

*Sleeping with a Killer:*

*The Effects of Smoking  
on Human Health*

Go  
smokefree!  
Vivez  
sans fumée!



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*The Effects of Smoking  
on Human Health*

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**One person dies every 10 seconds as a result of tobacco use.**

***World Health Organization***

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# 1. Introduction

All forms of tobacco use are hazardous, but the hazards are magnified when smoke from tobacco is inhaled. Use of tobacco has been clearly identified as the direct cause of cancers of the oral cavity, oesophagus, stomach, pancreas, larynx, lung, bladder and kidney, as well as certain type of leukaemia. Besides cancer, cigarette smoking is a direct cause of ischemic heart disease, lung disease, stroke, pneumonia, and more. The nicotine in tobacco is addictive, which makes it extremely difficult for most users to stop, once they have adopted it as part of their lifestyle. But stopping is possible, making death from tobacco-related disease avoidable.

## a. Historical aspects of tobacco use

According to the International Agency for Research on Cancer (IARC), when Columbus landed in the New World on October 11, 1492, he was offered dried tobacco leaves. Various names were given to the tobacco plant, one of the most popular being *Nicotiana*, after Jean Nicot, the French ambassador to Lisbon. Nicot was one of the first people to grow tobacco in Portugal and was largely responsible for introducing the plant to the royal court in Paris; in 1585 the Duc de Guise proposed that his name be used for the plant. However, the word “tobacco” had become established in North America and has outlasted all others in common usage. Early writers disagreed on the origin of this name; originally it seems to have meant not to tobacco itself, but a type of tube used by natives to inhale smoke from burning tobacco, or to a cylinder of tobacco leaf prepared for smoking. *Nicotiana* was retained as the generic name. The tobacco plant thus belongs to the genus *Nicotiana*, which is a member of the family *Solanaceae*. The tobacco first grown in France and Spain was *Nicotiana tabacum*, from seeds originating from Brazil and Mexico. The species first grown in Portugal and England was *N. rustica*, the seeds grown in Portugal came from Florida, those sown in England from Virginia.

Tobacco was originally smoked in pipes but cigarettes and cigars gradually became more popular. The early form of cigarettes consisted of tobacco stuffed into hollow reeds or cane tubes, or crushed tobacco leaves and shreds rolled in corn husks or other vegetable wrappers. During the eighteenth century

cigarettes became more widely accepted, and the first cigarette-making factories were set up in Havana, Cuba, in 1853, in London in 1856, and in the American colonies in 1860.

Tobacco has been consumed in a variety of ways in many parts of the world. Wider access to it became possible towards the end of the nineteenth century when cigarettes began to be manufactured industrially; production expanded enormously during the twentieth century. Today, cigarettes have become by far the most common form in which tobacco is used throughout the world. Consumption has increased steadily in most regions, although cigarette sales in a few western countries have stabilized or even declined in recent years.

## **b. Current trends**

About 1.1 billion people smoke worldwide. By 2025, the number is expected to rise to more than 1.6 billion. In high-income countries, although the number of smokers continues to rise in some groups, overall numbers have been declining for decades. In low- and middle-income countries, cigarette consumption has been increasing, particularly in recent years following freer trade in cigarettes.

In developed countries, around 40% of men and 17% of women are regular smokers. On average, globally, each consumes 15 cigarettes a day compared with 14 cigarettes per day in developing countries. In developed countries, tobacco use is responsible for 24% of all deaths among men and 7% of all deaths among women. According to World Health Organization (WHO) estimates, smoking kills 1 person every 10 seconds, which is around 4 million deaths a year. This is expected to rise to about 10 million deaths yearly (or 1 out of 6 smokers) by the 2020s or early 2030s. By this time, based on current smoking trends, tobacco will be the leading cause of disease in the world. Until recently, this epidemic of chronic disease and premature death affected mainly the rich countries. It is now rapidly shifting to the developing world. The WHO estimates that by 2020, 7 of every 10 people killed by smoking will be from low- and middle-income nations. Throughout the world, 500 million people will die because of smoking and half of these deaths will occur in the middle age.

