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REVIEW OF EVIDENCE SERIES

HEALTH AND ECONOMIC COSTS OF TOBACCO IN INDONESIA

Soewarta Kosen, Hasbullah Thabrany
Nunik Kusumawardani, Santi Martini

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1. TITLE I. TOBACCO
II. COST AND COST ANALYSIS

FOREWORD

Indonesia is considered as a country with the high level of smoking prevalence that will lead to the high incidence of tobacco attributable diseases and generally belong to expensive Non-Communicable Diseases.

This situation will encourage us to further improve public policy, implement effective tobacco control program and to accelerate the formulation of more strictest law and regulation.

This Review is targeted to provide evidence and information for tobacco control planning and to suggest appropriate intervention as well as to strengthen tobacco control activities.

Herewith, I personally and as the Director General of National Institute of Health Research and Development, Ministry of Health express our appreciation to Dr. Soewarta Kosen (Scientific Commission NIHRD), Prof. Dr. Hasbullah Thabrany (School of Public Health – University of Indonesia), Dr. Santi Martini (School of Public Health – University of Airlangga) and Dr. Nunik Kusumawardani who prepared this Review.

Hopefully, the current findings in this Review will be useful in designing and strengthening effective tobacco control intervention in Indonesia and as advocacy materials for tobacco control.

Dr. Siswanto

Director General
National Institute of Health Research
and Development,
Ministry of Health Republic of Indonesia

PREFACE

Development of public policy on tobacco control at national and local levels based on current evidence is needed. Indonesia faces a challenge of Non Communicable Diseases that dominates the morbidity and mortality statistics in the last few years and threaten the community health and economic security of the country; as well as causes negative impact to the Indonesian Health System and the National Health Insurance Program.

This Review is a collaborative effort from scholars in several institutions to bring together the available information on health and economic costs from verifiable data sources, as well as from unclassified yet authentic sources, and provide a brief analysis of current country situation.

The Review is presented in Seven Chapters as follows:

Chapter 1 : Introduction – provides an overview, background and objectives of the Review

Chapter 2 : Tobacco Consumption in Indonesia - based on latest data and information from Basic Health Research (RISKESDAS), Global Youth Tobacco Survey and other sources

Chapter 3 : Health Risk of Tobacco Consumption - cover Nicotine, Carbon Monoxide, Tar, Clove and other additives

Chapter 4 : Health Impact Due to Tobacco

Chapter 5 : Economic Costs - cover macro level (Burden of Disease Attributable to Tobacco in Indonesia, direct and indirect costs) and Micro Level: cost of purchasing cigarettes

Chapter 6 : Discussions

Chapter 7 : Policy Implication and Recommendations

Hopefully this Review may contribute to the sustainable tobacco control program and to re-design more cost-effective interventions for Indonesia.

Soewarta Kosen
Hasbullah Thabrany
Nunik Kusumawardani
Santi Martini

ACKNOWLEDGEMENTS

We want to acknowledge the technical guidance and financial support provided by the World Health Organization, Indonesia Office, especially from Dr. Farrukh Qureshi and Ms. Dina Kania, SH., MH. in preparing the Review and enable the completion of the work.

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EXECUTIVE SUMMARY

Relationship between health, economic and tobacco has become crucial issue that requires strong, intensive and comprehensive approaches to be solved. For some countries, including Indonesia, it is a very challenging issue because of the political, economic and cultural determinants are influencing the direction and achievement of preventing and controlling tobacco health impact.

Indonesian government has recently concentrated national development agenda towards economic development. National development priority should be directed to improve economic situation and community welfare. In this regards, it is also important to provide stronger evidence on economic cost of tobacco as well as its health impact. In Indonesia situation, there have been attempts to estimate health and economic costs using various national owned data sets through various research initiatives, however there is a need to compile and synthesize the available evidence to inform policy.

This review aims to bring together the available information on health and economic costs from verifiable data sources, as well as from unclassified yet authentic sources, and provide a brief analysis of country situation.

Chapter one provides analysis of tobacco consumption in Indonesia based on most recent several nationwide health surveys. The surveys include 2013 RISKESDAS and 2014 Global Youth Tobacco Survey. This chapter shows tobacco consumption based on social demographic dimension. Main points of this chapter shows that female smokers increased rapidly; passive smokers remain high among all age groups; prevalence of smoking of male and female population was increasing in both urban and rural areas;

Smoking was more common among lower education, productive age groups and young adults as well as in lower economic quintile. Data from Indonesian Statistics show that tobacco and betel is the third highest expenditure per capita during 2014, after prepared foods and rice grains.

Chapter three explains that some studies and reviews have proven that tobacco consumption create negative impact on health, particularly in oral health, lung, heart and blood vessels, stomach, kidney, bladder, pancreas, maternal health, depression and cognitive decline. Those negative health impacts also occur among those who expose to environmental tobacco smoke (second-hand and third-hand smoke) or passive smokers.

Chapter four describes specifically morbidity, disability and mortality related to tobacco consumption. Tobacco related morbidity has been clearly confirmed by several studies elsewhere, which includes muscular degenerative, congenital defects, diabetes mellitus, tuberculosis, liver disease, ectopic pregnancy, male sexual dysfunction, rheumatoid arthritis, colorectal cancer, and disturbance of immune system. In addition, second-hand tobacco smoke is correlated with cancer, respiratory & cardiovascular diseases, and harmful to infants and children. Smoking also caused negative impact on disability. Light smokers had a 73 % increase in risk for disability compared with never smokers. The second-hand smoke was responsible for 10.9 million DALYs worldwide, 61 % were in children. About 5 % of deaths worldwide were attributable to communicable diseases and 14 % of deaths of non- communicable diseases were due to tobacco. World Health Organization estimated that tobacco consumption is accountable for 6 million preventable deaths a year in the global community.

Chapter five illustrates the economic costs of tobacco based on 33 tobacco attributable diseases, which belong to major diseases

such as cancer, cardiovascular diseases, cerebrovascular diseases, respiratory diseases, and other diseases. The cost analysis shows that the total macro-economic loss in 2015 that includes: expenditures to purchase cigarettes (208.83 Trillion Rupiah), Disability Adjusted Life Years (DALYs) Loss or productive years loss due to morbidity, disability and premature mortality (374,06 Trillion Rupiah), medical expenditures due to tobacco attributable diseases (13.67 Trillion Rupiah; were in the amount of 596,56 Trillion Rupiahs (equal to 45.9 Billion US Dollars).

Chapter six discusses and elaborates the health impact and economic cost of tobacco, the low socioeconomic group of population are mostly affected by its negative impact and describes the priority of expenditures in the group.

Chapter seven describes policy implication and recommendations produced from the review and analysis of health and economic impact of tobacco. Key policy implication includes the main issues of tobacco, that is high tobacco consumption, higher risk and alarming figures of morbidity, disability and premature death.

The economic costs of tobacco tremendously high in the case of Indonesia situation that still need sufficient resources to improve national development. Total economic loss due to tobacco consumption is much higher compare to economic benefits (excise tax), particularly in term of human resource quality and health expenditure. This analysis recommends several points, among others: Indonesia needs to accelerate the efforts to improve the population health status, including control of one of major risk factors i.e. tobacco use, in order to curb the epidemic of Non Communicable Diseases. Strong pro-health leadership, government inter sector contribution and multi-discipline approaches are required to address economic loss due to tobacco consumption.

CAPTER 1

INTRODUCTION

CHAPTER 1

INTRODUCTION

BACKGROUND

Effective Tobacco Control requires addressing all possible social, health, economic and commerce domains of tobacco. This entails having uniform and unbiased information about the status of tobacco in each one of these domains.

In Indonesia, the data and evidence of tobacco in relation to the above areas is available, however it is generally sporadic and piecemeal. The unavailability of comprehensive information leads to varying and sometimes divergent understanding by various government departments, of potential impact of tobacco control in the above areas. As a result, the multi-sector dialogue on the issue falls short of reaching onto any consensus for policy decisions for tobacco control.

This varied understanding of the issue also limits delivery of evidence-based information not only to policy makers, but also to the general public, leading to confusion amongst the general public. Such limited communication also provides opportunity to the opponents of the tobacco control to propagate falsified

information to the general public, that in turn has detrimental effect on implementation of existing tobacco control policies, as well as it poses a potential challenge for pursuing for stronger tobacco control.

The issue of local evidence in relation to tobacco has been brought up in almost all national debates on tobacco control in Indonesia. A need was felt to compile and review available evidence related to tobacco and tobacco control in the above mentioned domains.

In order to explore further, the WHO held a meeting with identified researchers from academic institutions. The brainstorming exercise identified priority areas that require an immediate compilation and review of evidence.

One of the identified areas is Health and economic costs of tobacco. There have been attempts to estimate Health and economic using various national owned data sets through various research initiatives, however there is a need to compile and synthesize the available evidence to inform policy.

OBJECTIVES

General Objective: to bring together the available information on health and economic costs from verifiable data sources, as well as from unclassified yet authentic sources, and provide a brief analysis of country situation.

Specific Objectives:

1. To review the available evidence of morbidity and mortality attributable to tobacco consumption in Indonesia

2. To compile the available national data sets to be used to estimate the health and economic costs of tobacco
3. To estimate the direct and indirect health and economic costs of tobacco use.
4. To inform and disseminate the results of the review to relevant stakeholders in the government sectors, academia, civil society and media entities
5. To provide set of recommendations to the government entities for tobacco control policies based on the review
6. To suggest further research needs, in the light of existing evidence

CAPTER 2

TOBACCO CONSUMPTION IN INDONESIA

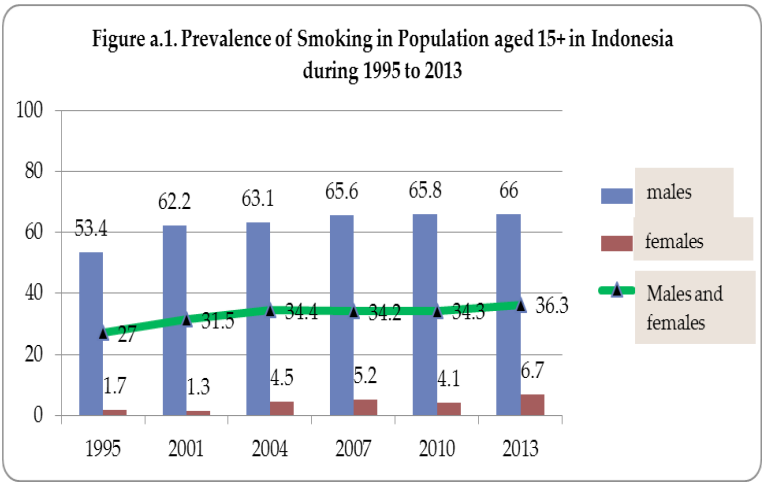
CHAPTER 2

TOBACCO CONSUMPTION IN INDONESIA

Prevalence of active and passive smokers by social demography

Gender determinant of active and passive smoking

Smoking is one of behavior risk factors for Non Communicable Diseases that still not yet improved for many decades. Prevalence of active smokers was increasing from 1995 to 2013 in both males and females and in almost all age groups. The prevalence of smoking among males population age 15 years and above increased from 53.4% in 1995 to 66% in 2013 and from 1.7% in 1995 to 6.7% in 2013 in females. Although the prevalence is much lower among females compare to males population, it increased almost four times among females.

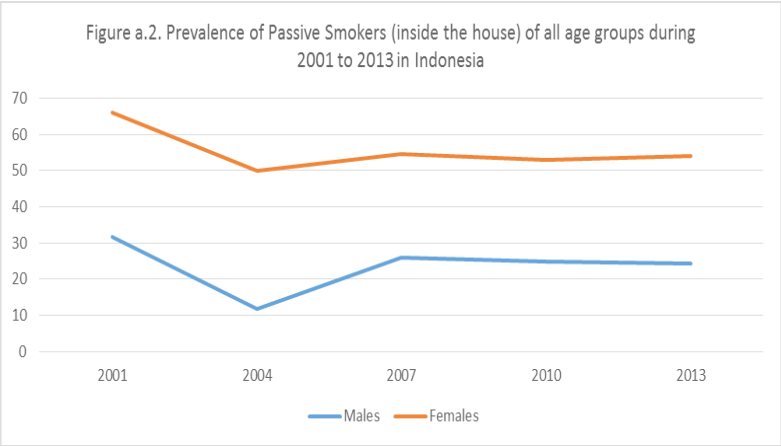


Source: Indonesia NIHRD MoH and TCSC-IAKMI. 2014. Tobacco Facts 2014 (*Bunga Rampai Fakta Tembakau dan Permasalahannya di Indonesia)*. p 3.

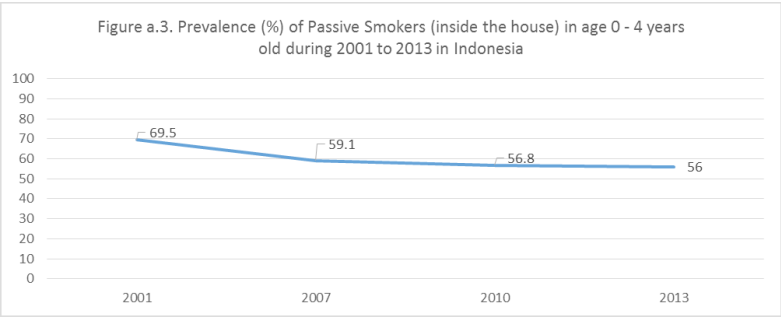
It can be assumed that smoking issues among females is actually crucial and requires specific intervention which may differs from males targeted intervention. Data from Statistics Indonesia showed that total number of female population aged 15 years and above based on 2010 census was 84,706,030 people and more than 5.6 million Indonesian females were smoking, based on 2013 female smoking prevalence (6.7%).

Meanwhile among the males population, the figure shows that the prevalence remains high above 60% and slightly increased overtime. Looking at the total population size of males aged 15 years and above, 84,332,033 people, the number of smokers would be approximately 55.6 million males based on 2013 males smoking prevalence (66%).

