



## Cigarettes and Its Effects on Health

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### ABSTRACT

**Background:** One of the biggest challenges in the world of health is the problem of smoking. In 2018, there was an increase in smokers at the age of 10-18 years by 9.1% compared to 2013, which was 7.2%. It is feared that the increasing number of smokers at a young age will increase the number of non-communicable diseases (NCD) at a young age. **Methods:** Writing this article uses the method of literature searching from various sources of information including e-books, websites and search engines. The e-books used contain cigarette information and its effects on health, the websites used are the website of the government and WHO to search for prevalence data and other information, and the search engines used are Google Scholar and Pubmed to search information on cigarette content research and its effects on health. **Discussion:** The content of cigarettes can cause various side effects in almost all organs of the body. Various studies have found that smoking is a risk factor for NCD. **Conclusion:** Cessation of smoking can save sufferers and also save people around smokers. When a smoker starts quitting smoking, the body will undergo the process of cleaning up toxic substances of cigarettes that have entered the body.

**Keywords:** cigarette, literature searching, NCD

### ABSTRAK

**Latar Belakang:** Salah satu tantangan terbesar dalam dunia kesehatan ialah masalah rokok. Pada tahun 2018, terjadi peningkatan perokok pada usia 10-18 tahun sebesar 9,1% dibandingkan pada tahun 2013 sebesar 7,2%. Peningkatan jumlah perokok di usia muda ini dikhawatirkan akan meningkatkan jumlah Penyakit Tidak Menular (PTM) di usia muda. **Metode:** Penulisan artikel ini menggunakan metode pencarian literatur dari berbagai sumber informasi berupa e-book, website dan search engine. E-book yang dipakai memuat informasi rokok dan pengaruhnya ke kesehatan, website yang dipakai adalah website pemerintah dan WHO untuk pencarian data prevalensi dan informasi lainnya, dan search engine yang dipakai adalah Google Scholar dan Pubmed untuk pencarian informasi penelitian kandungan rokok dan pengaruhnya kepada kesehatan. **Pembahasan:** Dari hasil pencarian, kandungan pada rokok dapat menimbulkan berbagai efek samping hampir di seluruh organ tubuh. Berbagai penelitian mendapatkan bahwa kebiasaan merokok merupakan faktor risiko terjadinya PTM. **Kesimpulan:** Penghentian kebiasaan merokok ini dapat menyelamatkan penderitanya dan juga menyelamatkan orang di sekitar perokok. Ketika seorang perokok mulai berhenti untuk merokok, maka tubuh akan melakukan proses pembersihan dari zat racun pada rokok yang sudah masuk ke dalam tubuh.

**Kata kunci:** rokok, PTM, pencarian literatur

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### INTRODUCTION

The problem of smoking is a challenge in the world of health that cannot be denied. Data from the World Health Organization (WHO) estimates that there are 1.1 billion smokers worldwide, 80% of whom live in countries with lower middle income.<sup>[1]</sup> In 2018, in Indonesia, there will be an increase

in the number of smokers from the age of 10-18 years, from 7.2% in 2013 to 9.1%.<sup>[2]</sup>

It is feared that the increasing number of smokers at a young age will lead to more human resources who are at risk of developing non-communicable diseases (NCDs). Smoking is closely related to the occurrence of various lung diseases. More than 80% of the incidence of Chronic

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Obstructive Pulmonary Disease (COPD) in the United States is caused by smoking.<sup>[3]</sup> Also, smoking habits cause other NCDs such as hypertension, stroke, heart disease to cancer.

NCDs incident is closely related to the chemical content contained in cigarettes. Various studies have shown that smoking can be a risk factor for NCDs. It is estimated that smoking increases the risk of coronary heart disease about 2-4 times, stroke 2-4 times, lung cancer 25 times in men, and 25.7 times in women. Besides, smoking can lead to an increased risk of type 2 diabetes mellitus by 30% -40%.<sup>[4]</sup>

Side effects from smoking are not only about the smoker (active smoker); people around smokers also get the impact. To prevent this smoking habit, cooperation from various parties, including government, medical staff, the communities, and religious leaders, are needed. This article was written to describe the health effects caused by smoking.

## METHODS

The method for writing this article is through literature searching. Information is sought from various sources, namely from e-books, websites, and search engines. The book used is a book that has a discussion chapter on cigarettes. The site used is the Ministry of Health and WHO (for finding prevalence data and other information). Search engines used are Pubmed and Google Scholar.