In a recent national survey of Canada, it was reported that 5.4 million Canadians, or 22 percent of the population aged 15 years and older, were smokers in the year 2001. Daily smokers consume an average of 16.2 cigarettes per day. Approximately 24% of men aged 15 and over were smokers, slightly higher than the proportion of women (20%). Most smokers begin by age 15, which means that they have virtually an entire lifetime of accumulated risk for cardiovascular disease, cancers, and other smoke-related illnesses. Encouragingly, smoking rates for youth have begun to decrease in recent years, 22.5% of teens aged 15–19 reported themselves as current smokers in 2001.

Based on four Canadian cohort studies, the expected number of premature deaths (before age 70) among lifelong smokers was found to be about twice that expected among lifelong never-smokers for both men (2.3) and women (1.9). The most important causes of premature deaths in these studies were cancer and coronary heart disease. In the USA, tobacco use is responsible for approximately 450,000 deaths yearly.

Few people now dispute that smoking is damaging human health on a global scale. However, many governments have avoided trying to control smoking through higher taxes, comprehensive bans on advertising and marketing promotions, or restrictions on smoking in public places because of concerns that such interventions might have harmful economic consequences. For example, some policy-makers fear that reduced sales of cigarettes would mean the permanent loss of thousands of jobs that higher tobacco taxes would result in lower government revenues, and that higher prices would encourage massive levels of cigarette-smuggling.

### **c. The health consequences**

Tobacco smoke contains literally thousands of chemical agents, including 60 constituents that are known carcinogens, co-carcinogens, or tumor promoters. The average smoker is subjected to a constant barrage of hazardous agents. It is thus not surprising that smokers are more likely to develop cancer, heart disease, emphysema, bronchitis, and other chronic and debilitating diseases at rates substantially higher than persons who never smoked. Smokers are 3 times more likely to develop cancer than non-smokers.

In North America tobacco is the cause of about half of all cancer deaths among middle-aged men and one-third among older men. It is also the cause of one-third of all deaths among middle-aged women in North America. Lung cancer due to tobacco kills more women in North America each year than breast cancer.

Quitting smoking greatly reduces the risks of all these diseases. For example, within a year of quitting, a former smoker's risk of heart disease is reduced by nearly 50% compared to someone who continues to smoke. The risk of lung cancer does not decrease as rapidly, but the sooner the smoker quits smoking, the quicker the benefit begins. Usually after 10 to 15 years without cigarettes, the health status of most former smokers is not significantly different from that of a lifelong non-smoker. Residual risk following cessation is strongly dependent on total previous exposure to cigarette smoke, length of time without cigarettes, and the health status of the individual at the time of stopping.

Smoking causes fatal and disabling diseases. Compared with other potentially dangerous behaviors, the risk of premature death is extremely high among smokers: half of all long-term smokers will eventually be killed by tobacco, and of these, half will die during middle age, losing 20 to 25 years of life. The diseases associated with smoking are well-documented, and include cancers of the lung and other organs, ischemic heart failure and other circulatory diseases, as well as respiratory diseases such as emphysema. Smokers also face a greater risk than non-smokers of dying from tuberculosis in regions where the disease is prevalent.

Since the poor are more likely to smoke than the rich, their risk of smoking-related and premature death is also greater. In high- and middle-income countries, men in the lowest socio-economic groups are up to twice as likely to die in middle age as men in the highest socio-economic groups, and smoking accounts for at least half their excess risk.

Smoking also affects the health of non-smokers. Babies born to smoking mothers have lower birth weights, face greater risks of respiratory diseases, and are more likely to die of sudden infant death syndrome than babies born to non-smokers. Adult non-smokers face small but increased risks of fatal and disabling disease from exposure to other people's smoke.

#### d. Tobacco is addictive

The WHO has classified smoking as an addiction (tobacco-dependence syndrome). Tobacco use shows regular and compulsive patterns, with a withdrawal syndrome usually accompanying tobacco cessation. The pharmacological and behavioral processes that determine tobacco addiction are similar to those that determine addiction to drugs such as heroin and cocaine. Nicotine's effects on brain dopamine reward systems are similar to those of drugs such as heroin, amphetamine, and cocaine. In a ranking of the addictiveness of psycho-active drugs, nicotine was determined to be *more* addictive than heroin, cocaine, alcohol, caffeine, and marijuana.