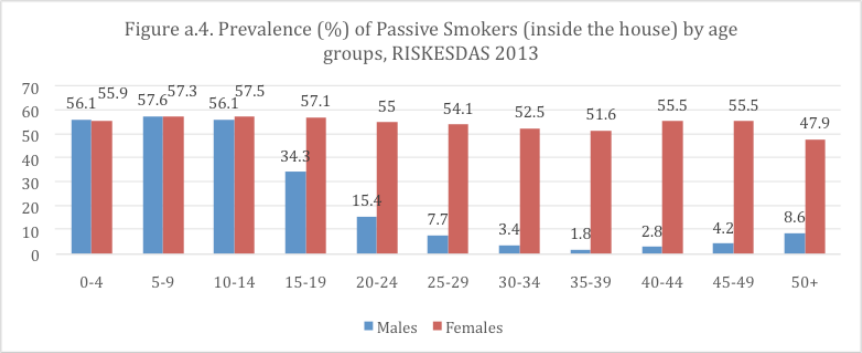
Indonesia is also facing crucial issues on passive smoking which also lead to greater risk of smoking related diseases. Prevalence of passive smoking was higher among the most vulnerable group such as among children and women.



Source: Indonesia NIHRD MoH and TCSC-IAKMI. 2014. Tobacco Facts 2014 (*Bunga Rampai Fakta Tembakau dan Permasalahanya di Indonesia*)



Source: Indonesia NIHRD MoH and TCSC-IAKMI. 2014. Tobacco Facts 2014 (B*unga Rampai Fakta Tembakau dan Permasalahanya di Indonesia*).

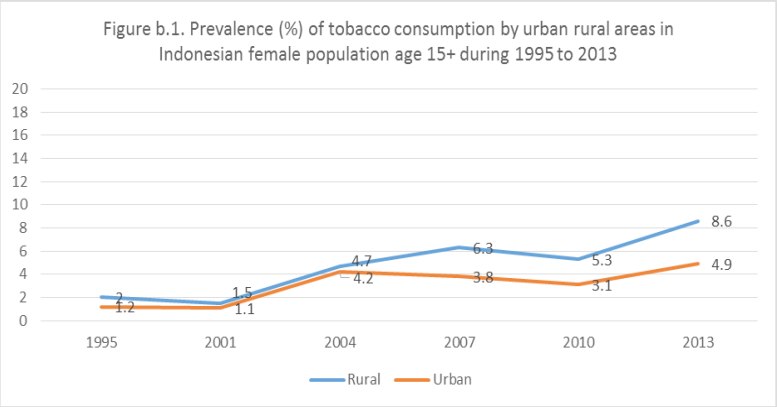


Source: Indonesia NIHRD MoH and TCSC-IAKMI. 2014. Tobacco Facts 2014 (*Bunga Rampai Fakta Tembakau dan Permasalahannya di Indonesia*).

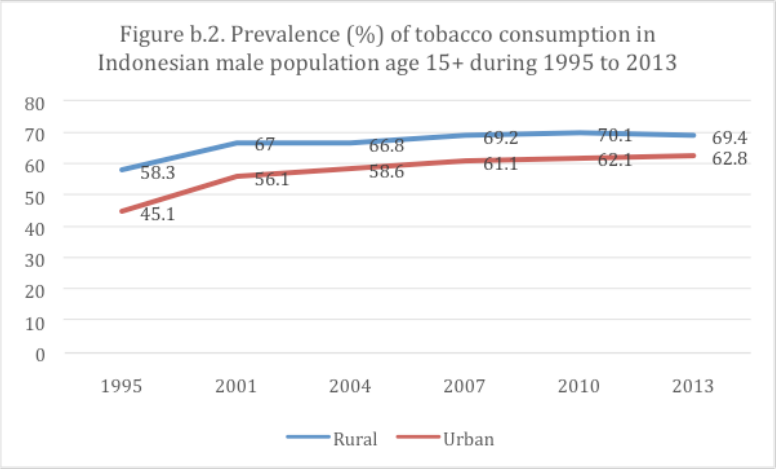
Pattern of passive smokers by age group was different between males and females who don't smoke within the age group of 15 years and above (Figure a.4). Among female population, the prevalence of passive smokers remained high for all age groups while the prevalence was lower for males population under age of 15 years and above. This can be related to condition that more males smokes and this figures exclude those who smoke. Most likely, females in the households expose to cigarettes smoke inside the house, which leads to more females has higher risk of cigarettes smoke related diseases.

Smoking is actually one of 'cultural' related behaviors that has been growing since many decades ago in Indonesia, particularly in Java Island. It is extended through other regions in Indonesia and become common in both urban and rural areas. The prevalence of smoking of males and females population was increasing in urban and rural areas (Figure b.1 and b.2). Although the prevalence was higher among males than females, the increasing was sharper in females than in males population over time. In both females and males population, showed that rural population tends to have higher

prevalence than urban population. The difference between urban and rural figures was getting bigger among females and getting closer among males. It can be seen also that rural females smoke more than urban females.



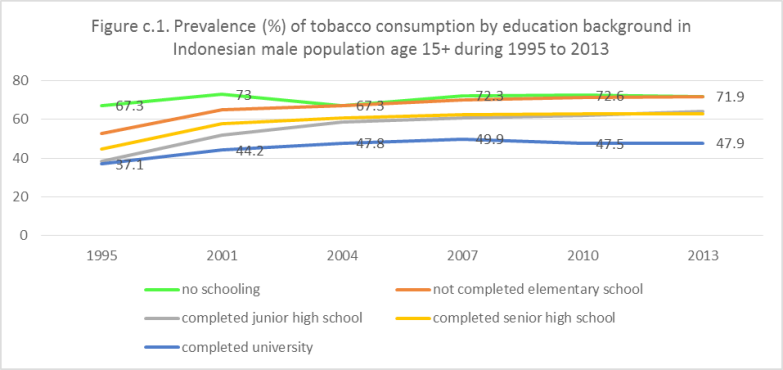
Source: Indonesia NIHRD MoH and TCSC-IAKMI. 2014. Tobacco Facts 2014 (*Bunga Rampai Fakta Tembakau dan Permasalahannya di Indonesia*).



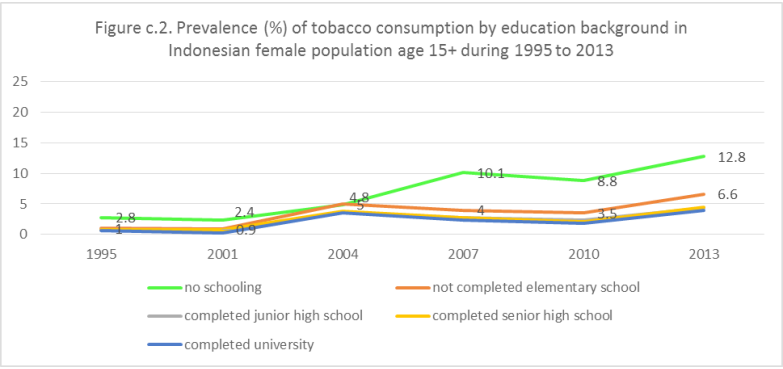
Source: Indonesia NIHRD MoH and TCSC-IAKMI. 2014. Tobacco Facts 2014 (*Bunga Rampai Fakta Tembakau dan Permasalahannya di Indonesia*).

Education

Tobacco consumption pattern by education background seems to be relatively stagnant over time during 1995 to 2013. The prevalence was higher among lower education background. Figure c.1 described that there was a very slightly decrease of tobacco consumption prevalence among males who had higher education background (completed university) from 49.9 in 2007 to 47.9% in 2013, although it was still higher compare to 1995 (37.1%).



Source: Indonesia NIHRD MoH and TCSC-IAKMI. 2014. Tobacco Facts 2014 (*Bunga Rampai Fakta Tembakau dan Permasalahanya di Indonesia*).

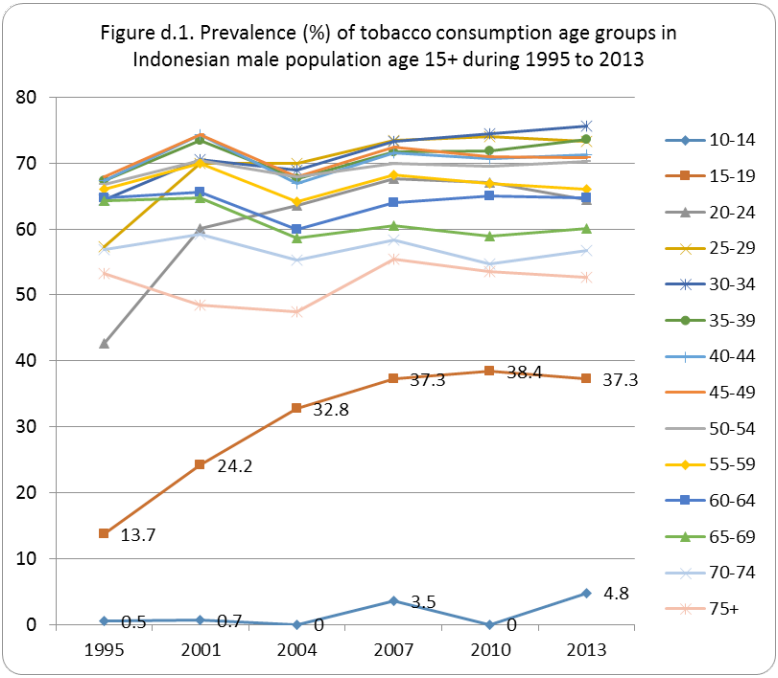


Source: Indonesia NIHRD MoH and TCSC-IAKMI. 2014. Tobacco Facts 2014 (*Bunga Rampai Fakta Tembakau dan Permasalahanya di Indonesia*).

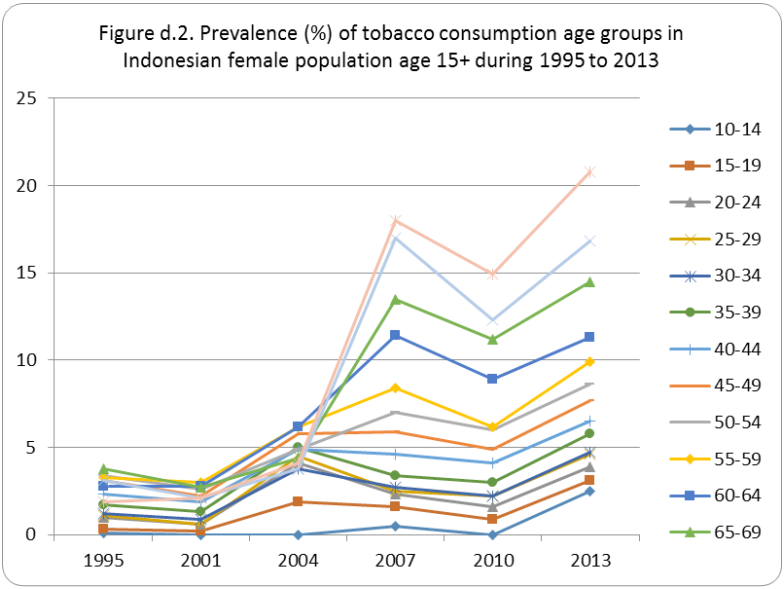
Figure c.2 indicates that female tobacco consumption increased over time among education background. The prevalence was higher in lower education groups (no schooling and not completed elementary school).

Age Groups

Tobacco consumption shows different pattern among males with younger age groups (10- 14 years and 15-19 years) compare to older age groups (Figure d.1). The prevalence among the older age groups remained high but slowly increased among adolescents.



Source: Indonesia NIHRD MoH and TCSC-IAKMI. 2014. Tobacco Facts 2014 (*Bunga Rampai Fakta Tembakau dan Permasalahanya di Indonesia*).
*Note: no available data (data was not collected) on age group of 10 – 14 years for 2004 and 2010



Source: Indonesia NIHRD MoH and TCSC-IAKMI. 2014. Tobacco Facts 2014 (*Bunga Rampai Fakta Tembakau dan Permasalahannya di Indonesia*).
*Note: no available data (data was not collected) on age group of 10 – 14 years for 2004 and 2010

Economic Condition

Trend analysis from 1995 to 2013 has shown a different pattern of tobacco consumption between males and females. Figure e.1 and e.2 show that the prevalence was higher among lower economic quintile (quintile 1 and 2) over time in both males and females. However, the prevalence continue increase sharply in females with lowest economic quintile (quintile 1) from 2.2% in 1995 to 14% in 2013, while the prevalence was very slowly increase and slightly decrease in males under highest economic quintile group.

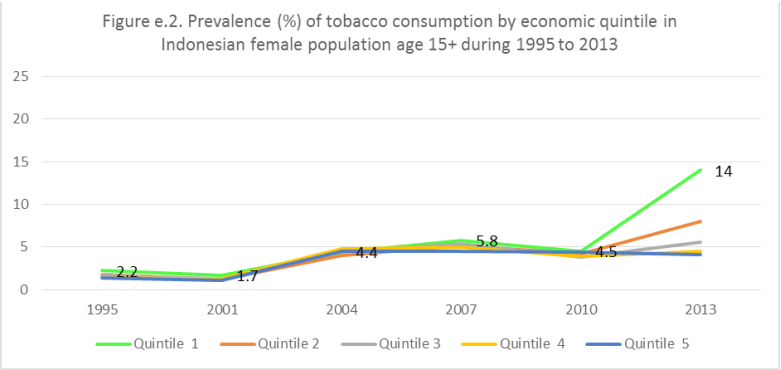


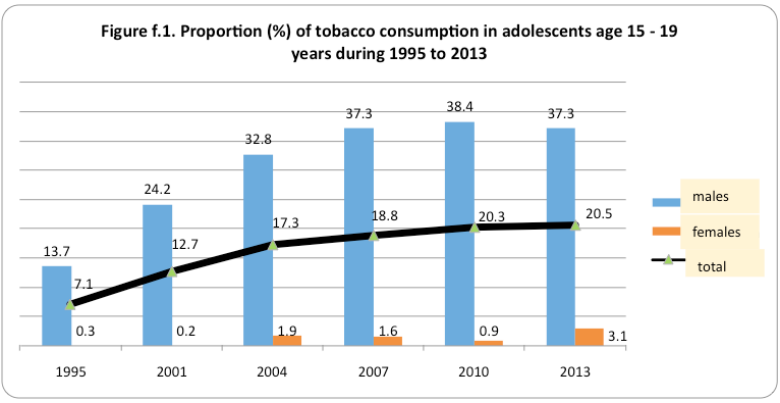
Figure e.2. Prevalence (%) of tobacco consumption by economic quintile in Indonesian female population age 15+ during 1995 to 2013

Source: Indonesia NIHRD MoH and TCSC-IAKMI. 2014. Tobacco Facts 2014 (*Bunga Rampai Fakta Tembakau dan Permasalahannya di Indonesia*).