## DISCUSSION

### Epidemiology of Smoking

Globally, there has been a decline in the number of smokers over the age of 15 from 23.5% in 2007 to 20.7% in 2015.<sup>[5]</sup> There are several factors related to the decrease in the prevalence of smokers, namely increases in tobacco taxes and prices, anti-tobacco campaigns, access to services to stop using tobacco, and

government regulations regulating tobacco products.<sup>[6]</sup> The prevalence of smokers in Indonesia has increased from 7.2% in 2013 to 9.1% in 2018 in smokers aged 10-18 years.<sup>[2]</sup>

Every year, more than 7 million deaths are caused by cigarette use, and 1.2 million are non-smokers exposed to cigarette smoke.<sup>[1]</sup> A smoker's life expectancy is ten years shorter than someone who has never smoked.<sup>[7]</sup> In reducing the number of smokers in Indonesia, the government seeks to make various health counseling, anti-smoking campaigns, regulate cigarette advertisements, and increase cigarette excise tax by 23% and retail price by 35%.<sup>[8]</sup> This effort can help reduce the number of smokers in Indonesia.

### Chemical Substances in Cigarettes

Since 1950, there has been an identification of the chemical components in tobacco.<sup>[9]</sup> Until now, almost 7,000 chemical compounds have been identified in cigarette smoke. Of the 7,000 chemical compounds, 69 of them are known to be carcinogenic.<sup>[10]</sup> Carcinogenic compounds are present in cigarette smoke such as acetaldehyde, arsenic, benzene, cadmium, ethylene oxide, formaldehyde, polonium nickel (Figure 1).<sup>[11]</sup> Smoking is enjoying burned nicotine.

Nicotine is a specific organic compound contained in tobacco leaves. If we smoke nicotine, it will cause psychological stimulation of addiction. In addition to nicotine, the additives, flavoring, and aroma of cigarettes are also formed to fulfill the tastes of consumers (smokers). Currently, several types of cigarettes have been equipped with filters to reduce tar and nicotine levels.<sup>[12]</sup> Even though you have used a filter, this does not mean that cigarettes will be safe for consumption, as some chemicals can still pass through the filter. Table 1 and Table 2 describe some cigarette compounds that can penetrate and be caught by the filter.



**Figure 1.** Illustration of the chemical substance in cigarettes<sup>[13]</sup>

**Table 1.** The main chemical component of smoke caught in Cambridge filters<sup>[12]</sup>

Compound	$\mu\text{g}/\text{cigarette}$
Nicotine	100-3000
Solanesol	600-1000
Total nonvolatile HC*	300-400
Catechol	200-400
Dihydroxybenzenes	200-400
Neophytadienes	200-350
Benzofuranes	200-300
Linoleic acid	150-250
Acetic acid	100-150
Phenol	80-160
Normikotine	5-150
Oleic acid	40-110
n-Hentriacontane	100
Lactic acid	60-80
Stearic acid	50-75
Cyclones	40-70
Limonene	30-60
Bipyridils	10-30
Scopoletin	15-30
Skatole	12-16

\*HC: Hydrocarbon

**Table 2.** The main chemical component of smoke that passes through the Cambridge filter<sup>[12]</sup>

Compound	Concentration/cigarette
Nitrogen	120-280 mg
Oxygen	50-70 mg
Carbon dioxide	45-65 mg
Carbon monoxide	14-23 mg
Water	7-12 mg
Argon	5 mg
Methane	1,0-2,0 mg
Hydrogen	0,5-1,0 mg
Acetaldehyde	400-1400 µg
Nitrogen Oxide	100-680 µg
Acetone	100-650 µg
Formic acid	200-600 µg
Hydrogen cyanide	400-500 µg
Propionic acid	100-300 µg
Acetonitrile	100-150 µg
Pyridine	20-200 µg
Acrolein	60-140 µg
Ammonia	10-130 µg
Formaldehyde	20-100 µg
Methanol	80-100 µg

### General Disease Manifestations Due to Smoking

Smoking can increase the risk of various diseases. The ratio of smoking-related conditions compared to non-smokers (relative risk) is higher at a young age, especially in types of stroke and coronary artery disease.<sup>[14]</sup> Common diseases often caused by smoking are described in Table 3. From 1965-2014, more than 20 million Americans died due to chronic conditions caused by smoking or as passive smokers, and complications due to smoking during pregnancy (Table 4).

