzed. These variables were univariate, bivariate, and multivariate.
130 Univariate analysis was done for each variable with the proportional results of each. Bivariate
131 analysis with chi-square with the results whether there was a relationship between each
132 independent variable and the dependent variable if the p value was less than 0.05 was considered
133 to statistical significance. Multiple logistic regressions with backward determinant modeling
134 shows multivariate result to find significant determinant factors. The research was conducted at
135 X Hospital in Surabaya from September to April 2020. This study will use secondary data based
136 on interviews with people with Type-2 Diabetes Mellitus which have been carried out in an
137 research group by lecturers of the Faculty of Public Health, namely Dr. Santi Martini, dr.,
138 M.Kes. in 2019 entitled "The Burden of Diseases Due to Cigarettes in East Java". The lack of
139 physical activity measurement questionnaire consists of questions taken from the Riskesdas 2018

140 which is a modification of the WHO Global Physical Activity Questionnaire (GPAC) which is
141 part of the WHO STEPS instrument for measuring and monitoring risk factors for non-
142 communicable diseases.

143 **Results**

144 From January to June 2019, the number of Diabetes Mellitus patients at X Hospital in
145 Surabaya was 8060 people, while Type-2 Diabetes Mellitus (T2DM) patients were 7875 people.
146 The average visit for one month is 1313 people. This number represents the number of DM
147 patients in general. The study was conducted on Type-2 Diabetes Mellitus patients who made
148 outpatient visits at the Internal Medicine polyclinic and inpatients at X Hospital in Surabaya.

149 Based on table 1, most of the respondents are in the age range above 45 years as many as
150 58 people (44.2%). The gender distribution of respondents shows that the majority (80.8%) are
151 female. From the table 1 is known that the most respondents are with high school education
152 level, which is 33 people (31.7%) and the least is with junior high school education level, which
153 is 17 people (16.3%). These data indicate that most of the respondents are classified as having a
154 low level of education. It was also found that most of the respondents are passive smokers who
155 are going to work. While the income of the respondents is balanced between below the Surabaya
156 minimum wage and above the Surabaya minimum wage. Most of the respondents are passive
157 smokers who do sufficient physical activity. Most of the respondents are passive smokers who
158 do not excessive sedentary behavior (69,20%). Most of them have no history of diabetes in the
159 family (60,58%) and also a history of hypertension (71,15%).

160 **Table 1. Characteristics of the Sample (Passive Smokers Patients) at the X Hospital in**
161 **Surabaya in 2019**

Characteristics	n = (Total Sample)	%
Age (Year)		
18 -45	46	44.23

≥ 46	58	55.77
Gender		
Male	20	19.23
Female	84	80.77
Education		
Not in School/ Elementary School	31	29.81
Junior High School	17	16.35
High School	33	31.73
College	23	22.11
Occupation		
Unemployed	48	46.15
Employed	56	53.85
Physical Activity		
Not Enough	19	18.30
Enough	85	81.7
Sedentary Lifestyle		
≥ 6 hours	32	30.80
< 6 hours	72	69.20
Income		
> Minimum Wage	34	32.70
< Minimum Wage	70	67.30
Genetic		
Yes	41	39.42
No	63	60.58
Hypertension		
Yes	30	28.85
No	74	71.15

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Table 2. Results of Bivariate Analysis of Type-2 Diabetes Mellitus Incidence in Passive Smokers

Variable	Disease Incidence X				<i>p</i> -value	OR value (95%CI)
	Yes		No			
	n	%	n	%		
Age (Year)						
18 -45	4	7.7	43	82.7	<0.001	57.3 (16.4-199.6)
≥ 46	48	92.3	9	17.3		
Gender					0.082	2,825 (0.99-8.059)
Male	14	26.9	6	11.5		
Female	38	73.1	46	88.5		
Education					<0.001	8,09 (2.268 -28.853)
Not in School/ Elementary School	26	50	5	9.6		
Junior High School	5	9.6	12	23.1	>0.05	0.65 (0.170-2.470)