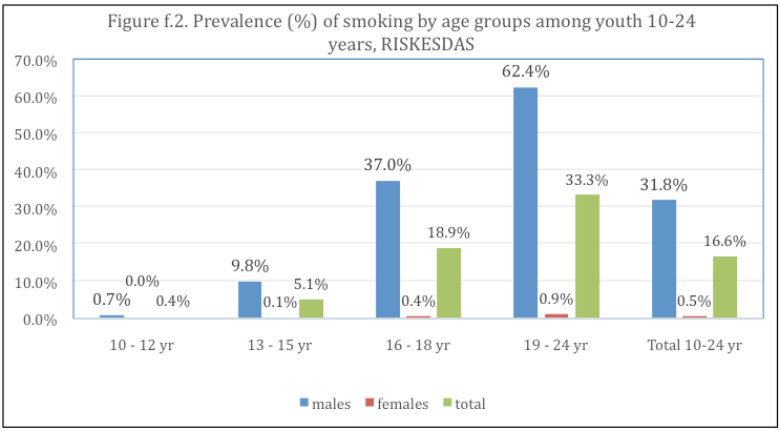
Youth smoking (GYTS, GSHS, RISKESDAS)

Smoking among youth is also one the main health related behavior in Indonesia. There are several data sources that provide data on smoking behaviors among youth, such as RISKESDAS, Global Youth Tobacco Survey (GYTS), Global School-based Health Survey (GSHS). Based on RISKESDAS data, it was showed that overall the prevalence of tobacco consumption among aged 15-19

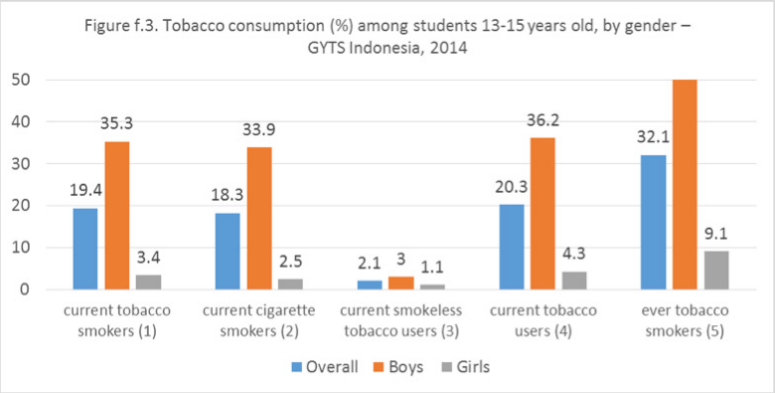
years was increasing from 7.1% in 1995 to 20.5% in 2013 (Figure f.1). The trend shows increasing prevalence on 2013 in female but there was a slight decrease in males from 38.4% in 2010 to 37.3% in 2013 .



RISKESDAS 2013 also showed smoking prevalence among youth aged 10-24 years was 31.8% in males and 0.5% in females. Total sample size of youth 10 -24 years was 180,811 males and 170,740 females. The figure shows that the prevalence of smoking was higher among older age groups in both male and female youth.

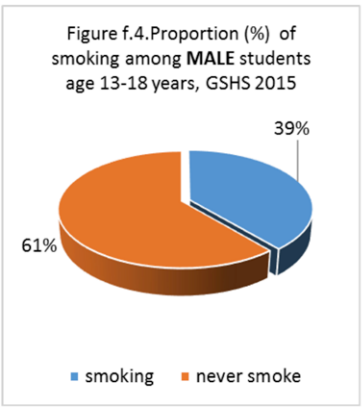


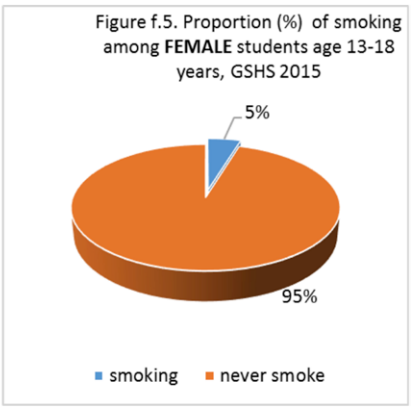
Other data source, Global Youth Tobacco Survey (GYTS) in 2014 showed much higher prevalence of smoking prevalence, which were 33.9% in males and 2.5% aged 13-15 years. Results from the 2014 GYTS indicates an alarming issues of smoking among young age which may leads to bigger issues on health risk behaviors as well as chronic diseases risk.



A different data source, a School-based Health Survey in 2015, shows that the prevalence of smoking among adolescents aged 13 – 18 years was 39% in males and 5% in females.

a.





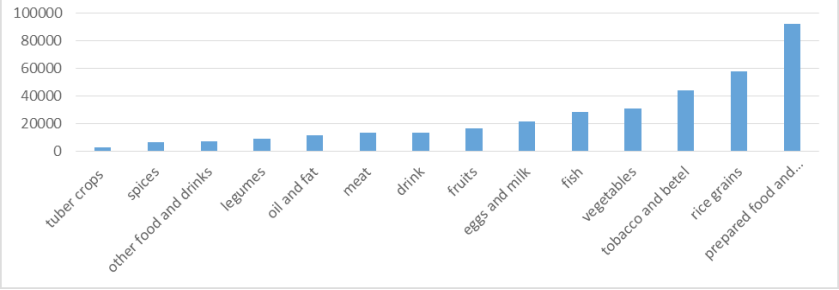
The figures from GYTS and GSHS showed a much higher prevalence than from the RISKESDAS. This relates to different survey design and population. GYTS and GSHS were using a school-based setting and school children as the sample frame, meanwhile the RISKESDAS include participants in the general population. The difference shows quite high among female in all of the age group.

In general, tobacco consumption in Indonesia is still increasing overtime in almost all age groups both in males and female population. Smoking also is more common among rural population, lower education and economic quintile, as well as among those who are in productive age or young adult.

C. Household expenditure on tobacco

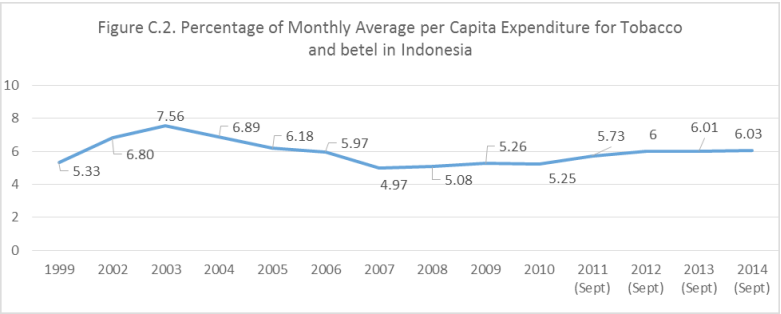
Data from Indonesia Statistic shows that tobacco and betel is the third highest expenditure per capita during 2014, after prepared foods and rice grains. The figure also describes that it is higher than expenditure for meat, fruits and vegetable and fish.

Figure C.1. Average Monthly Expenditure per Capita by Commodity Group (IDR) in Indonesia, 2013-2014

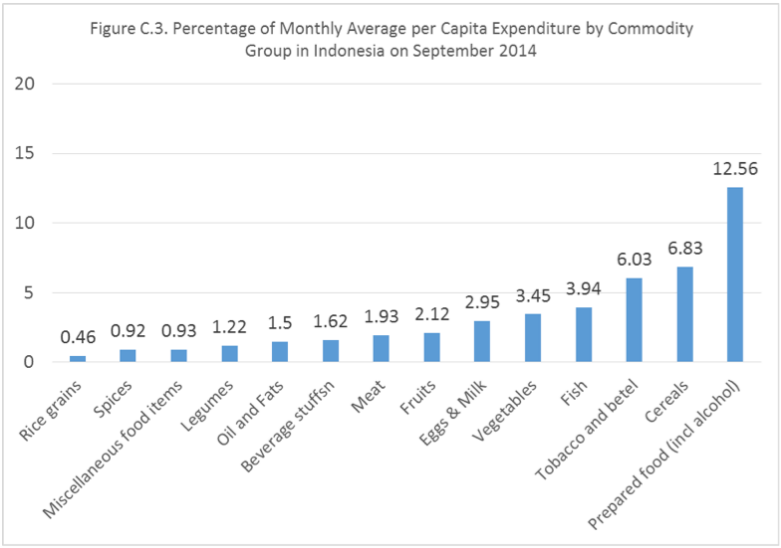


Source: Indonesia Statistic

Looking at the trend from 1999 to 2014, the percentage of monthly average per capita spent for tobacco and betel was fluctuated and tend to increasing from 5.33% in 1999 to 6.03% in 2014 (Figure C.2). This percentage was the highest three of total percentage by commodity type (Figure C.3). Figure C.3 shows that most people spent more money on prepared foods, rice grains (or cereal) and tobacco and betel.



Source: Statistics Indonesia



CAPTER 3

HEALTH RISKS OF TOBACCO CONSUMPTION

CHAPTER 3:

HEALTH RISKS OF TOBACCO CONSUMPTION

a. Nicotine, Carbon Monoxide, Tar, Clove and other additives

The main ingredient of cigarettes is tobacco. Tobacco plants have alkaloids that provide a strong defense against microorganisms, insects and vertebrae. Tobacco leaves comprise of chemical substances with a high content of nicotine.

Cigarette is a complex and dynamic mixture of chemical substances. Scientists estimate that each cigarette may contain more than 7357 chemical substances, including 400 toxic ones and about 40 of whom are carcinogenic. Some examples of the substances are nitrogen (N_2), oxygen (O_2), carbon dioxide (CO_2), carbon monoxide (CO), acetaldehyde, methane, hydrogen cyanide (HCN), nitric acid, acetone, acrolein, ammonia, methanol, hydrogen sulphide (H_2S), hydrocarbons, gaseous nitrosamine, and carbonile structures.

The main elements of cigarette smoke in solid form are carboxylic acids, phenols, water, humectants, nicotine, terpenoids, paraffin waxes, tobacco-specific nitrosamines (TSNAs), PAHs, and catechol. The relatively stable free radicals, nitrogen oxide (NO), are found at a high concentration of up to 400 parts per million

and the biggest producer of these radicals is cigarette smoke. It is thought up to now that many harmful effects to respiration that are directly or indirectly related to cigarette smoke are due to inhaling the high concentration of free radicals contained in it.

Main stream smoke drawn through the mouthpiece of the cigarette when the puffs are taken, and side stream smoke emitted from the smoldering cigarette between puffs. Mainstream smoke contains only a small amount of nicotine in gaseous form (Johnson et al. 1973b; Pakhale et al. 1997). The larger fraction of gaseous nicotine is actually in sidestream smoke (Johnson et al. 1973b; Brunnemann and Hoffmann 1974; Adams et al. 1987; Pakhale et al. 1997). Chemical substances in cigarette smoke are pharmacologically active, antigenic, cytotoxic, mutagenic and carcinogenic (table 1). In addition to this, the second minor derivative of nicotine and alkaloid is a precursor carcinogen TSNAs (IARC 2004, 2007).

Table 3,1. Selected constituents of cigarette smoke

Particulate phase	Main effects	Gas phase	Main effects
Tar	Mutagenic/carcinogenic	Carbon monoxide	Impairment of oxygen binding to haemoglobin
Nicotine	Dose-dependent stimulator or depressor of parasympathetic N-cholinergic receptors	Oxides of nitrogen	Irritant, pro-inflammatory, ciliotoxic
Aromatic hydrocarbons	Mutagenic/carcinogenic	Aldehydes	Irritant, pro-inflammatory, ciliotoxic
Phenol	Irritant, mutagenic/carcinogenic	Hydrocyanic acid	Irritant, pro-inflammatory, ciliotoxic
Cresol	Irritant, mutagenic/carcinogenic	Acrolein	Irritant, pro-inflammatory, ciliotoxic
β-Naphthylamine	Mutagenic/carcinogenic	Ammonia	Irritant, pro-inflammatory, ciliotoxic
Benzo(a)pyrene	Mutagenic/carcinogenic	Nitrosamines	Mutagenic/carcinogenic
Catechol	Mutagenic/carcinogenic	Hydrazine	Mutagenic/carcinogenic
Indole	Tumour acceleration	Vinyl chloride	Mutagenic/carcinogenic
Carbazole	Tumour acceleration		

(Source: Behr & Nowak, 2002. Tobacco smoke and respiratory disease page: 164)

The particulates fraction of cigarette smoke contains numerous harmful effects. Tar is one particulate mass of tobacco smoke that nicotine-free and has carcinogenic and mutagenic effect. The

chemical components in tar and their effect on health vary widely across tobacco from various sources (Fowles, 2000).

Many chemicals are found in the gaseous phase of tobacco smoke. The most reported of the gaseous chemical constituents in cigarette smoke is carbon monoxide (CO). Carbon monoxide fixes in the hemoglobin and decreases the capacity of hemoglobin to bind with oxygen. Consequently, the supply of oxygen in blood are low and increase the risk of cardiovascular disease (Geiss and Kotzias, 2007).

b. Health Impact on Active Smoker

Smoke causes a variety of disorders of smoker's organs either physical or mental disorders, the specifics are as follows:

1) **Brain**

Smoking sends chemicals into the brain, changes their chemical and affects the feeling of the smoker. The addictive nature of nicotine to humans is caused by nicotine molecules that are similar to acetylcholine, an important neurotransmitter to the brain (Brody et al. 2006). Nicotine reaches the brain within 10 minutes after the cigarette is smoked. Smoking is a major cause of stroke, vascular disorder (deep vein thrombosis or hemorrhage)in the brain, resulting in paralysis. In Indonesia, stroke is the second leading cause of death. Stroke is also the third leading cause of death in the United States.

2) **Eyes**

Cataract (clouding of the lens in the eye) is the number one cause of blindness in the world. Smokers have a risk of developing cataracts

2 to 3 times greater compared to non-smokers. The chemical components in tobacco smoke can damage the lens protein and enzymes. It also lowering antioxidant that protecting lens, thus the lens are susceptible to the eye diseases (US Department of Health and Human Services, 2004).