The mechanism of chemical compounds in cigarettes in causing various side effects is a series of multiple stages. Toxic compounds and free radicals in cigarettes can trigger oxidative stress, inflammation to DNA damage that can trigger cancer. These chemical compounds can be taken by the body from the lungs and circulated in the bloodstream to reach almost the entire body.<sup>[6]</sup>

- Smoking and cancer

Smoking is the most significant risk factor for cancer triggers due to 30% of deaths in cancer patients.<sup>[3]</sup> Various carcinogenic substances found in cigarettes. This carcinogenic substance can bind to DNA, causing mutations. If the body cannot repair this mutation, it will become cells that grow out of control and become cancerous.<sup>[6]</sup>

These substances in cigarettes also induce mutations in p53 protein.<sup>[3]</sup> This p53 protein plays an essential role in regulating cell division and death. Mutations in this protein will cause uncontrolled cell growth that triggers cancer. The nicotine content can influence the occurrence of disease by activating angiogenesis, cell growth, and invasion of cancer cells.<sup>[15]</sup>

- Smoking and lung

Cigarette smoke can invite cytotoxic cells and inflammatory cells to trigger a pro-inflammatory effect on

**Table 3.** The relative risk of illness due to smoking<sup>[14]</sup>

Diseases	Smokers	
	Males	Females
Coronary heart disease		
Age 35-64	2.8	3.1
Age ≥65	1.5	1.6
Cerebrovascular disease		
Age 35-64	3.3	4
Age ≥65	1.6	1.5
Aortic aneurysm	6.2	7.1
Cancer		
Lung	23.3	12.7
Larynx	14.6	13
Lip, oral cavity, pharynx	10.9	5.1
Esophagus	6.8	7.8
Bladder	3.3	2.2
Kidney	2.7	1.3
Pancreas	2.3	2.3
Stomach	2	1.4
Liver	1.7	1.7
Colorectal	1.2	1.2
Cervix		1.6
Acute myeloid leukemia	1.4	1.4
Sudden infant death syndrome		2.3
Infant respiratory distress syndrome		1.3
Low birth weight at delivery		1.8

**Table 4.** Total death caused by smoking and exposure to secondhand smoke (1965-2014)<sup>[6]</sup>

Cause of death	Total
Cancer	6.587.000
Metabolic and cardiovascular diseases	7.787.000
Pulmonary diseases	3.804.000
Perinatal conditions	108.000
Lung cancer in secondhand smoke	263.000
Coronary heart disease in secondhand smoke	2.194.000

nasal epithelial cells, which will increase the production of Reactive Oxygen Species (ROS), Toll-like Receptor-4 (TLR-4), lipopolysaccharides and IL-17A synthesis. Moreover, cigarette smoke causes mucous hypersecretion so that the mucus cleaning process will be disrupted.<sup>[17]</sup> Smoking decreases immunoglobulin levels in the circulation, decreases CD4<sup>+</sup> lymphocytes, and decreases phagocyte

activity. This process makes smokers become more easily infected. This immunological disorder will recover within six weeks when smokers stop smoking.<sup>[3]</sup>

- Smoking and cardiovascular

Cigarettes have the property to cause inflammation. Smoking is associated with an increased risk of atherosclerotic plaque. This plaque formation is characterized by an inflammatory reaction and an increase

in the expression of matrix metalloproteinases. The pro-inflammatory effect occurs in not only an active smoker but also a passive smoker.<sup>[16]</sup>

- Smoking and pregnancy

The content of cigarettes can harm the fetus. Smoking habits during pregnancy are associated with the incidence of Low Birth Weight (LBW). This relates to the carbon monoxide (CO) due to the cigarette burning process, which can bind strongly to hemoglobin. A strong bond of CO with hemoglobin will reduce oxygen transport to the fetus, causing hypoxia in the fetus and LBW.<sup>[6,18]</sup> Also, smoking during pregnancy is a risk factor for ectopic pregnancy. The content of cotinine (active nicotine metabolite) increases the expression of prokinetic (PROKR1) in the fallopian tubes. This process disrupts fallopian contractility and triggers ectopic pregnancy.<sup>[19]</sup>

- Visit smoke-free places such as houses of worship, libraries or other places
- Look for a substitute for smoking like gum, with the consumption of gum is expected to forget the smoking habit
- Busy after eating. Most smokers after eating will start smoking again, so when you finish eating, try to busy yourself to forget about smoking
- Consult a doctor. The doctor will prescribe drugs that can replace the effects of opium from nicotine to reduce tobacco frequently. Currently, the medications used to help stop smoking are nicotine, bupropion, and varenicline.<sup>[3]</sup>

When smoking is stopped, the body will start a toxic disposal response and improve bodily functions. The effects of smoking cessation can be seen in Table 5.