High School	12	23.1	21	40.4		0.89 (0.297-2.663)
College	9	17.3	14	26.9		1
Occupation						
Unemployed	26	50	22	42.3		1.364
Employed	26	50	30	57.7	0.555	(0.629-2.955)
Physical Activity						
Not Enough	14	26.9	5	9.6		3.463
Enough	38	73.1	47	90.4	0.042	(1.1145-10.477)
Sedentary Lifestyles						
≥ 6 hours	15	28.8	17	32.7		0.835
< 6 hours	37	71.2	35	67.3	0.832	(0.362-1.922)
Income						
> Minimum Wage	35	67.30	35	67.30		1.000
< Minimum Wage	17	32.70	17	32.70	1.000	(0.441-2.269)
Genetic						
Yes	23	44.23	18	34.52		0.668
No	29	55.77	34	65.38	0.422	(0.303-1.472)
Hypertension						
Yes	30	57.69	0	00.00		0.423
No	22	42.31	52	100.00	<0,001	(0,308-0,581)

165 Notes: OR: Odd Ratio; CI: Confidence Interval; *Variables that were significantly related, p-value < 0.05

166 Based on table 2, it shows the distribution of study participants according to the presence of
167 incidence of T2DM in passive smokers. Bivariate analysis showed that variable age (p value =
168 <0,001, OR= 57,3), education not in school/elementary school graduated (p value = <0,001,
169 OR= 8,09), physical activity (p value = <0,042, OR= 3,463), and hypertension (p value =
170 <0,001, OR= 0,423) were significantly correlated with the incidence of T2DM in passive
171 smokers. It shows too that variable gender, junior high school graduated, senior high school
172 graduated, college graduated, occupation, sedentary lifestyles, income, and genetic were not
173 significantly correlated with the incidence of T2DM in passive smokers (p value >0,05).

174 **Table 3. Multivariate Analysis of Variable Associated with Type-2 Diabetes Mellitus**
175 **Incidence in Passive Smokers**

Variables	β	p	OR	95% Confidence Interval
Step 1 ^a Age	3.992	.001	54.143	4.866 - 602.418
Gender	-3.035	.013	.048	.004 - .521

	Physical Activity	.841	.507	2.318	.193 - 27.793
	Education	.098	.954	1.103	.039 - 30.904
	Hypertension	22.747	.997	7566889697.486	.000
	Constant	-27.384	.996	.000	
Step 2 ^a	Age	4.010	.000	55.122	12.218 - 248.673
	Gender	-1.519	.077	.219	.041 - 1.178
	Physical Activity	1.482	.123	4.404	.668 - 29.029
	Education	.680	.506	1.974	.266 - 14.631
	Constant	-7.800	.001	.000	
Step 3 ^a	Age	4.301	.000	73.768	17.635 - 308.569
	Gender	-1.317	.137	.268	.047 - 1.518
	Physical Activity	1.465	.108	4.327	.724 - 25.882
Step 4 ^a	Age	4.189	.000	65.987	16.975 - 256.509
	Physical activity	1.694	.058	5.442	.943 - 31.389
	Constant	-9.014	.000	.000	
Step 5 ^b	Age	3.937	.000	51.250	9.360 - 280.613
	Physical activity	1.506	.145	4.509	.595 - 34.199
	Hypertension	21.503	.997	2180215011.610	.000
	Constant	-29.018	.997	.000	-

Notes :

a. Variable(s) entered on step 1: Age, Physical activity, Education, hypertension, gender.

b. Variable(s) entered on step 5: hypertension.

176

177 **Table 4. Multivariate Final Model of Variable Associated with Type-2 Diabetes Mellitus**
178 **Incidence in Passive Smokers**

Variables	β	p	OR	95% Confidence Interval
Age	3.937	.000	51.250	9.360 – 280.613
Gender	-1.317	.137	.268	.047 – 1.518
Physical Activity	1.506	.145	4.509	.595 – 34.199

179

180

181 Based on Table 4, variable age, gender, and physical activity were significant with the

182 incidence of type 2 diabetes mellitus with p value < 0.25. Multivariate analysis was applied to

183 determine the dominant factors of T2DM incidence in passive smokers. Backward Wald method

184 is carried out on all independent variables that meet the requirements included in the model.