3) **Mouth, throat, larynx, esophagus**

Smokers have a higher risk of developing gum disease (periodontitis) compared to non-smokers. Smoking, including pipe smoking, also causes oral cancer. Smoking causes throat cancer, laryngeal cancer, and oesophageal cancer (Ito et al, 2010). Smokers are more susceptible to upper respiratory infection (ARI) such as colds and sore throat due to a virus or bacteria. Smoking is harmful to the body's ability to fight infection. In other words, smoking impairs immune system. In Indonesia, women who chew betel-quid show the highest prevalence of oral lichen planus, oral sub mucous fibrosis and oral leucho-plaque or oral pre-malignant disorders (9.1-17.3%) (Lee at al, 2011).

4) **Lungs**

The effect of smoking on the lungs is lung cancer. Compared to non-smokers, men who smoke have a risk of lung cancer 23 times greater, and women who smoke have a risk of lung cancer 13 times greater. Smoking causes about 90% of deaths due to lung cancer among men and about 80% of deaths due to lung cancer among women in the United States (US Department of Health and Human Services, 2014).

Smoking low tar cigarette does not reduce the risk of lung cancer substantially. Smoking causes wound on the respiratory tract and air pockets that can lead to obstructive lung diseases (such as bronchial asthma and emphysema). Smokers have a higher risk of

lower respiratory infections such as pneumonia or acute bronchitis compared to non-smokers.

Smoking is associated with asthma in children and adolescents.

Smoking is associated with a long coughing and wheezing among adults, children, and adolescents. Smoking during childhood and adolescence inhibits the growth of the lungs. The function of the lungs, measured by how effective the lungs extract and release air into and out of the body, naturally declines as we get old. The function declines more rapidly in smokers. Smoking during pregnancy causes the function of the baby's lungs to decline.

Smoking increases the risk of being infected by Mycobacterium tuberculosa. Research shows that exposure to tuberculosis increased 3 times in adults who smoked one pack of cigarette or more a day and in smokers who smoked for more than 30 years (Singh et al, 2013).

5) **Heart and Blood Vessels**

Smoking cigarette is associated with all kinds of sudden death due to heart disease in men and women. Smoking causes plaque in blood vessels (atherosclerosis) as a result of the chemicals in cigarette. Artherosclerosis is the most common cause of coronary heart disease, stroke, and vascular diseases. Smoking also causes the aneurysm of blood vessels in the abdominal to bulge and leads to rupture.Low tar - nicotine does not reduce the risk of coronary heart disease.

Epidemiological studies showed that smoking was associated with increased hypertension for 11 years, enlarged arm size, and dyslipidaemia. Smokers have a higher risk of hypertension, no matter how many cigarettes smoked.

Smokers have a higher risk of insulin resistance, hyperinsulinaemia, dyslipidaemia, and endothelial dysfunction compared to non-smokers(Reaven & Tsao 2009).

6) **Stomach**

One of the gastric acid compositions is hydrochloric acid (HCl), a very strong acid that can dissolve iron nails. Stomach tissue that is easily damaged if protected from this acid by a thick layer on the surface of the stomach. Nicotine and other components of cigarette smoke affect several aspects of gastric physiology. Short-term effects of smoking include increased reflux of duodenal contents into the stomach and mouth. Research showed that smokers have a greater possibility of having a wound on the stomach compared to non-smokers.

Smoking also causes stomach cancer. The risk for dysplasia increased with the number of cigarettes smoked per day and years of smoking (US Department of Health and Human Services, 2014).

7) **Kidneys**

Smoking causes renal cancer resulting in impaired renal function. The products of metabolized components of tobacco smoke are removed from the body through the kidneys, thus exposing the kidney to these harmful products and their metabolites. The smoking habit associated with kidney cancer incidence, with relative risks ranging from 1 to more than 5. The risk of kidney cancer is increasing for both males and females smoker. There was a dose-response relationship based on the number of cigarettes smoked per day. If impaired renal function occurs in a long time, the renal function should be replaced by hemodialysis or dialysis machine (US Department of Health and Human Services, 2014).

8) **Bladder**

Smoking causes bladder cancer that could disturb the urine disposal process and the flow of urine from the kidneys. The risk increases with the quantity of cigarettes smoked and the duration of smoking, and declines after smoking cessation (US Department of Health and Human Services, 2014).

9) **Pancreas**

Smoking causes pancreas cancer resulting in digestive process disorder. Tobacco-specific carcinogenic agent can reach the pancreas through blood or through reflux bile that is in contact with the pancreatic duct. The carcinogenic agents such as nitrosamine that are found in high levels in cigarette smoke and aromatic amines also may play a role in pancreatic carcinogenesis. (US Department of Health and Human Services. 2004).

Dyslipidemia is related to dysfunction of pancreatic β cells in people with normal glucose tolerance and this is particularly evident in people with elevated total cholesterol and low density lipoprotein cholesterol levels, especially males. There were inverse relationships between β cell function and total cholesterol in men and women (Zheng, et al, 2012).

The research showed the risk of development diabetes on current smokers was 1.65 (95% CI: 1.27 to 2.13) compared to never smokers without passive smoke exposure after adjustment for multiple baseline sociodemographic, biological, and behavioural factors. The dose-response effect of cigarette consumption also apparent. Consumption of pack years cigarettes showed a consistent dose response effect of higher risk with higher exposure to tobacco. The risk of developing glucose intolerance increased by 18% for every increase in 10 pack years of smoking (Houston et al, 2006). Other

studies showed the similar result that the development of glucose intolerance over a 15 year period after tobacco exposure. Smoking increases diabetic incidences, aggravates glucose homeostatis and chronic diabetic complication. The risk of type II diabetes is signtificantly increased with the number of cigarettes smoked. Men and women who smoked 20 cigarettes or more per day have risk 1.55 (95% [CI], 1.51 to 1.60) times greater compared to non smoker (Chang, 2012).

The risk of type II diabetes related to age initiation of smoking, comparative study in Korea and US showed that. Risk of type II diabetes are 2.46 (95% CI: 1.04 – 5.79) times higher in the South Korean men who began smoking before age 16 compared to the men who never smoke. Among U.S men, starting smoking between 16 and 20 years increased the risk of type II diabetes 1.58 (95% CI: 1.05 – 2.37) than who never smoke. Smoking pack years were also related to the incidence of type II diabetes in U.S men (Kim et al, 2014).

Smoking has been shown to emphasize the degree of insulin resistance in patient with type II diabetes. Smoking 1 cigarette per hour for 6 hours was related with the decrease insulin sensitivity. The insulin level (a surrogate marker of insulin resistance) on smokers were higher than on nonsmokers. There were also substantial evidence that combination of insulin resistance, hyperinsulinema, and dyslipidemia occurs together in smokers more commonly than in nonsmokers (Reaven and Tsao, 2009).

10) **Pregnancy**

In the United States, it is estimated that each year, 6 million women are pregnant and more than 11.000 are giving birth. Between 12% to 22% of those women smoke during pregnancy. Women who

do not smoke have a lower complication during pregnancy and have healthier babies compared to women who smoke. Smoking is harmful during each stage of infant development or during pregnancy and after the baby is born.

Smoking has a negative impact on the health of the baby conceived (fetus) as well as the baby born. Nicotine cigarette can narrow the blood vessels in the placenta and uterus, thus decreasing the amount of oxygen the fetus receives. Nicotine also reduces the amount of blood in the baby's blood flow which can contribute to low birth weight. Babies with low birth weight (less than 2.5 kg) have a greater risk of death.

Women who smoke during pregnancy have a higher risk of having torn membrane prior to the time of delivery, resulting in premature birth or even fetal death. Smoking during pregnancy increases the risk of placenta previa (placenta is covering the birth canal leading to hemorrhage) and placental abruption (placenta is separated suddenly that may cause fetal death).

Newborns will become passive smokers if their mothers smoke. Mothers who smoke will cause sudden infant death syndrome. Babies who are exposed to smoke from their mothers (passive smokers) have two times greater risk of sudden death compared to babies who are not exposed to smoke from their mothers. If a nursing mother smokes, the milk may contain nicotine. In women, smoking can cause cervical cancer and infertility (US Surgeon General, 2014).

11) **Depression**

Results showed that the risk of depression of smokers was higher compared to that of non-smokers, with odds ratios (ORs) of depression was 1.35 (0.92-1.98) for male former smokers and 1.77

(1.27 - 2.48) for male smokers, and 2.67 (1.38 – 5.16) for female former smokers and 3.72 (2.11 – 6.54) for female smokers, after adjusting to confounders. Compared to light smokers, male heavy smokers were significantly associated with depression [OR = 3.97, 95% confidence interval (CI) = 1.42 to 11.14], but it was not the case with female smokers (OR = 1.24, 95% CI = 0.73-2.09). In conclusion, smoking increases the risk of depression, especially in women (Yun et al. 2012).

12) **Cognitive Decline**

Smoking is related to cognitive decline especially in the older age. Study showed no difference in IQ based on smoking status at the age of 11 years, but at the age of 64 years, smokers had a lower cognitive test results compared to non-smokers and former smokers. The psychomotor speed of smokers was also lower compared to that of non-smokers. These differences were obtained after noticing a confounder (IQ in childhood). Multiple linear regressions showed that IQ in childhood, education level, employment status, lung function and smoking history were predictors of mental function at the age of 64 years (Whalley et al. 2005).

Other studies showed that new smokers tended to have cognitive impairment, compared to those who never smoked, while former smokers showed no risk of cognitive impairment compared to those who never smoked. Having the status of smoker is predicted to have the risk of cognitive impairment with the risk ratio (RR) at 3.7; (95% confidence interval (95% CI) = 1.1-12.3) (Cervilla et al. 2000).

Results of the study conducted in the Netherlands showed that the middle-aged (45-70 years old) smokers experienced a decline in the cognitive function (beta = -0133, 95% confidence interval: -0035, -0230; p = 0.008) compared to respondents who had never

smoked. The same effect was also obtained in the last 4 years of research (Kalmijn, 2002).

Research conducted in Scotland, England and Wales showed that heavy smokers were associated with cognitive impairment and cognitive decline in middle age. Smoking is associated with a faster decline in verbal memory with the weakening of visual search speed. These effects were widely calculated from individuals who smoked more than 20 cigarettes / day. Smokers who survive until the end of their life may be at risk of significant clinical cognitive decline (Richards, M. et al., 2003)

c. Health Impact on Passive Smoker and Environment

In addition to the issue of direct tobacco use in smokers, another issue rises in passive smokers. Passive smoking or involuntary smoking is defined as the inhalation of tobacco smoke for nonsmokers. The smoke inhaled by nonsmokers that contaminate indoor spaces and outdoor environment has frequently been referred to as secondhand smoke or environmental tobacco smoke. Secondhand smoke is the combination of mainstream smoke exhaled from the smoker and side stream smoke that enters the environment from the burning cigarette (US Surgeon General, 2006).

Recently, third-hand smoke exposure has been known as a source of tobacco smoke and nicotine exposure, especially in indoor environment. Third hand smoke exposure happens when components of tobacco smoke adhere to the surfaces. These chemicals components may attach to dust, be re-emitted into the air, or react with other chemicals in the environment (Gibbs et al, 2016)

The various studies showed the health effect on the passive smoker. WHO, IARC (International Agency for Research in Cancer), EPA (the United States Environmental Protection Agency), and a variety of scientific and medical studies in the world have documented the adverse effects of exposure to environmental tobacco smoke on the respiratory system and blood vessels, its role as a carcinogenic substance in adults and the impact on health and child development.

The toxic substances are higher in side stream smoke and these substances may remain for a few hours in the room after the smoking stops, also known as third-hand smoke. The details of the comparison of the substances contained in the mainstream smoke and side stream smoke are shown in Table 2.

Table 3.2. Comparison of the substances in the main stream and side stream smokes.

Compound	Main stream	Side stream	Ratio of Side stream/ Main stream
Tobacco combustion	347 (20 sec)	411 (550 sec)	1,2
Number of particles produced	10^{12}	$3,5 \times 10^{12}$	3,5
Tar	20,8 10,2*	44,1 34,5*	2,1 3,4*
Nicotine	0,92 0,46*	1,69 1,27*	1,8 2,8*
Benzo(a)pyrene	$3,5 \times 10^{-5}$	$13,5 \times 10^{-5}$	3,7
Pyrene	13×10^{-5}	39×10^{-5}	3,0
Phenols	0,228	0,603	3,0
Ammonia	0,16	7,4	46
Nitrogen Oxide	0,014	0,051	3,6
Carbon Monoxide	19	88	4,7

Note: * Cigarette with filter
Source: Tager (1984), Harvard Medical School and Beth Israel Hospital Boston

Research on the impact of exposure to environmental tobacco smoke on the increase in the risk of lung cancer was initiated by Hirayama in 1981 in Japan. The subjects were wives aged 40 or more who did not smoke. They were observed for 14 years and the mortality due to cancer was analyzed based on the husbands' smoking habits. The results showed that the wives, who did not smoke, of husbands who smoke as many as more than 20 cigarettes per day had a 2.08 times higher risk of lung cancer compared to wives of husbands who did not smoke (95% CI: 1.39 to 3.11) (Hirayama, 1981).

Hirayama's research results led to opposition from the tobacco industry that resulted in the cigarette industry to further improve cigarette ads aimed at discrediting the research results. However, subsequent studies conducted in other regions also showed the same results and reinforced the fact that exposure to cigarette smoke increases the risk of lung cancer incidence (Table 3). The research results encouraged the emergence of regulations on smoke-free area that not only protect nonsmokers from exposure to cigarette smoke, but also create an environment that facilitates smokers to quit (Ong & Glanz, 2000).

Table 3.3. Results of the study on the correlation between exposure to cigarette smoke and lung cancer

Published by	Year	Country	RR	Confidence Interval
Hirayama	1981	Japan		
1-19 cigarettes per day			1.61	1.09 – 2.39
≥20 cigarettes per day			2.08	1.39 – 3.11
US Environmental protection Agency	1992	USA	1.19	1.01 – 1.39
National Research Council	1986	USA	1.34	1.18 – 1.53
Surgeon General	1986	USA	1.53	n.a
California Environmental Protection Agency	1997	USA	1.20	n.a
National Health and Medical Research Council	1997	Australia	1.32	1.10 – 1.69
Scientific Committee on Tobacco and Health	1998	UK	1.20 – 1.30	n.a

The use of cigarettes and cardiovascular diseases increased in countries with low and middle incomes. It means that the burden related to tobacco use and cardiovascular diseases are increased in countries that do not have enough resources to address the issues. Passive smokers have a higher risk of heart attack. This is because some of the components contained in cigarette smoke cause significant cardiovascular toxicity. Therefore, it is important to make regulations on smoke-free area to protect non smokers from the dangers of cigarette smoke. The regulations on smoke-free area are proved to be the most effective way in terms of cost to prevent heart disease and heart attack. Research carried out in various countries and regions showed that the regulations on smoke-free

area led to a significant decline in hospitalization due to heart attack. It indicates that the regulations can reduce the economic and medical burden regarding the medical care of heart disease and heart attacks. Therefore, an easy and effective way to prevent heart attack as a result of exposure to cigarette smoke is to ensure that 100% indoor area is smoke-free (Global Smoke Partnership, 2016).