Stimulation is nicotine's predominant pharmacological action, producing electrocortical activation as well as affecting the heart and endocrine systems. Nicotine entering the body through cigarette-smoking affects nearly all brain neurotransmitters and neuroendocrine systems. Chronic exposure to nicotine through cigarette smoke causes structural changes in the brain by increasing the number of nicotinic receptors.

The immediate consequences of nicotine use are increased heart rate, blood pressure, and blood flow from the heart, with narrowing of the blood vessels. Other smoking effects, which may be due mainly to other smoke components but with a contribution from nicotine in some cases, include decreased oxygen levels in blood due to increased levels of carbon monoxide; elevated amounts of fatty acids, glucose, cortisol and other hormones in the blood; higher risk of hardened arteries and blood clotting (leading to heart attack and stroke); and carcinogenesis.

The most serious chronic consequence of nicotine use is dependence. Once a person becomes a smoker, it is physically and psychologically difficult to break the habit. In addition to being physiologically addictive, cigarette-smoking may also supply desired psychological rewards. These, together with frequently repeated rituals of lighting up and puffing, ensure that smoking becomes a powerfully compulsive behavior.

Smoking is an expensive habit. You can save around \$5 a day, depending on the number of cigarettes you smoke. For example, if you smoke a packet of cigarettes a day, in a year you can save \$1,825. In 10 years, this totals \$18,250.00,

and in 30 years the amount is around \$54,750.00. A 30-year smoker will not only burn more than \$50,000 during his or her lifetime but has a good chance of developing non-curable possibly fatal diseases.

Tobacco products are estimated to have caused 3 million deaths in the early 1990s and the death rate is steadily increasing. Unless current smoking trends are reversed, that figure is expected to rise to 10 million deaths per year by the 2020s or early 2030s, with 70% of those deaths occurring in developing countries.

Worldwide, it is estimated that 47% of men and 12% of women smoke. In the developed countries the corresponding figures are 42% for men and 24% for women. In developing countries, available data suggest that about 48% of men and 7% of women smoke.

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## 2. Risk of Cancer Attributed to Tobacco-Smoking

A review of 1,135 well-designed epidemiological studies on tobacco-smoking and cancer that took place between 1985-2002 are summarized in this section. They are divided into studies concerned with active smoking, when a person smokes tobacco regularly; and passive smoking, or what is called second-hand smoking, when a person is exposed to the cigarette smoke of others.

When tobacco burns a large variety of chemical reactions occur. So far, more than 2,500 components have been identified in the tobacco leaf and more than 3,900 components in tobacco smoke. Many of these have possible tumorigenic and carcinogenic effects. Among the most potent are polycyclic aromatic hydrocarbons (PAH) and tobacco specific nitrosamines (TSNAs). Among the many components in smoke are some that contain hundreds of sub-chemical compounds. The most important:

Alcohol	Ether
Aldehydes	Hydrocarbons
Amides	Ketones
Amines	N-nitrosamines
Benzene	N-heterocyclics
Carboxylic acids	Nitriles
Carbohydrates	Phenols
Esters	

### a. Active smoking

**Lung cancer**, the disease most frequently found causally associated with smoking, is also the most extensively studied in this context. The average relative risk (RR) found in the studies considered was 3.0, meaning that a smoker has a 3 times greater risk of developing lung cancer than a non-smoker of the same age. The RR in the studies reviewed here, for both sexes and multiple racial groups, ranged from 2.8-16.9 (6.8 to 23.5 for men and 2.2 to 16.1 for women). In other words, smokers have 3 to 17 times more chance of developing lung cancer than non-smokers.

Lung cancer continues to be the leading cause of cancer death in North America. It is the most frequent cancer worldwide, accounting for about 12% of all new cancers diagnosed in both men and women combined. The incidence of lung cancer in men has slowly decreased since the late 1980s, but has begun to reach a plateau in women only in 2000.

The 1986 International Agency for Research on Cancer (IARC) monograph on smoking showed conclusively that smoking plays a causative role in respiratory and upper digestive tract (ADT) cancers, particularly **cancers of the mouth, larynx, pharynx, and esophagus**. The RR of developing these cancers for smokers is higher than for cancer at other sites, except perhaps for lung cancer. In general, rates of oral and esophageal cancers are 2.0-3.5 and 1.9-6.3 times higher respectively in smokers than in non-smokers. In a cohort study of 2,600 men and women followed for 28 years, a dose-response relationship was observed between both cigarette and pipe smoking and cancer of the respiratory tract.