185 Variables that are not significant are excluded gradually, starting from the variable with the

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186 highest p value. In Table 4, the age variable (p-value= 0.000) is a factor that is significantly
187 related to T2DM incidence in passive smokers after being controlled with age, gender, education,
188 hypertension, and physical activity. The final stage of logistic regression results obtained
189 variable age as the most important risk factor for T2DM incidence in passive smoker (OR=
190 51,520, 95% confidence interval [CI]= 9,360-280,613).

191
192
193

Discussion

194 The majority of respondents with Type-2 Diabetes Mellitus and passive smokers are >45
195 years old (54.8%) with p value = <0.001 which means that there is a significant relationship
196 between age in passive smoking and the incidence of Type-2 Diabetes Mellitus. classified as
197 elderly (elderly). Along with increasing age, the risk of diabetes mellitus and heart disease
198 increases.¹⁵ This is in accordance with the results of a report from the IDF in 2017 which stated
199 that as long as the increasing age, the prevalence of Diabetes Mellitus also get higher.¹⁶ This is
200 because Diabetes Mellitus often appears after a person enters a vulnerable age, especially after
201 the age of 45 years and those who are overweight, so that the body is no longer sensitive to
202 insulin. The aging process results in changes in the body's anatomical, physiological and
203 biochemical systems that can cause insulin resistance. This condition will get worse if it is
204 accompanied by complications of other diseases, especially in the elderly group.¹⁷ As we age, the
205 body's metabolism slows down naturally, which causes decreased physical activity. Low
206 mobility will speed up the replacement of muscle mass with body fat. This condition can lead to
207 obesity, which is one of the risk factors for Type-2 Diabetes Mellitus.

208 The majority of respondents with Type-2 Diabetes Mellitus had no education/graduated from
209 elementary school (50%). The results of data processing also showed that the level of education
210 that did not go to school/graduated from elementary school was related to the incidence of Type-

211 2 Diabetes Mellitus ($p = <0.001$). Meanwhile, respondents with junior high and senior high
212 education levels had a p value of > 0.05 so that there was no significant relationship between
213 junior high school, senior high school, and Universities education levels than those with no
214 education level/graduated from elementary school. This is in accordance with previous research
215 by Irawan (2010) which stated that people with a low level of education were 1.27 times at risk
216 of suffering from DM than people with higher education.¹⁸ Although elementary and junior high
217 school education levels are included in the type of basic education, both have differences in
218 terms of level of competence and knowledge taught. The level of education is believed to be an
219 important factor for someone to be able to understand the management of blood sugar control,
220 overcome symptoms that arise with appropriate treatment and prevent complications generally
221 related to knowledge. Patients with high education are believed to have better knowledge about
222 diabetes and its effects on health compared to low education, so sufferers will respond in a
223 positive way and will try to recover.¹⁹

224 This study also revealed that physical activity is associated with the incidence of Type-2 DM
225 in passive smokers (p value = 0.042). This shows that there is a significant relationship between
226 physical activity of passive smoking and the incidence of Type-2 DM. In the physical activity
227 variable, the OR value is 3.4. This shows that people with less physical activity have a 3.4 times
228 greater risk of Type-2 DM than people with sufficient physical activity. From these data, it was
229 found that most of the respondents were passive smokers who did sufficient physical activity.
230 These results are the same as the research by Sipayung, Siregar and Nurmaini which showed
231 82.8% of the 120 respondents did sufficient physical activity.

232 Absorption of glucose by body tissues at rest requires insulin, whereas in active muscles,
233 although the need for glucose increases, it is not accompanied by an increase in insulin levels.