### Tips for Quitting Smoking

Quitting smoking is not easy to do for smokers because nicotine addiction is one of the obstacles to quitting smoking. Quitting smoking is not impossible. Here are the ways you can stop smoking.<sup>[20]</sup>

- Strong inner determination. Consider first to make a list of reasons to stop smoking to sustain the determination
- Think positive, and be sure to quit smoking successfully. Give a reward to yourself when the money is usually used for cigarettes and can now be used to buy favorite things
- Set a target time. Never immediately stop smoking. Try to reduce smoking habits slowly
- Give support to stop smoking, especially from the smoker's family and friends
- Look for activities to keep yourself busy. Activities such as worship, exercise, work can reduce the desire to smoke

**Table 5.** Benefits of quitting smoking<sup>[21]</sup>

<b>Start to stop smoking</b>	<b>Benefits</b>
20 minute	Blood pressure, heart rate and peripheral blood flow improve
12 hours	Almost all nicotine in the body has been metabolized The level of carbon monoxide in the blood returns to normal
24-48 hours	Nicotine begins to be eliminated from the body. The taste and smell function starts to improve
5 days	Most of the nicotine metabolites in the body are gone. Taste/taste and odor function is much better
2-6 weeks	The risk of infection in a post-surgical wound is reduced Ciliary airway function and pulmonary function improve Shortness of breath and coughing are reduced
1 year	The risk of coronary heart disease is reduced by half compared with people who continue to smoke
5 years	The risk of stroke decreases at the same level as people who have never smoked
10 years	All causes of mortality and the risk of coronary heart disease decrease at the same level as people who have never smoked

## CONCLUSION

Until now, smoking is one of the toughest challenges in the world of health. Smoking is a risk factor from various diseases to cancer. This is due to the different chemicals contained in cigarettes that endanger health. Stopping smoking is not only saving yourself but also protecting people around smokers.

## REFERENCES

- [1] World Health Organization. Tobacco [Internet]. Geneva: World Health Organization; 2019 May [cited 2020 Jan 04]; Available from: <https://www.who.int/news-room/fact-sheets/detail/tobacco>
- [2] Kementerian Kesehatan Republik Indonesia. Hasil Utama RISKESDAS 2018. Jakarta: Kementerian Kesehatan Republik Indonesia; 2018.
- [3] Benowitz NL, Brunetta PG. Smoking hazards and cessation. In: Broaddus VC, Mason RJ, Ernst JD, King TE Jr, Lazarus SC, Murray JF, et al., editors. Murray & Nadel's textbook of respiratory medicine. 6<sup>th</sup> ed. Philadelphia: Elsevier Saunders; 2016. p. 807-13
- [4] Centers for Disease Control and Prevention. Health effects of cigarette smoking [Internet]. Atlanta, GA: Centers for Disease Control and Prevention; 2020 Apr [cited 2020 Jan 06]. Available from: [https://www.cdc.gov/tobacco/data\\_statistics/fact\\_sheets/health\\_effects/effects\\_cig\\_smoking/index.htm](https://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/effects_cig_smoking/index.htm)
- [5] World Health Organization. Monitoring tobacco use and prevention policies. Geneva: WHO; 2017.
- [6] Onor IO, Stirling DL, Williams SR, Bediako D, Borghol A, Harris MB, et al. Clinical effects of cigarette smoking: epidemiologic impact and review of pharmacotherapy options. *Int J Environ Res Public Health*. 2017;14(10):1147. doi: [10.3390/ijerph14101147](https://doi.org/10.3390/ijerph14101147)
- [7] Jha P, Ramasundarahettige C, Landsman V, Rostron B, Thun M, Anderson RN, et al. 21<sup>st</sup>-Century hazards of smoking and benefits of cessation in the United States. *N Engl J Med*. 2013;368:341-50. doi: [10.1056/NEJMsa1211128](https://doi.org/10.1056/NEJMsa1211128)
- [8] Kementerian Koordinator Bidang Pembangunan Manusia dan Kebudayaan. Pemerintah Indonesia