The next target who is exposed to second hand smoke is pregnant mother. Studies showed that exposure to environmental tobacco smoke caused low birth weight. There is a significant difference between weight and body length of newborns of mothers who are passive smokers and of those who are not passive smokers. Newborns of mothers who are passive smokers have a lower weight of 35 grams (95% CI: 2-68 grams) and shorter body length of 0.261 cm (95% CI: 0058-0464 cm) compared to newborns of mothers who are not passive smokers. Therefore, it is necessary to plan effective programs to reduce cigarette smoke exposure to pregnant women so that adverse effects on the health of mothers and babies can be minimized (Wahabi et al, 2013).

Children exposed to secondhand smoke are at an increased risk for sudden infant death syndrome (SIDS). Higher concentrations of nicotine are found in the children who die from SIDS compared with who die of other causes. Secondhand smoke also related to respiratory tract infection in children. There is strength association between tobacco exposure from maternal smoking with admission for bronchitis or pneumonia in children from birth to five years of age (US Surgeon General, 2006).

Exposure of tobacco smoke and nicotine during prenatal and postnatal period can affect human lung development that spans both prenatal and postnatal stage. Research showed that there is

association between secondhand smoke exposure during prenatal and postnatal and increased respiratory symptoms or reduced lung function in exposed children (Gibbs et al, 2016).

Exposure to environmental tobacco smoke has the same health impact as on smokers. Various health issues may arise due to environmental tobacco smoke. Not only physical disorder, exposure to cigarette smoke also causes stress. This is shown by research conducted in Korea in which the research subjects were citizens over the age of 19. The results showed that there was a correlation between environmental tobacco smoke and stress level. A person exposed to environmental tobacco smoke has a risk of more severe stress compared to those who are not exposed to environmental tobacco smoke. The greatest impact of exposure to environmental tobacco smoke in the form of stress is on those who have never smoked, amounting to 1.42 times greater (95% CI: 1.30 to 1.56) compared to smokers. The impact of exposure to environmental tobacco smoke in the form of stress on former smokers is greater than that on active smokers. Exposure to cigarette smoke at home and in the workplace cause greater stress to nonsmokers at 1.56 times greater (95% CI: 1.06 to 2.34). Therefore, consistent regulations related to smoke-free area are required to achieve a healthier environment and reduce the risk of stress (Kim et al, 2015).

d. Nicotine and Addiction

The addiction caused by the nicotine in tobacco smoke is critical in the transition of smokers from experimentation to sustained smoking and to prevent quitting.

The 1988 of the Surgeon General report concluded that: “Cigarettes and other forms of tobacco are addicting” and “Nicotine is the drug in tobacco that causes addiction”.

Smoking was not just a habit. Cigarettes considered as equally addictive as other illegal drugs, such as heroin and cocaine. The 1994 Surgeon General’s report on “Preventing Tobacco Use Among Young People” stated that tobacco use and addiction almost always begin before 18 years of age and most of adolescent smokers face the same challenges as adults in quitting smoking.

Cigarettes have been designed and manufactured to increase the likelihood that initiation will lead to dependence and difficulty achieving cessation, due to contents and emissions in addition to nicotine, design features that may increase free-base nicotine and produce larger puffs. The positive reinforcing aspects of nicotine addiction primarily results from the release of dopamine in the ventral tegmental area region of the brain.

CAPTER 4

HEALTH IMPACTS DOE TO TOBACCO

CHAPTER 4

HEALTH IMPACTS DUE TO TOBACCO

The health impacts of tobacco used are measured by three main categories of tobacco related diseases: morbidity, disability, and mortality.

Morbidity

Morbidities caused by tobacco consumption first identified in early 1960s. In the US, the Surgeon General launched the first warning of tobacco uses cause diseases in 1964. In commemorating the first 50 years of cigarette warning in the US, the Surgeon General published the progress report in 2014 adding many diseases such as muscular degenerative, congenital defects, diabetes mellitus, tuberculosis, liver, ectopic pregnancy, male sexual dysfunction, rheumatoid arthritis, colorectal cancer, and disturbance of immune system (see fig 1). Tobacco warning and other tobacco control programs in the US had successfully reduced the prevalence of adult smoking from 48% in 1965 to 18% in 2012 (Surgeon General, 2014). The report reviewed more than 7,000 literatures in biomedical sciences to generate evidences for public health policy. The reviewers strictly evaluated all literatures to conclude the effect of tobacco to health conditions: morbidity, disability, and mortality.

In Indonesia, however, many of policy and legal makers have not been convinced of such evidences. This is the biggest challenge for the Indonesian tobacco control efforts. Additional, more intensive and extensive discussions and advocacies to legal and policy makers are needed for the effective tobacco control in Indonesia. To provide evidences for policy makers, this chapter explains the health consequences of tobacco consumption from various literatures in published in many countries. However, tobacco industries and people who are seduced by the tobacco industries continue to foolish the public by twisting information. Even in the US, where the publics are generally more intelligent, the industry fights with various ways to induce smoking. The Surgeon General (2014) mentioned, "The tobacco epidemic has been sustained by the aggressive strategies of the tobacco industry, which has deliberately misled the public on the risks of smoking cigarettes".

The Surgeon General's report of 2014 provides evidences of cigarette smoking that causally linked to diseases of nearly all organs and to harm to the fetus. The more than 1,000 page reports, the Surgeon General uncovered newly identify diseases caused by smoking such as diabetes mellitus, rheumatoid arthritis, and colorectal cancer. The report, also disseminated proofs that secondhand tobacco smoke is correlated with cancer, respiratory & cardiovascular diseases, and harmful to infants and children.

Disability

Disability is a condition that a person is unable to function normally in his/her age period and therefore he/she loses productive days. For example, a student who suffers from a disease and is hospitalized loses his/her productive days during sickness. A young person who dies prematurely, before the life expectancy in his/her respective country also loses his/her productive days. Therefore, disability is

measured by years of lives lost due to an illness and or premature deaths.

After reviewing systematically published and unpublished data, Lim and colleagues (2012)[1] estimated deaths and disability-adjusted life years (DALYs) of 67 risk factors from 1990 and 2010. Their comprehensive study, smoking and secondhand smoke, was the top three contributors to more than 5 million deaths in 1990 and more than 6 million in 2010 in the World and 150 million DALYs lost. In 2010, cigarette accounted for 8.4% of the global disease burden among men and 3.7% of disease burden among women.

In 1984, Ebert Koop—the Surgeon General at that time, reported that smoking was the major cause of Chronic Obstructive Lung Diseases (COLD) accounting for 80–90% of COLD deaths in the US (SG 2014). The Surgeon General report of 2014 cited Ostbye study (2002) who found that light smokers had a 73% increase in risk for disability compared with never smokers. The Surgeon General also reported another study (2004) examining secondhand smoke in 192 counties in the US that concluded cigarette accounted for 33% DALYs of nonsmoking males, 35% DALYs of nonsmoking females, and 40% of children. The second-hand smoke was responsible for 10.9 million DALYs worldwide, 61% were in children.

Mortality

The World Health Organization (WHO 2012) published a global report regarding mortality attributable to tobacco about 5 million deaths among productive ages of 30 years of age in 2004. Those

1 US Surgeon General.**The Health Consequences of Smoking—50 Years of Progress**. Washington DC, 2014

deaths represented about 12% of global deaths in this age range, with 16% of deaths in men and 7% of deaths in women. The Americas and European WHO regions had the highest proportion of deaths due to tobacco (16% for both), while the Eastern Mediterranean (7%) and African (3%). About 5% of deaths worldwide were attributable to communicable diseases and 14% of deaths of no communicable diseases were due to tobacco. Tobacco killed people via noncommunicable diseases comprising of respiratory diseases (36%), cancers (22%), cardiovascular diseases (10%), and the rest of other diseases. Globally, 71% of deaths from lung cancer and 42% of deaths from COPD were attributable to tobacco use. Currently, tobacco use is accountable for 6 million preventable deaths a year in the world (WHO 2014).[2]

Since 1964 more than 20 million premature deaths in the US could be attributed to cigarettes. Despite declines in the prevalence of current smoking, the annual burden of smoking-attributable mortality in the United States currently is estimated to be about 480,000. Cigarettes account for 70% higher all-cause mortality rates among men in the US (SG, 2014).[3]

Diseases Correlated with Cigarettes

The Surgeon General of the US Government published 50-year studies of tobacco related diseases and mapped the diseases as shown in figure 4.1. The bold words and stars represent newly reported diseases attributable to tobacco uses reported in the last fifty years. In general, the diseases attributable to smoking are grouped into two categories: cancers and chronic diseases. Cancers that have

2 World Health Organization. **Global Report on NCDs.**WHO, Geneva, 2014, p 72

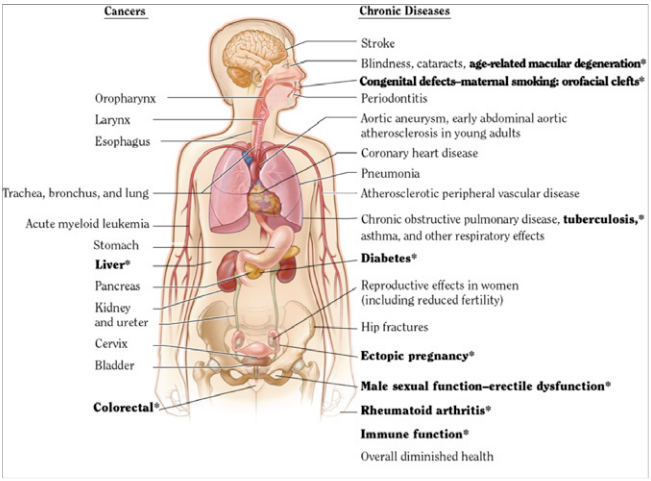
3 US Surgeon General. The Health Consequences of Smoking—50 Years of Progress. The US Ministry of Health and Welfare. *Washington DC, 2014*

been found caused by cigarette are oropharynx, larynx, esophagus, trachea, bronchus, lung, acute myeloid leukemia, stomach, liver, pancreas, kidney and ureter, cervix, bladder, and colorectal. Liver and colorectal cancers are newly proven the last fifty years. On the chronic diseases, smoking attributes the following diseases or health conditions: stroke, blindness, cataract, age-related macular degeneration, congenital defects, or facial clefts, periodontitis, aortic aneurisms, early abdominal aortic atherosclerosis, coronary heart diseases, pneumonia, atherosclerotic peripheral vascular diseases, chronic obstructive pulmonary diseases, tuberculosis, asthma, other respiratory diseases, diabetes mellitus, reproductive diseases, hip fracture, ectopic pregnancy, erectile dysfunctions, rheumatoid arthritis, reduced immune function, and overall poor health.

Figure 4.1. Health Consequences linked to smoking

Surgeon General's Report

Figure 1.1A The health consequences causally linked to smoking

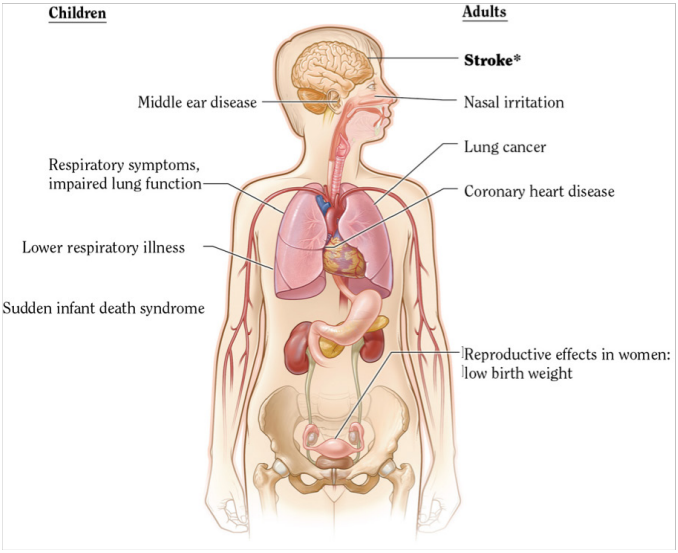


Source: USDHHS 2004, 2006, 2012.
Note: Each condition presented in bold text and followed by an asterisk (*) is a new disease that has been causally linked to smoking in this report.

Source: The Surgeon General Report of the US 50 year's tobacco control, 2014.

Figure 4.2. Health Consequences linked to secondhand smoke

Figure 1.1B The health consequences causally linked to exposure to secondhand smoke



Source: USDHHS 2004, 2006.
Note: Each condition presented in bold text and followed by an asterisk (*) is a new disease that has been causally linked to exposure to secondhand smoke in this report.

Source: The Surgeon General Report of the US 50 years tobacco control, 2014.

To describe more detail of the health consequences of smoking, the following paragraphs explain some studies related to some high prevalence of diseases as well as mortality caused by tobacco related diseases (TRDs) of Cancers and Non Communicable Diseases (NCDs). The tobacco related diseases cause morbidity, mortality, and disability due to treatments and premature deaths. The evidences of TRDs have been reported widely in all continents in the last five decades. The following details are just an example of rapid progresses and massive impacts of smoking that medical sciences have uncovered in Asia, America, Europe, Australia, and Africa.