234 This is because when a person is physically active, there is an increase in insulin receptor
235 sensitivity in active.²⁰ The condition of insulin resistance results in glucose not being able to
236 enter the cells. When a person does physical activity, there will be muscle contractions. This can
237 make it easier for glucose to enter cells, so that when a person is physically active, there will be a
238 decrease in insulin resistance and will ultimately reduce blood sugar levels.²⁰ Based on the
239 research of Siti Cholishotul Himmah et al (2020) at the Aulia Jombang Clinic, it was found that
240 physical activity was an influential variable with Type-2 Diabetes Mellitus.²¹ Patients who had
241 high physical activity experienced the greatest decrease in sugar levels, namely a decrease of
242 53.6 mg/dl. Decrease in blood sugar levels in patients who have moderate physical activity by
243 6.73mg/dl. While the decrease in blood sugar levels in patients who have low physical activity is
244 4.3 mg/dl.²¹

245 From this study we also know that no hypertension has the significant (p value = <0,001,
246 OR= 0,423) relationship with the T2DM in passive smokers. It can maybe occur, because most
247 of the case group has the hypertension history (57,69%). These results are the same as the study
248 conducted by Nainggolan, Olwin, et al (2011) which stated that hypertension was significantly
249 associated with the incidence of T2DM (p = 0.00). Respondents with no hypertension have
250 protective value 0,423 times compared to those with hypertension for diabetes. Hypertension is a
251 factor that causes DM disease.²² Hypertension and DM are health problems that are closely
252 related and both need to be handled carefully. high blood pressure causes the distribution of
253 sugar blood in the cells do not run optimally, so that occur accumulation of sugar and cholesterol
254 in the blood. The point is if blood pressure is good, sugar blood will also be awake. Insulin acts
255 as a substance controlling blood pressure and water levels in the body, so that insulin levels are
256 enough to maintain blood pressure (Alfiyah, 2011).

257 Meanwhile, the gender variable did not have a significant relationship with the incidence of
258 Type-2 DM in passive smokers. However, the table shows that the majority of respondents are
259 female passive smokers, as many as 84 people (80.8%) of respondents. The actual results in the
260 field show that there are more women affected by Type-2 Diabetes Mellitus than men. In
261 addition, the p value is almost close to significant (p value = 0,082) indicating that there is a
262 possible relationship between the gender of passive smokers and the incidence of Type-2
263 Diabetes Mellitus. This result is also in accordance with several previous studies, namely
264 Nordstrom (2016) which stated that the prevalence of Type-2 Diabetes Mellitus in males was
265 higher larger than women.²³ The IDF report in 2017 stated that the prevalence of Type-2
266 Diabetes Mellitus in the world in the male sex was greater than the female gender.¹⁵

267 The results of data processing also shows that some variables are not associated with the
268 incidence of Diabetes Mellitus Type 2. Like the occupation of passive smokers (p = 0.431), The
269 sedentary behavior excessive (≥ 6 hours) in passive smokers with the incidence of Type 2
270 Diabetes Mellitus (p = 0.832). The income of passive smokers (p = 1,000), and the genetic of
271 passive smoker (p = 0,422).

272 The results showed that age is a major factor contributing to T2DM incidence in passive
273 smokers at X Hospital in Surabaya in 2019. It was found that respondents who were over 45
274 years of age and a passive smoker had an 51,52 times higher risk of developing type 2 diabetes
275 mellitus compared to those who were under 45 years of age and were passive smokers (OR=
276 51,520, 95% CI= 9,360-280,613). American Diabetes Association (ADA) (2011) stated that risk
277 Type 2 diabetes mellitus increases with age. Mechanism underlying higher risk type 2 diabetes
278 mellitus in individuals who being older is increase in body fat composition which accumulates in
279 the abdomen, so that lead to central obesity. Central obesity further triggers occurrence of insulin