- perkuat komitmen penanggulangan tembakau [Internet]. Jakarta: Kementerian Koordinator Bidang Pembangunan Manusia dan Kebudayaan; 2019 Sep [cited 2020 Jan 07]. Available from: <https://www.kemerkopmk.go.id/artikel/pemerintah-indonesia-perkuat-komitmen-penanggulangan-tembakau>
- [9] Rodgman A, Perfetti TA. The composition of cigarette smoke: a catalogue of the polycyclic aromatic hydrocarbons. *Beiträge zur Tabakforschung*. 2006;22(1):13-69.
- [10] U.S. Department of Health and Human Services. How Tobacco Smoke Causes Disease: The Biology and Behavioral Basis for Smoking Attributable Disease: A Report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Diseases Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2010.
- [11] National Cancer Institute. Harms of Cigarette Smoking and Health Benefits of Quitting [Internet]; 2017 Dec [cited 2020 Jan 09]. Available from: <https://www.cancer.gov/about-cancer/causes-prevention/risk/tobacco/cessation-fact-sheet#r2>
- [12] Tirtosastro S, Murdiyati AS. Kandungan kimia tembakau dan rokok. *Buletin Tanaman Tembakau, Serat & Minyak Industri*. 2010;2(1):33-43.
- [13] Connecticut State Department of Public Health. Tobacco smoke – the dangers of secondhand smoke [Internet]. [cited 2020 Jan 10]. Available from: <https://portal.ct.gov/DPH/Health-Education-Management-Surveillance/Asthma/Tobacco-Smoke>
- [14] Burns DM. Nicotine addiction. In: Kasper DL, Hauser SL, Jameson JL, Fauci AS, Longo DL, Loscalzo J, editors. *Harrison's principle of internal medicine*. 19<sup>th</sup> ed. New York: McGraw-Hill Education; 2015. p. 2729-32
- [15] Xue J, Yang S, Seng S. Mechanism of cancer induction by tobacco-specific NNK and NNN. *Cancers (Basel)*. 2014;6(2):1138-56. doi: [10.3390/cancers6021138](https://doi.org/10.3390/cancers6021138)
- [16] Messner B, Bernhard D. Smoking and cardiovascular disease: mechanism of endothelial dysfunction and early atherogenesis. *Arterioscler Thromb Vasc Biol*. 2014;34(3):509-15. doi: [10.1161/ATVBAHA.113.300156](https://doi.org/10.1161/ATVBAHA.113.300156)
- [17] Strzelak A, Ratajczak A, Adamiec A and Feleszko W. Tobacco smoke induces and alters immune responses in the lung triggering inflammation, allergy, asthma and other lung diseases: a mechanistic review. *Int J Environ Res Public Health*. 2018;15(5):1033.
- [18] Banderali G, Martelli A, Landi M, Moretti F, Betti F, Radaelli G, et al. Short and long term health effects of parental tobacco smoking during pregnancy and lactation: a descriptive review. *J Transl Med*. 2015;13:327. doi: [10.1186/s12967-015-0690-y](https://doi.org/10.1186/s12967-015-0690-y)
- [19] Horne AW, Brown JK, Nio-Kobayashi J, Abidin HB, Adin ZE, Boswell L, et al. The association between smoking and ectopic pregnancy: why nicotine is bad for your fallopian tube. *PloS One*. 2014;9(2):e89400. doi: [10.1371/journal.pone.0089400](https://doi.org/10.1371/journal.pone.0089400)
- [20] Departemen Kesehatan Republik Indonesia. Inilah 15 tips cara berhenti merokok yang efektif [Internet]. Jakarta: Departemen Kesehatan Republik Indonesia; 2015 Nov [cited 2020 Jan 11]. Available from: <https://www.kemkes.go.id/developmant/site/layanan-kesehatan/index.php?view=print&cid=1-15112500016&id=inilah-15->

[tips-cara-berhenti-merokok-yang-efektif-](#)

- [21] Direktorat Pencegahan dan Pengendalian Penyakit Tidak Menular. Manfaat berhenti merokok [Internet]. Jakarta: Direktorat Pencegahan dan Pengendalian Penyakit Tidak Menular; 2017 May [cited 2020 Jan 12]. Available from: <https://www.p2ptm.kemkes.go.id/kegiatan-p2ptm/subdit-penyakit-paru-kronik-dan-gangguan-imunologi/manfaat-berhenti-merokok-faq>