Cancer

The relationship between smoking and various types of cancers have long been documented. In the conclusion, the Surgeon General mentioned that there have been sufficient facts that smoking increased the risk of adenocarcinoma of lung since 1960s. The report showed evidence that the decline of squamous cell carcinoma of lung correlated with the trend of declining smoking prevalence in the US. Tang et al. (2010)[4] conducted a case control study among Chinese women who suffered from lung cancer to examine interaction of smoking and inhalants. They found OR of 2.8 for smokers. They reported that inhalants and smokes from cooking oil increase the risk of lung cancer to OR almost double. Fagan et al. (2015)[5] who examined biomarker of tobacco exposure to lung cancer among ethnic groups concluded that lung cancer grew slower among Asian and Hispanic compared to White ethnic. They compared nicotine metabolite ratio (NMR), and expired CO among racial/ethnic groups.After adjusting for gender, body mass index, menthol smoking, Hispanic ethnicity, and number of cigarettes smoked per day, the NMR was significantly higher among Whites than among Native Hawaiians and Filipinos (NMR = 0.33, 0.20, 0.19, p=0.001). The NMR increased with increasing White parental ancestry. The study lead to the necessary to observe various prevalence rates among different nationality due to bio natural conditions. To support a class action suit, Semiatycki et al. (2014) developed a dose-response study using the pack-years as a

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4 Tang, Li;Lim, Wei-Yen;Eng, Philip;Leong, Swan Swan;Lim, Tow Keang;Ng, Alan W K;Tee, Augustine;Seo. **Lung Cancer in Chinese Women: Evidence for an Interaction between.** *Environmental Health Perspectives;* Sep 2010; 118, 9;

5 Fagan et al. **Biomarkers of Tobacco Smoke Exposure in Racial/Ethnic Groups at High Risk for Lung Cancer.** *American Journal of Public Health. June 2015, Vol 105, No. 6*

measure of smoking, and the distribution of pack-years of smoking among cases of lung cancers. They found that more than 90% of cases of lung cancer in Quebec are legally attributable to smoking of 3 and 11 pack-years. They concluded that the methodology enhances the ability to conduct class action suits against the tobacco industry.[6]

In the digestive system, cigarette also found to cause cancers. Ito et al (2010). Explained that cigarette smoke contains more than 60 carcinogens linked to various smoking-induced cancers. They found synergistic effects of cigarette smoking and alcohol in carcinogenesis of the upper aero digestive tract. Intensive molecular biological studies have revealed the molecular mechanisms involved in the development of esophageal squamous cell carcinoma (ESCC), and adenocarcinoma.[7] Lubin et al. (2011) analyzed gender risk in a case control study involving cancer cases of 2,441 oral cavity (925 women and 1,516 men), 2,297 oropharynx (564 women and 1,733 men), 508 hypo pharynx (96 women and 412 men), and 1,740 larynx (237 women and 1,503 men) using data of the INHANCE consortium of 15 head and neck cancer case–control studies. They used control cases numbering from 7,604 to 13,829 cases to examine correlation between tobacco smoking and alcohol consumption and lower body mass

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6 Jack Siemiatycki, PhD, Igor Karp, MD, PhD, Marie-Pierre Sylvestre, PhD, and Javier Pintos, MD, PhD. **Estimating the Proportion of Cases of Lung Cancer Legally Attributable to Smoking: A Novel Approach for Class Actions Against the Tobacco Industry.** *Am J Public Health. 2014;104:e60–e66. doi:10.2105/AJPH.2014.302040*

7 S. Ito, A. Egashira, H. Saeki, Y. Kakeji, M. Morita, Y. Maehara . **Alcohol drinking, cigarette smoking, and the development of squamous cell carcinoma of the esophagus: molecular mechanisms of carcinogenesis.** *Int J Clin Oncol (2010) 15:135–144*

index (BMI). They found ORs of smoking and drinking greater in women compared with men for oropharyngeal cancer (p 0.01 for both factors), suggestive for hypo pharyngeal cancer (p = 0.05 and p = 0.06, respectively), but homogeneous for oral cavity (p = 0.56 and p = 0.64) and laryngeal (p = 0.18 and p = 0.72) cancers.[8]

Another cohort investigation sought ethnic differences in the association of cigarette smoking with gastric cancer in the US. The study involved 215,000 men and women, representing five ethnic groups (African Americans, Japanese Americans, Latino Americans, Native Hawaiians, and Whites) using a mailed questionnaire from 1993–1996. After following up for an average of 7.3 years, 454 men and 242 women were diagnosed with gastric adenocarcinoma. The authors used Cox proportional hazard models to estimate adjusted hazard ratios. They found current cigarette smokers had higher hazard ratios compared with never smokers among men (HR = 1.98; 95% CI 1.46–2.70) and women (HR = 1.78; 95% CI 1.23–2.57). The smoking risk was consistent across all five ethnicities. The authors also reported a significant trend correlated intensity (cigarettes per day) and duration (years) of smoking with gastric cancer among all current smokers. The researcher investigated anatomic location of the tumor; ever smokers had a higher risk for gastric cardiac cancer (HR = 2.86; 95% CI 1.66–4.93) than for distal gastric cancer (HR = 1.52; 95%

8 Jay H. Lubin et al.**An examination of male and female odds ratios by BMI, cigarette smoking, and alcohol consumption for cancers of the oral cavity, pharynx, and larynx in pooled data from 15 case–control studies.***Cancer Causes Control (2011) 22:1217–1231*

CI 1.25–1.86) among men and women combined.[9]

In Canada, Zhao et al. (2010) examined the correlation between smoking and colorectal cancer (CRC) using a case control study in Newfoundland and Labrador (NL) area. The population was newly diagnosed cases identified between 1999 and 2003 the matched control were residents with 5-year age group and sex randomly dialed. A total of 702 cases and 717 controls voluntarily agreed to participate in the study and completed a set of self-administered questionnaires. The study found former and current smokers were at a significantly higher risk of CRC with odds ratios of 1.36 and 1.96 respectively. They also observed that higher risks were significantly associated with smoking years, the amount of cigarettes smoked daily, and cigarette pack years. The risk significantly decreased with years of abstention from smoking cigarettes. Alcohol drinkers among men had higher risk.[10]

In Brazil, a large study conducted to estimate the magnitude of the etiological fraction (AF) attributable to smoking for different types of cancers. The study reported a case control published in 2014 covering 231, 102 patients registered in the Cancer Hospital Registries (CHR) from 1998 to 2011. A total of 204,131 cancer cases in 30 topographies were compared with 26,971 cases of non-melanoma skin cancer. Smoking exposure was considered at the time of hospital registration. The authors reported very high risk

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9 Abraham M. Y. Nomura • Lynne R. Wilkens • Brian E. Henderson • Meira Epplein • Laurence N. Kolonel. **The association of cigarette smoking with gastric cancer: the multiethnic cohort study.** *Cancer Causes Control (2012) 23:51–58*

10 Jinhui Zhao et al.**Tobacco Smoking and Colorectal Cancer: A Population-based Case-control Study in Newfoundland and Labrador.** *Can J Public Health 2010;101(4):281-89.*

of smoking to cancer of piriform sinus, bronchi and lung, larynx, hypo pharynx, oropharynx and oral cavity. The high risk was found for cancer of esophagus and bladder, while moderate risks were observed for cancer of anus and anal canal stomach, nasal cavity, middle ear and Para nasal sinuses, pancreas, nasopharynx, other parts of the biliary tract and kidney. The low risks were correlated with liver and gall cancer. They found no association between smoking and cancers of the central nervous system and myeloid leukemia. The authors reported 50% higher AF for hypo pharynx, larynx, bronchi and lung, oropharynx, oral cavity and esophagus cancers.[11]

The Surgeon Report of the 50 years observation in the US (2014) summarized various studies reported sufficient causal relationship between smoking and the following cancers: colorectal adenomatous polyps, colorectal cancer, breast cancer. However, the Surgeon General found suggestive evidence in the association of smoking and prostatic cancer.

Smoking cessation among cancer patients also contribute to the treatment progresses both for tobacco-related cancer survivors (TRCS) and non-tobacco related. A study used 2009 Behavioral Risk Factor Surveillance System data to describe demographic characteristics, cancer history, and smoking history. Tobacco-related cancers were defined as lung/bronchial, pharyngeal, laryngeal, esophageal, stomach, pancreatic, kidney/renal, urinary bladder, cervical, and acute myeloid leukemia. The study reported that 20 % of all cancer survivors were TRCS. Smoking prevalence

11 Marcione Aparecida de Souza Moura,1 Anke Bergmann,1,2 Suzana Sales de Aguiar,1 Luiz Claudio Santos Thuler. **The magnitude of the association between smoking and the risk of developing cancer in Brazil: a multicenter study.** *BMJ Open 2014;4:e003736. doi:10.1136/bmjopen-2013-003736*

was higher among TRCS (27 %) compared with other cancer survivors (16 %) and respondents without a history of cancer (18 %).[12]

Cardiovascular

Cardiovascular is the most common NCD that is attributable to smoking found in various studies, consistently reported from all continents. An astonishing study conducted byHuxley and Woodward (2011)[13] who conducted systematic review of 8,005 articles on the effect of smoking on cardiovascular diseases published from 1966 to 2010. They specifically looked at the risk of women compared to men. This review uncovered consistent effects of smoking across more than three decades. Overall, their review covered almost four million people in mostly cohort studies and 67,075 heart disease patients. They found that risks of heart diseases for smokers were 25% higher compared to non-smokers. The review consists of longitudinal studies in various countries in America, Europe, and Asia. This review contributes to very relevant policy in countries where smoking prevalence among women is increasing. Studies proved that smoking risks for women are higher than for men. While, the risks of heart diseases across gender have been proven unanimously everywhere. Another longitudinal study, on mortality, was reported in Massachusetts, USA, by Kabir et.al

12 J. Michael Underwood & Julie S. Townsend & Eric Tai & Arica White & Shane P. Davis & Temeika L. Fairley. **Persistent cigarette smoking and other tobacco use after a tobacco-related cancer diagnosis.** *J Cancer Surviv (2012) 6:333–344*

13 Huxley and Woodward. **Cigarette smoking as a risk factor for coronary heart disease in women compared with men: a systematic review and meta-analysis of prospective cohort studies.***Lancet 2011; 378: 1297–305*

who reported a 29% decline in smoking prevalence correlated with 31% reduction in CHD mortality rates from 1993 to 2003. They observed total of 425 fewer CHD deaths in 10-year observation, generating 3,365 extra life years attributable to decreased smoking prevalence. They cited empirical evidence from other studies reporting that 15% to 45% of acute myocardial infarctions were correlated with active smoking.[14]

Another study by He et al. (1999)[15] found relative risks of passive smoking in various studies. All reviewed studies reported higher RR among passive smokers to suffer from CHD as shown in Table 4. 1. All studies shown in Table 1 consistently found higher relative risks for smokers compared to non-smokers. Apparently, case-control studies uncovered higher relative risks compared to cohort studies. The impacts of smoking on male and female were relatively equal. Some studies shown different risks among men and women. Interestingly, passive smokers in house or in working places had higher risks of CHD justifying the necessity for non-smoking areas in workplaces. Groh and Morison (2002)[16] conducted metanalysis in Canada to find out the effect of passive smoking on mortality due to heart diseases. They quoted several studies revealing relative risks of 1.25 of passive smokers compared to active smokers in developing CHD. Their important finding was that in 1997, over 800 Canadians died due to passive smoking.

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14 Kabir, Zubair; et al. Coronary Heart Disease Deaths And Decreased Smoking Prevalence in Massachusetts, 1993–2003. *Am J Public Health.* 2008; 98:1468–1469

15 He et al. **Passive Smoking And The Risk Of Coronary Heart Disease — A Meta-Analysis Of Epidemiologic Studies.***The New England Journal of Medicines. 1999; March 25:920-926*

16 Groh and Morrison. **Environmental tobacco smoke and deaths from coronary health diseases in Canada.** *Chronic Diseases in Canada. 2002; 23: 1*

Table 4.1. Relative Risks of CHD by Types of Studies, Gender, and Passive Smoking. Source He et al, 1999

Variable	No Studies	Relative Risk (95% Confident interval)	P value
Cohort	10	1.21 (1.14-1.30)	<0.001
Case-control	8	1.51 (1.26-1.81)	<0.001
Male	9	1.22 (1.10-1.35)	<0.001
Female	15	1.24 (1.15-1.34)	<0.001
Passive smoking home	18	1.17 (1.11-1.24)	<0.001
Passive smoking workplace	8	1.11 (1.00-1.23)	<0.005

Study by He et al. 1999

A US nationwide cohort examined 102,635 women in the Nurses' Health Study followed biennially from 1980 to 2004. This a quarter century study focused on the relation between cigarette smoking and cause-specific deaths. The authors used risk survival analysis to compare associations of smoking on risk of death of coronary heart disease (CHD), cerebrovascular diseases, lung cancer, other respiratory diseases, other smoking-caused cancers and other causes. They found the effect of each smoking-related variable differed significantly (p_h <0.0001) across causes of deaths. For example, risks up to 37% for lung cancer death for a 5-year earlier age at initiation of smoking. Compared with continuing to smoke, former smokers with 5-10 years of cessation had a 61% reduction in risk of dying from CHD and cerebrovascular diseases.[17]

17 Stacey A Kenfield, Esther K Wei, Bernard A Rosner, Robert J Glynn, Meir J Stampfer, Graham A Colditz.**Burden of smoking on cause-specific mortality: application to the Nurses' Health Study.** *Tobacco Control 2010;19:248e254. doi:10.1136/tc.2009.032839*

Other NCDs

In Ireland, a group of researchers evaluated the impact of national smoking ban on cerebrovascular or respiratory mortality. Ireland was the first country in the world implementing nationwide prohibiting smoking in workplace since 2004. The authors utilized a time-series assessment using Poisson regression to examine 215,878 non-trauma deaths. The study found between 2000 and 2007, a post-ban follow-up of 3.75 years there was an immediate 13% decrease in all-cause mortality (RR: 0.87; 95% CI: 0.76–0.99), a 26% decline of mortality from ischemic heart disease (IHD) (RR: 0.74; 95% CI: 0.63–0.88), a 32% drop in stroke mortality (RR: 0.68; 95% CI: 0.54– 0.85), and a 38% fall of mortality from chronic obstructive pulmonary disease (COPD) (RR: 0.62; 95% CI: 0.46–0.83). All of those mortality reductions from IHD, stroke, and COPD were occurred among population ages 65 years. In ages 35–64 years, COPD mortality reductions were found only in females (RR: 0.47; 95% CI: 0.32–0.70). Unadjusted estimates indicated that 3,726 (95% CI: 2,305–4,629) smoking-related deaths were likely prevented by the no smoking regulation in workplaces.[18]

The Surgeon General report (2014) reminded us that the risk of developing diabetes is 30–40% higher for active smokers than nonsmokers. The estimated increase in risk for stroke from exposure to secondhand smoke is about 20-30%. The compilation of the Surgeon General was inline with a study by Fu (1998) who examined the patterns of cigarette smoking in undiagnosed

18 Sericea Stallings-Smith, Ariana Zeka, Pat Goodman, Zubair Kabir, Luke Clancy. **Reductions in Cardiovascular, Cerebrovascular, and Respiratory Mortality following the National Irish Smoking Ban: Interrupted Time-Series Analysis.** *PLOS ONE| www.plosone.org ; April 2013 | Volume 8 | Issue 4 | e62063*

diabetics using a nation survey of the NHANES III. They evaluated an outcome variable of undiagnosed and diagnosed type 2 diabetes. They found that heavy cigarette smoking is correlated with type 2 diabetes. The risk of type 2 diabetes decreased proportionally with the length of time since quitting smoking. There was no evidence suggesting that passive smoking leads to diabetes.[19]

The above review of literatures is just an illustration about serious impacts of tobacco use on morbidity, mortality, and disability across the globe. Evidences of health impacts of tobacco uses are abundant in the medical and social references that could be accessed electronically. People who concern on saving human lives and productivity will find current available literatures are more than enough to support their active role in reducing tobacco use by 30% as committed in the Sustained Development Goals

19 Qiang Fu. **Cigarette Smoking, Alcohol Use, And Type 2 Diabetes Mellitus Among U.S. Adults: Findings From The NHANES III, 1988-1994.** *Dissertation. University of Alabama, USA, 1998*

CAPTER 5

ECONOMIC COSTS OF TOBACCO

CHAPTER 5

ECONOMIC COSTS OF TOBACCO

Tobacco is the single major preventable cause of death. The tobacco consumption in Indonesia has increased significantly in the last three decades due to several factors, such as the growth of the population, the relatively cheap price of cigarettes, wide and intensive marketing of tobacco industries and the lack of community knowledge on the ill impact of tobacco.