280 resistance is the initial process of diabetes mellitus type 2 (Suastika et al, 2012). WHO also
281 stated that after a person reaches the age of 40 years, blood glucose levels rise 1-2 mg% per year
282 during fasting and will rise approximately 5.6 – 13 mg% at 2 hours after eating. From that, it's
283 not surprising if the age factor is a major factor in the occurrence of increasing prevalence of
284 diabetes mellitus especially type II and impaired tolerance glucose.²⁴

285 Based on previous research conducted by Wei, et al (2014), it can be concluded that passive
286 smoking is also one of the risks of T2DM.²⁵ The research by Pan, et al (2015) stated that both
287 active and passive smoking are associated with significantly increased risks of type 2 diabetes.
288 The risk of diabetes is increased in new quitters, but decreases substantially as the time since
289 quitting increases.²⁶ Therefore, interventions to prevent exposure to secondhand smoke remain
290 an urgent priority.²⁷

291 However, in conducting this research, there are still some limitations. The limitations of the
292 study include the absence of data regarding the length of exposure to passive smokers who have
293 co-workers who smoke, so that it cannot be seen that there is an influence of the variable length
294 of exposure with the age of the respondent when it is associated with the incidence of Type-2
295 DM.

296 **Conclusion**

297 From the results of the above discussion, it can be concluded that age is the most dominant
298 risk factor of T2DM incidence in passive smokers. People with age >45 years old are having 57
299 times risk of developing Type-2 DM than the age of 18-45 years. The aging process results in
300 changes in the body's anatomical, physiological and biochemical systems that can cause insulin
301 resistance. This condition will get worse if it is accompanied by complications of other diseases,
302 especially in the elderly group.

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303 The level of education in passive smokers relate to the incidence of Type-2 Diabetes
304 Mellitus. The level of education of passive smoker respondents that does not go to
305 school/graduated from elementary school has a risk of developing Type-2 DM 8.09 times than
306 the level of college education. Physical activity in passive smokers has relationship with the
307 incidence of Type-2 Diabetes Mellitus. Less physical activity in passive smokers rises the risk of
308 developing Type-2 Diabetes Mellitus 3.463 times than sufficient physical activity. Respondents
309 with no hypertension have protective value 0,423 times compared to those with hypertension for
310 diabetes. Meanwhile, there is no relationship between the gender, occupation, and sedentary
311 lifestyles of passive smoking and the incidence of Type-2 DM at X Hospital in Surabaya in
312 2019.

313 According to the results, the following suggestions are given by researchers for the Surabaya
314 City government to reduce the incidence of Type-2 DM. First, the government is expected to
315 improve the health promotion and education programs about the effects of smoking, especially
316 related to passive smokers who are affected by exposure of cigarette smoke and age above >45
317 or among the elderly. Second, increasing and activating the efforts for the establishments of Non-
318 Smoking Areas in various public places and facilities. Third, always aggressively and actively
319 socializing CERDIK behavior (regular health checks, getting rid of cigarette smoke, diligent
320 activity, balanced diet, getting enough rest, managing stress) to the wider community to increase
321 awareness of Diabetes Mellitus. And finally, providing sports facilities or jogging tracks in every
322 area such as parks or green open areas so that people, especially passive smokers, can be
323 motivated to do physical activity.

324 **Abbreviations**

325 ATP : Adenosine triphosphate

326 DM : Diabetes Mellitus

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327 GPAC : Global Physical Activity Questionnaire

328 nAChR : Nicotinic Acetylcholine Receptor

329 ROS : Oxidative Stress

330 T2DM : Type-2 Diabetes Mellitus

331 WHO : World Health Organization

332

333 **Ethics Approval and Consent to Participate**

334 This research was approved by the ethics committee of RSUD dr. Soetomo Surabaya with letter
335 number 0727/KEPK/X/2018 and has received research permission from X Hospital in Surabaya,
336 all subjects in the study also agreed to be respondents.