For the purpose of analysis, medical expenditures and economic impact of 33 tobacco attributable diseases are included, as follows:

A. Cancer

1. Mouth and oropharynx cancers
2. Esophagus cancer
3. Stomach cancer
4. Colorectal cancer
5. Kidney cancer
6. Liver cancer
7. Pancreas cancer
8. Trachea, bronchus and lung cancers
9. Larynx cancer
10. Cervix uteri cancer

11. Bladder cancer
12. Acute Myeloid Leukemia

B. Cardiovascular Diseases

1. Coronary Heart Disease
2. CerebrovascularDisease/Stroke
3. Abdominal Aortic Aneurysm

C. Respiratory Diseases

1. COPD (Chronic Obstructive Pulmonary Disease)
2. Pneumonia
3. Tuberculosis
4. Asthma
5. Acute respiratory Infection

D. Others

1. Diabetes Mellitus
2. Cataract
3. Peptic Ulcer
4. Ectopic Pregnancy
5. Low Birth Weight
6. Stillbirth
7. Sudden Infant Death Syndrome (SIDS)
8. Oro-facial Cleft
9. Periodontal Disease
10. Female Infertility
11. Male Erectile Dysfunction
12. Low bone density and Hip Fractures
13. Rheumatoid Arthritis

TOTAL: 33 diseases/conditions

METHODS OF ESTIMATION

Cost of Illness Approach

The majority of the cost of smoking studies and most of the economic consequences of disease and injury studies adopt the cost of illness approach (Rice 1966, 1967, 2000; Cooper and Rice, 1976; Rice, Hodgson and Kopstein, 1985).

The approach analyzes the impact of illness from a macroeconomic perspective by aggregating the impact to obtain a societal assessment.

The economic consequences of illness consisted of:

- the expenses incurred because of the illness, and other related indirect costs
- the value of loss of production due to reduced or loss of working time.

The cost of illness approach does not include the impact on welfare and leisure time. It does not capture the long-term dynamic impact of disease on changes in demographic composition, or reduced resources for investing in financial and human capital formation. Thus, it provides a static and only partial estimate of the total macroeconomic impact of disease.

The economic impact of smoking imposes an adverse impact on society, both through the loss of life and productive years and through the financial burden borne by smokers, their families, their healthcare providers, insurance providers as well as their employers.

The economic costs of smoking consist of direct and indirect costs. Direct costs consist of goods or services which involve a monetary exchange in the marketplace. Indirect costs represent losses for

which no money exchanges hands, but nonetheless involve a loss of resources. Indirect costs include the value of time lost from activities due to illness and disability, and the value of lives lost prematurely from smoking-related illnesses.

Direct Costs of Smoking.

Direct costs represent the monetary value of goods and services consumed as a result of smoking and smoking-related illness, and for which a payment is made. Some direct costs result from the use of healthcare services (medical expenditures), while other are related to nonhealthcare costs.

There are two approaches that can be used to estimate the direct costs of smoking, namely: annual cost approach and lifetime cost approach.

Health-Care Costs (Medical Expenditures)

Health-care costs include hospitalizations, physician services, home healthcare, medications, and services of other healthcare providers due to the treatment of smokingrelated diseases. Other related costs include medical supplies and equipment.

In the analysis, we use the Minister of Health Decree No. 59/2014 on Standard Tariff of National Health Insurance.

Non-Healthcare Costs

Non-healthcare costs of smoking include those for transportation to health care providers, care-giving by non-health providers such as family members provided to sick smokers, property losses from fires caused by smoking. In the analysis we exclude the non-healthcare cost.

Indirect Costs of Smoking

Morbidity and Disability Costs.

Morbidity costs are an indirect cost representing the value of lost productivity by persons who are ill or disabled from smoking related diseases. An ill person may be unable to work at their usual job or perform their usual housekeeping and childcare activities. Morbidity costs are estimated by determining what a person would have been able to earn (performing paid labor), and also by estimating an imputed value for lost household production services.

Mortality Costs.

Smokers have an increased probability of dying from a number of diseases that have been causally linked to smoking. The value of the lives lost is known as the mortality cost. One measure of the value of life is based on assigning a monetary value to a life. This can be done using the human capital approach, which values life according to what an individual produces, or the willingness to-pay approach, which values life according to what someone would pay to avoid illness or death.

Another measure of the value of lives lost prematurely is the number of years of potential life lost (YPLL). YPLL denotes the number of years an individual would have lived had they not died of a smoking-attributable disease. The YPLL is determined by the number of years of life expectancy remaining at the age of death.

DALYs Loss

Disability Adjusted Life Years (DALYs) Loss (Murray and Lopez, 1997) incorporates both the impact of smoking-related illness and disability and premature death, i.e., the qualitative and quantitative

aspects of illness, by combining them into one measure.

Years of life lost due to living with a disability is the product of number of incident cases of disease, duration of each case, and a disability weight which reflects the degree of disability. Disability weights to be used with years lived with a specific illness have been developed, incorporating data from several countries, including Indonesia.

Potential years of life lost from premature death are determined by comparing age at death with the expected life expectancy of Indonesia. The mortality component of the DALYs is similar to the YPLLs.

DALY = YLL + YLD

YLL = *years of life lost due to premature mortality*

YLD = *years of life lost due to disability*

YLLi =

$$\frac{KCe^{ra}}{(r+\beta r)^2}\times\left[e^{-(\beta+r)(L+a)}\times(r+\beta r)\times((L+a)-1)-e^{-(r+\beta r)a}\times((-(r+\beta r)(a-1))\right]+\left[\left(\frac{1-K}{r}\right)\left(1-e^{-rL}\right)\right]$$

where

r = the discount rate (r = 0.03),

C = the age weighting correction constant (C = 1),

β = the parameter from the age-weighting function,

K = the age-weighting modulation factor

a = the age of death

L = the standard expectation of life at age

$$YLDi = D\left\{\frac{KCe^{ra}}{(r+\beta)^2}\left[e^{-(r+\beta)(L+a)}\left[-(r+\beta)(L+a)-1\right]-e^{-(r+\beta)a}\left[-(r+\beta)a-1\right]\right]\right.$$

where

a = the age of onset of the disability

L = the duration of disability

r = the discount rate (r = 0.03)

β = the age weighting parameter

K = the age weighting modulation factor

C = the adjustment constant necessary because of unequal age weights

Table 5.1. : Indonesian Population by Age Group and Sex, 2015

Age Group(years)	Population		
	Male	Female	Total
0 – 4	12,273	11,792	24,065
5-15	23,481	22,310	45,791
15 – 44	61,833	61,080	122,913
45 – 59	20,545	20,461	41,006
60 – 64	4,018	3,938	7,956
65 – 69	2,644	2,846	5,490
70 – 74	1,759	2,093	3,852
75 +	1,814	2,574	4,388
Total	128,367	127,094	255,461

Table 5.1. shows the Indonesian Population by age group and sex in 2015, based on projection of 2010 Population Census (Statistics Indonesia, 2010).

Table 5.2.Diseases attributable to tobacco, ICD- 10 Code, Population Attributable Risk (PAR) due to Tobaco,Unit Cost per episode (Minister of Health Decree No. 59/2014) and Total No. of Cases, Indonesia 2015

	Disease	ICD – 10 Code Number	Population Attributable Risk due to Tobacco	Cost of hospitalization per episode per case	Total No of Cases
1)	Mouth and oropharynx cancers	C 00 – 14	0.33	8,124,300	7,850
2)	Oesophagus cancer	C 15	0.3	8,124,300	2,820
3)	Stomach cancer	C 16	0.25	7,647,900	10,960
4)	Colorectal cancer	C18, C19, C20	0.2	7,647,900	6,440
5)	Kidney cancer	C64	0.2	4,854,400	6.600
6)	Liver cancer	C 22	0.1	7,378,900	23,410
7)	Pancreas cancer	C 25	0.2	7,378,900	3,050
8)	Trachea, bronchus and lung cancers	C 33, C 34	0.71	8,497,700	45,100
9)	Larynx cancer	C32	0.15	8,124,300	2,000
10)	Cervix uteri cancer	C 53	0.2	5,576,000	31,450
11)	Bladder cancer	C 67	0.2	4,854,400	4,830
12)	Acute Myeloid Leukemia	C 92	0.15	8,980,800	2,490
13)	Coronary Heart Disease	I 20 – 25	0.12	5,552,200	217,670
14)	Cerebrovascular Disease/Stroke	I 60 – 69	0.07	7,996,300	179,900
15)	Abdominal Aortic Aneurysm	I 71	0.1	18,602,100	304
16)	COPD (Chronic Obstructive Pulmonary Disease)	J 44 – 47	0.85	4,511,300	132,250
17)	Pneumonia	J 10 – J 18	0.12	6,577,300	263,530
18)	Tuberculosis	A 15	0.17	2,814,200	275,430
19)	Asthma	J45	0.4	2,814,200	144,030
20)	Acute Upper Respiratory Infection	J 00 – J 06	0.3	2,748,300	957.850
21)	Diabetes Mellitus	E 10 – E 14	0.13	5,082,200	76,450

22)	Cataract	H 25 – H 28	0,3	3,780,000	14,150
23)	Peptic Ulcer	K 25, K 26, K27, K 28	0,2	3,786,900	35,910
24)	Ectopic Pregnancy	O 00	0,15	10,293,000	68,120
25)	Low Birth Weight	P 05, 07	0.3	4,789,100	818,210
26)	Stillbirth	P 95	0,1	4,676,700	27,700
27)	Sudden Infant Death Syndrome (SIDS)	R 95	01,	4,245,800	7,210
28)	Oro-facial Cleft	Q 67	0,1	5,770,600	7,100
29)	Periodontal Disease	K 05	0,3	2,941,200	103,390
30)	Female Infertility	N 97	0,1	3,804,500	72,630
31)	Male Erectile Dysfunction	N 48	0,2	3,240,300	121,500
32)	Low bone density and Hip Fractures	S72	0,2	7,769,500	2,510
33)	Rheumatoid Arthritis	M 05, M 06	0,2	4,043,300	18,950
TOTAL					**1,997,385**

Table 5.2 shows the total number of cases with 33 diseases attributed to tobacco use in 2015, that is about 1,997,385; with names of diseases, ICD Code Number, Population Attributable Risk due to Tobacco and Cost of hospitalization per episode per case.

Table 5.3. Number of Death Cases Attributable to Tobacco Use by Sex, Indonesia, 2015

		Total Death	Male	Female
1)	Mouth and oropharynx cancers	1,901	1,049	852
2)	Esophagus cancer	904	434	470
3)	Stomach cancer	2,801	1,385	1,416
4)	Colorectal cancer	2,328	1,151	1,177
5)	Kidney cancer	4,298	2,127	2,171
6)	Liver cancer	2,704	1,324	1,380
7)	Pancreas cancer	1,344	629	715

8)	Trachea, bronchus and lung cancers	26,762	21,473	5,289
9)	Larynx cancer	524	310	214
10)	Cervix uteri cancer	18,138	-	18,138
11)	Bladder cancer	1,939	942	997
12)	Acute Myeloid Leukemia	1,954	986	968
13)	Coronary Heart Disease	24,912	13,373	11,539
14)	Cerebrovascular Disease/Stroke	29.727	13,848	15,879
15)	Abdominal Aortic Aneurysm	57	27	30
16)	COPD (Chronic Obstructive Pulmonary Disease)	26,083	16,650	9,433
17)	Pneumonia	11,187	5,561	5,626
18)	Tuberculosis	27,486	14,635	12,851
19)	Asthma	3,406	1,661	1,745
20)	Acute Upper Respiratory Infection	12,096	6,009	6,087
21)	Diabetes Mellitus	1,944	948	996
22)	Cataract	0		
23)	Peptic Ulcer	1,353	510	843
24)	Ectopic Pregnancy	364		364
25)	Low Birth Weight	19,251	9,818	9,433
26)	Stillbirth	0	0	0
27)	Sudden Infant Death Syndrome (SIDS)	7,210	3,440	3,770
28)	Oro-facial Cleft	0		
29)	Periodontal Disease	0		
30)	Female Infertility	0		
31)	Male Erectile Dysfunction	0		
32)	Low bone density and Hip Fractures	0		
33)	Rheumatoid Arthritis	189	81	108
TOTAL		230,862	118,371	112,491

Table 5.3. shows the total death attributed to tobacco use by disease and sex in 2015 and distribution by sex.