337 **Competing Interest**

338 We declare no competing interests.

339 **Availability of Data and Materials**

340 All data set generated and analysis are available in the article.

341 **Authors' Contribution**

342 SM designed the study and wrote the protocol. All authors did the study. SM supervised all the
343 steps in the review process. All authors interpreted the findings. ART and RDN drafted the
344 manuscript. SM supervised the writing. KDA, SW, RDN, provided feedback.

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347 **References**

- 348 1. Siegel JD, Rhinehart E, Jackson M, Chiarello L. Guideline for isolation precautions:
349 Preventing transmission of infectious agents in healthcare settings 2007. Hosp Infect.
350 2009;1–232.

Commented [j10]: Write neatly, please.
Provide the URL/link for each references.

- 351 2. Tjandrawinata RR. Patogenesis Diabetes Tipe 2 : Resistensi Defisiensi Insulin. Dexa
352 Medica. 2016;(February):1–4.
- 353 3. Organization WH. Global Report on Diabetes. 2016.
- 354 4. Colussi GL, Da Porto A, Cavarape A. Hypertension and type 2 diabetes: lights and
355 shadows about causality. J Hum Hypertens [Internet]. 2020;34(2):91–3. Available from:
356 <http://dx.doi.org/10.1038/s41371-019-0268-x>
- 357 5. Nordström A, Hadrévi J, Olsson T, Franks PW, Nordström P. Higher prevalence of type 2
358 diabetes in men than in women is associated with differences in visceral fat mass. J Clin
359 Endocrinol Metab. 2016;101(10):3740–6
- 360 6. Chung GKK, Lai FTT, Yeoh EK, Chung RYN. Gender-specific trends of educational
361 inequality in diagnosed diabetes from 1999 to 2014 in Hong Kong: a serial cross-sectional
362 study of 97,481 community-dwelling Chinese adults. Popul Health Metr [Internet].
363 2021;19(1):1–9. Available from: <https://doi.org/10.1186/s12963-021-00268-x>
- 364 7. Organization WH. Global recommendations on physical activity for health. 2010.
- 365 8. Kowall B, Rathmann W, Strassburger K, Heier M, Holle R, Thorand B, et al. Association
366 of passive and active smoking with incident type 2 diabetes mellitus in the elderly
367 population: The KORA S4/F4 cohort study. Eur J Epidemiol. 2010;25(6):393–402.
- 368 9. Kemenkes RI. Laporan Riset Kesehatan Dasar Indonesia 2018 [Internet]. Riskesdas 2018.
369 2018. p. 182–3. Available from: [https://www.litbang.kemkes.go.id/laporan-riset-](https://www.litbang.kemkes.go.id/laporan-riset-kesehatan-dasar-riskesdas/)
370 [kesehatan-dasar-riskesdas/](https://www.litbang.kemkes.go.id/laporan-riset-kesehatan-dasar-riskesdas/)
- 371 10. Kemenkes RI. Laporan Riset Kesehatan Dasar Indonesia 2013. Riskesdas 2013 [Internet].
372 2013; Available from: [https://www.litbang.kemkes.go.id/laporan-riset-kesehatan-dasar-](https://www.litbang.kemkes.go.id/laporan-riset-kesehatan-dasar-riskesdas/)
373 [riskesdas/](https://www.litbang.kemkes.go.id/laporan-riset-kesehatan-dasar-riskesdas/)

- 374 11. Fitriyani. Universitas Indonesia Faktor Risiko Diabetes Melitus Tipe 2 Di Puskesmas
375 Kecamatan Citangkil Dan Puskesmas Kecamatan Pulo Merak , Kota Cilegon Universitas
376 Indonesia Faktor Risiko Diabetes Melitus Tipe 2 Di Puskesmas Kecamatan Pulo Merak ,
377 Fakt Resiko Diabetes Melitus TIPE 2 DI Puskesmas. 2012;1–102.
- 378 12. Yoshikawa H, Hellström-Lindahl E, Grill V. Evidence for functional nicotinic receptors
379 on pancreatic beta cells. *Metabolism*. 2005 Feb;54(2):247–54.
- 380 13. Xie X, Liu Q, Wu J, Wakui M. Impact of cigarette smoking in type 2 diabetes
381 development. 2009;30(6):784–7.
- 382 14. Morimoto A, Tatsumi Y, Deura K, Mizuno S, Ohno Y, Watanabe S. Impact of cigarette
383 smoking on impaired insulin secretion and insulin resistance in Japanese men : The Saku
384 Study. 2013;4(3).
- 385 15. Purnama A, Sari N. Aktivitas Fisik dan Hubungannya dengan Kejadian Diabetes Mellitus.
386 *Wind Heal J Kesehat*. 2019 Oct;2(4):368–81.
- 387 16. Nam Han Cho (chair) dkk. Eighth edition 2017. *IDF Diabetes Atlas, 8th edition*. 2017. 1–
388 150 p.
- 389 17. Rosyada A dkk. Determinan Komplikasi Kronik Diabetes Melitus pada Lanjut Usia
390 Determinan of Diabetes Mellitus Chronic Complications on Elderly. *J Kesehat Masy Nas*.
391 2013;7:395–401.
- 392 18. Irawan D. Prevalensi Dan Faktor Risiko Kejadian Diabetes Melitus Tipe 2 Di Daerah
393 Urban Indonesia (Analisa Data Sekunder Riskesdas 2007). Universitas Indonesia; 2010.
- 394 19. Pahlawati A, Nugroho PS, Kalimantan timur UM, Melitus D. Hubungan Tingkat
395 Pendidikan dan Usia dengan Kejadian Diabetes Melitus di Wilayah Kerja Puskesmas
396 Palaran Kota Samarinda Tahun 2019. 2019;2030:1–5.

- 397 20. Paramitha GM. Hubungan Aktivitas Fisik Dengan Kadar Gula Darah Pada Pasien
398 Diabetes Melitus Tipe 2 di Rumah Sakit Umum Daerah Karanganyar. 2014.
- 399 21. Himmah SC, Irawati DN, Triastuti N, Ambar NS. Pengaruh Pola Makan Dan Aktifitas
400 Terhadap Penurunan Kadar Gula Pada Pasien Diabetes Melitus Tipe 2 di Klinik Aulia
401 Jombang. 2020;7(1).
- 402 22. Nainggolan O, Kristanto AY, Edison H. Determinan Diabetes Melitus Analisis Baseline
403 Data Studi Kohort Penyakit Tidak Menular Bogor 2011. *Bul Penelit Kesehat.*
404 2013;16(2):331–9.
- 405 23. Nordström A, Hadrévi J, Olsson T, Franks PW, Nordström P. Higher Prevalence of Type
406 2 Diabetes in Men Than Visceral Fat Mass. 2016;101(October):3740–6.
- 407 24. Organization WH, Federation ID. Definition and diagnosis of diabetes mellitus and
408 intermediate hyperglycaemia : report of a WHO/IDF consultation. *World Health*
409 *Organization*; 2006. p.
- 410 25. Wei X, E. M, Yu S. A meta-analysis of passive smoking and risk of developing Type 2
411 Diabetes Mellitus. *Diabetes Res Clin Pract* [Internet]. 2015;107(1):9–14. Available from:
412 <http://dx.doi.org/10.1016/j.diabres.2014.09.019>
- 413 26. Pan A, Wang Y, Talaei M, Hu FB, Wu T. Relation of active, passive, and quitting
414 smoking with incident type 2 diabetes: A systematic review and meta-analysis. *Lancet*
415 *Diabetes Endocrinol* [Internet]. 2015;3(12):958–67. Available from:
416 [http://dx.doi.org/10.1016/S2213-8587\(15\)00316-2](http://dx.doi.org/10.1016/S2213-8587(15)00316-2)
- 417 27. Zhu B, Wu X, Wang X, Zheng Q, Sun G. The association between passive smoking and
418 type 2 diabetes: A meta-analysis. *Asia-Pacific J Public Heal.* 2014;26(3):226–37.
- 419