Table 5.4. Total Productive Years Loss (Disability Adjusted Life Years/ DALYs Loss)due to Tobacco Attributable Diseases, By Sex, Indonesia, 2015

	DISEASE	Total	Male	Female
1)	Mouth and oropharynx cancers	29,160	14,640	14,520
2)	Esophagus cancer	11,150	5,520	5,630
3)	Stomach cancer	65,500	34,990	30,510
4)	Colorectal cancer	52,340	26,240	26,090
5)	Kidney cancer	85,300	42,710	42,590
6)	Liver cancer	77.220	40,050	37,170
7)	Pancreas cancer	5,410	2,560	2,850
8)	Trachea, bronchus and lung cancers	394,510	333,240	61,270
9)	Larynx cancer	3,880	2,390	1,490
10)	Cervix uteri cancer	425,970		425,970
11)	Bladder cancer	18,100	9,170	8,930
12)	Acute Myeloid Leukemia	47,090	23,900	23,190
13)	Coronary Heart Disease	368,220	207,710	160,510
14)	Cerebrovascular Disease/Stroke	1,288,410	571,630	716,780
15)	Abdominal Aortic Aneurysm	184,400	116,960	67,440
16)	COPD (Chronic Obstructive Pulmonary Disease)	491,390	305,800	185,600
17)	Pneumonia	252,660	127,890	124,770
18)	Tuberculosis	637,140	422,020	215,120
19)	Asthma	192,460	98,540	93,920
20)	Acute Upper Respiratory Infection	265,600	133,730	131,870
21)	Diabetes Mellitus	86,740	43,170	43,570
22)	Cataract	7,860	3.540	4,320
23)	Peptic Ulcer	38,360	23,180	15,180
24)	Ectopic Pregnancy	236,451		236,451
25)	Low Birth Weight	2,733,110	1,206,750	1,526,370
26)	Stillbirth	0		
27)	Sudden Infant Death Syndrome (SIDS)	310,370	153,040	157,330

28)	Oro-facial Cleft	15,340	7,810	7,530
29)	Periodontal Disease	6,640	3,100	3,540
30)	Female Infertility	89,050		89,050
31)	Male Erectile Dysfunction	107,000	107,000	
32)	Low bone density and Hip Fractures	2,510	1,130	1,380
33)	Rheumatoid Arthritis	29,250	13,940	15,310
	TOTAL DALYs LOSS in 2015:	**8,558,601**	**4,082,350**	**4,476,251**

Table 5.4. Shows the total productive years loss due to morbidity, disability and premature mortality in 2015 was 8,558,601 DALYs.

With GDP per capita of Indonesia in 2015 (IMF): US $ 3,362.00; the total macroeconomic loss was US $ 28,774,016,560.00, - (28.7 Billion US Dollars) or equal to 374.06 Trillion Rupiah (US $ 1 ~ Rp 13,000.00).

The medical expenditures include hospital costs (in-patient services) based on Standard Tariff of the National Health Insurance in Class B Hospital (Region 1) and out-patient services in primary care and secondary care facilities.

Table 5.5. Total Medical Expenditures (in-patients) of Tobacco Attributable Diseases, Indonesia 2015

	Disease	Total Cases	Cost per episode	Total Cost (Rp)
1)	Mouth and oropharynx cancers	2,490	8,124,300	63775755000
2)	Esophagus cancer	1,710	8,124,300	22910526000
3)	Stomach cancer	820	7,647,900	83820984000
4)	Colorectal cancer	6,440	7,647,900	49252476000
5)	Kidney cancer	140	4,854,400	32039040
6)	Liver cancer	260	7,378,900	1.7274E+11
7)	Pancreas cancer	100	7,378,900	22505645000
8)	Trachea, bronchus and lung cancers	12,820	8,497,700	3.83246E+11
9)	Larynx cancer	4,550	8,124,300	16248600000
10)	Cervix uteri cancer	16,610	5,576,000	1.75365E+11
11)	Bladder cancer	3,260	4,854,400	23446752000
12)	Acute Myeloid Leukemia	5,700	8,980,800	22362192000
13)	Coronary Heart Disease	36,000	5,552,200	1.20855E+12
14)	Cerebrovascular Disease/Stroke	51,270	7,996,300	1.43853E+12
15)	Abdominal Aortic Aneurysm	3,040	18,602,100	5655038400
16)	COPD (Chronic Obstructive Pulmonary Disease)	50,980	4,511,300	5.96619E+11
17)	Pneumonia	149,260	6,577,300	1.73332E+12
18)	Tuberculosis	275,430	2,814,200	7.75115E+11
19)	Asthma	144,030	2,814,200	4.05329E+11
20)	Acute Upper Respiratory Infection	957,850	2,748,300	2632459155
21)	Diabetes Mellitus	76,450	5,082,200	3.88534E+11
22)	Cataract	14,150	3,780,000	53487000000
23)	Peptic Ulcer	35,910	3,786,900	1.35988E+11
24)	Ectopic Pregnancy	96,640	10,293,000	7.01159E+11
25)	Low Birth Weight	217,720	4,789,100	3.91849E+12
26)	Stillbirth	103,620	4,676,700	1.29545E+11
27)	Sudden Infant Death Syndrome (SIDS)	7,210	4,245,800	30612218000

28)	Oro-facial Cleft	7,100	5,770,600	40971260000
29)	Periodontal Disease	103,390	2,941,200	3.04091E+11
30)	Female Infertility	72,630	3,804,500	2.76321E+11
31)	Male Erectile Dysfunction	121,500	3,240,300	3.93696E+11
32)	Low bone density and Hip Fractures	4,850	7.769.500	19501445000
33)	Rheumatoid Arthritis	18,880	4,043,300	76620535000
TOTAL MEDICAL EXPENDITURES (Rupiah)				**1.36705E+13**

Table 5.6. Total Medical Expenditures (out-patient services) of Tobacco Attributable Diseases, Indonesia 2015

Disease		Total Cases	Cost per visit	Total Cost (Rp)
1)	Mouth and oropharynx cancers	2,490	10,000	24900000
2)	Esophagus cancer	1,710	10,000	17100000
3)	Stomach cancer	820	10,000	8200000
4)	Colorectal cancer	2,748,300	10,000	2.75E+10
5)	Kidney cancer	140	10,000	1400000
6)	Liver cancer	260	10,000	2600000
7)	Pancreas cancer	100	10,000	1000000
8)	Trachea, bronchus and lung cancers	12,820	10,000	1.28E+08
9)	Larynx cancer	4,550	10,000	45500000
10)	Cervix uteri cancer	16,610	10,000	1.66E+08
11)	Bladder cancer	3,260	10,000	32600000
12)	Acute Myeloid Leukemia	5,700	10,000	57000000
13)	Coronary Heart Disease	36,000	10,000	3.6E+08
14)	Cerebrovascular Disease/Stroke	51,270	10,000	5.13E+08
15)	Abdominal Aortic Aneurysm	3,040	10,000	30400000
16)	COPD (Chronic Obstructive Pulmonary Disease)	50,980	10,000	5.1E+08
17)	Pneumonia	149,260	10,000	1.49E+09
18)	Tuberculosis	275,430	10,000	2.75E+09
19)	Asthma	144,030	10,000	1.44E+09
20)	Acute Upper Respiratory Infection	957,850	10,000	9.58E+09

21)	Diabetes Mellitus	76,450	10,000	7.65E+08
22)	Cataract	14,150	10,000	1.42E+08
23)	Peptic Ulcer	35,910	10,000	3.59E+08
24)	Ectopic Pregnancy	96,640	10,000	9.66E+08
25)	Low Birth Weight	217,720	10,000	2.18E+09
26)	Stillbirth	103,620	10,000	1.04E+09
27)	Sudden Infant Death Syndrome (SIDS)	7,210	10,000	72100000
28)	Oro-facial Cleft	7,100	10,000	71000000
29)	Periodontal Disease	103,390	10,000	1.03E+09
30)	Female Infertility	72,630	10,000	7.26E+08
31)	Male Erectile Dysfunction	121,500	10,000	1.22E+09
32)	Low bone density and Hip Fractures	4,850	10,000	48500000
33)	Rheumatoid Arthritis	18,880	10,000	1.89E+08
	TOTAL MEDICAL EXPENDITURES (Rupiah)			**53,446,700,000**

Table 5.5 shows the total medical expenditure (in patients) due to tobacco attributable diseases in 2015: Rp. 13,670,500,000,000,- and Table 5.6. shows the total medical expenditures (out-patients) with the assumption only 1 visit per case in 2015: Rp. 53,446,700,000,-

The average estimated cigarette consumption per person per day in 2015 was 12.3 sticks or 369 sticks per month.

If the average price per stick was Rp. 700.00; the total expenditures per capita to purchase cigarettes in one month was Rp. 258,300.00,- or in one year Rp. 3,099,600.00,-

It is estimated that in 2015, the total expenditure in 2015 to purchase cigarettes by the Indonesian (36.3 % of 185,605,000 active smokers @ Rp. 3,099,600.00) was RP.208,834,356,700,000,-.

Thus, the total macro economic loss in 2015 were in the amount of 596,61 Trillion Rupiahs (equal to 45.9 Billions US Dollars) that includes: expenditures to purchase cigarettes (208.83 Trillion Rupiah), Disability Adjusted Life Years (DALYs) Loss or productive years loss due to morbidity, disability and premature mortality (374,06 Trillion Rupiah), total medical expenditures due to tobacco attributable diseases (13.67 Trillion Rupiah for in-patient services and 53.44 Billion Rupiah for out-patient services).

CAPTER 6

DISCUSSIONS

CHAPTER 6

DISCUSSIONS

The analysis shows that the prevalence of active smokers is high among the disadvantaged population (low income, less educated, staying in rural area), thus those population groupare mostly affected by the ill impact of smoking.

As a risk factor, tobacco is responsible for more than 30 attributable diseases (mostly non-communicable diseases). Data from the national health insurance provider (BPJS – Kesehatan) shows the high burden of non-communicable diseases attributed to tobacco that affect the current financing capacity of the insurance provider.

Since nicotine in tobacco is addictive, the competing expenditureof tobacco defeats all other priority spending need in the household such as education and nutritious food for their children; and create more social and health problems in the family. This situation will perpetuate the poor conditions of the disadvantaged family.

The increased prevalence of active smokers among young adults will endanger the quality of the future generation and affect the anticipated demographic bonus in Indonesia.

The similar pathways between nicotine, heroin and cocaine in affecting the central nervous system through the limbic system, aggravate the addictive condition of smokers.

International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Second Edition, WHO 2004 has classified tobacco as a cause of mental and behavioral disorders due to psychoactive substance use: Tobacco (F17).

The Indonesia Health Law No. 36/2009 has also regulated the safety of addictive substance that includes tobacco and products that contain tobacco, followed by the Government Regulation No. 109/212 on the safety of addictive substance of tobacco products for health.

Given the importance of tobacco as one of main risk factors to health of the Indonesian, monitoring the distribution and intensity of tobacco use is critical to identify priority areas for action and evaluating progress of tobacco control efforts.

CAPTER 7

POLICY IMPLICATION AND RECOMMENDATIONS

CHAPTER 7

POLICY IMPLICATION AND RECOMMENDATIONS

POLICY IMPLICATION

The epidemic of tobacco use creates unnecessary preventable tobacco attributable diseases, affects social welfare of the poor and aggravates macroeconomic burden of the country. The high level of smoking attributable diseases and deaths (more than 230,000 deaths in 2015) will persist in the near future; unless we could improve the implementation of appropriate tobacco control efforts.

Indonesia needs to accelerate the efforts to improve the population health status, including control of one of major risk factors i.e. tobacco use, to be able to curb the epidemic of Non Communicable Diseases.

On February 7, 2008, the World Health Organization launched the MPOWER (Monitor, Protect, Offer help, Warn, Enforce, Raise taxes) as a package of the six most important and effective tobacco control policies established by WHO. MPOWER strategies include raising taxes and prices, banning advertising, promotion and sponsorship, protecting people from secondhand smoke, warning everyone about the dangers of tobacco, offering help to people who

want to quit, and carefully monitoring the epidemic and prevention policies.

Serious commitment of government, civil society including community groups and private sector to implement tobacco control policies as outlined in MPOWER are urgently needed to lower tobacco consumption, reduce health and economic burden of tobacco attributable diseases and to prevent premature mortality.

The evidence shows that we were not able to curb the increase prevalence of tobacco use, including among youth; that would bring negative health consequences. Thus we need to fully implement and sustain the most effective tobacco control interventions and regulations.

The macro-economic loss estimates clearly show that the economic impact of tobacco consumption tends toward substantial disadvantage for public health improvement and country development. Governments at various level and private sector should have equal perception, commitment, direction and action to accelerate economic achievement without sacrificing public health concerns.

The situation indicates a need for better coordination within the central and local governments in implementing the tobacco control and curbing the increase use of tobacco.

Under a decentralized government system, local authorities have more power to prevent negative economic and social impact of tobacco consumption with intensive supports from the central government. Stronger pro-health leadership is required in central and local government to support programs to prevent hazardous impact of tobacco consumption.

RECOMMENDATIONS

- There is urgent need to counteract the marketing of tobacco industry by strengthening tobacco control through national media campaigns, to prevent initiation of tobacco useby young generation and female population and to gain public awareness on hazardous and addictive impact of all forms of smoking.
- Increase the average excise cigarette taxes to a maximum of 57 % (according to the current law)
- Provide access to tobacco cessation services in strategic settings, such as school, workplaces, public places, health care facilities and community groups;establish ”quit-line service” (telephone hot-line), including counselling facilities for active smokers, especially women and youth; by providing support and services at grass-root level facilities
- Expanding and strengthen smoke free regulation for public places as well as maintaining the existing regulation in health, education, transport facilities, as well as play-ground area
- Obtaining additional resources for tobacco control efforts, e.g. utilizing the local tobacco excise tax fund
- Build a Health Promotion Board to manage local tobacco excise tax fund and to utilize for enhancing promotion of healthy life-style at national and local level, and to implement more effective tobacco control interventions, specifically under WHO’s MPOWER (Monitor, Protect, Offer Help, Warn, Enforce, Raise taxes) guidelines

- Improve investment on research and development of smoking related issues in the areas of economy, social, anthropological, health, agricultural and trade to provide stronger evidences to support inter-sector advocacy processes as well as to obtain more effective

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