Two well-designed studies indicate that active tobacco smoking is a risk factor for **stomach cancer**. Both studies report that smokers have around 1.8 times more chance of developing stomach cancer. In a recent meta analysis, the evidence suggests that cumulative exposure to cigarette smoking overlong periods of time may increase **colorectal cancer** risk.

The published papers on smoking and **liver cancer** show a positive association with a dose-response relationship in most studies. Based on several recent studies of incident cases with histological verification, the overall magnitude of risk among current smokers exceeds that for stomach cancer.

**Pancreatic cancer** is one of the cancer sites clearly related to tobacco-smoking. Ten studies on the carcinogenic effect of tobacco on the pancreas have demonstrated an overall RR of 1.2-2.6. Two case-control studies in Canada have reported a similar risk for active smokers, both statistically significant. One of these studies presented data that showed a much more pronounced smoking-associated risk among women. In this study, female smokers had approximately 6 times higher risk than non-smokers. In a large cohort followed for 26 years, a strong association between cigarette smoking and pancreatic cancer was reported.

According to 10 epidemiological studies, cigarette-smoking is a major cause of **bladder cancer**. In most studies, risks declined over time following smoking cessation. The RR range in these studies was 1.8-3.1, with a pooled RR estimate of 2.2. The tobacco-associated risk for bladder cancer seemed to be lower in women than in men. A dose-response relationship of cigarette smoking and bladder cancer was observed in a large cohort study.

The magnitude of association with smoking appears to be higher for **cancers of the renal pelvis and ureter** than for kidney cancer. The RR in 5 studies on both sexes combined ranged from 1.6 to 3.9. A large case-control study of renal cancer and smoking in Canada reported the risk of renal cancer among smokers to be twice as high as that for non-smokers for both sexes, with a similar pattern among males and females.

Strong evidence has been presented for an association between **anal cancer** and tobacco-smoking, RR of 3.2. The RR in males was 5.0, compared with 3.0 in females. Slight to moderate associations were noted for cancer of the vulva, with RR ranging from 1.2 to 3.3. The overall smoking-associated RR for cancer of the *vagina* was around 1.9, indicating that smokers have almost double the risk for this cancer.

The pooled estimate of RR in 5 studies on the role of tobacco smoke in the etiology of **cervical cancer** was 1.6. In other words, smokers are 60% more likely to develop cervical cancer than non-smokers. In a recent large cohort study, current cigarette smokers had a significantly higher risk of cervical cancer than those who never smoked.

The range of RR in 3 epidemiological studies on the effect of tobacco-smoking on **ovarian cancer** was not significant and a cohort study also confirmed this outcome. Therefore, no firm conclusions could be reached regarding smoking and risk of ovarian cancer.

The latest Surgeon General's report (United States Department of Health and Human Services) concluded that cigarette smoking is not associated with risk of **breast cancer**. The 1986 IARC report also reached no firm conclusion on an association between smoking and breast cancer. It was considered that a small level of risk reduction could be expected, due to the influence that cigarette-smoking has on hormone balance.

Regarding **prostate cancer** and smoking, 11 studies documented a small increase in risk. In a recent population based case-control study among men with high body mass index, an appreciable association was found between cigarette smoking and prostate cancer risk.

A total of 12 epidemiological studies on the effect of tobacco smoke and risk of **leukemia** were reviewed, with a pooled RR estimate of 1.75 (75% increased risk). The smoking-associated risk for leukemia seemed to be higher among males than females. A joint case-control study analysis in the U.S.A., Canada, and Denmark showed a 10% increase in risk for smokers. In a recent case-control study of tobacco smoking and *acute myeloid leukaemia* (AML), smoking appeared to have an effect at high cumulative doses. For *non-Hodgkin's lymphoma*, the risk associated with smoking seemed to be higher among white males.

**Endometrial cancer** is the only site with a consistent negative association with smoking. This negative association ranges from 5% to 38% for persons with endometrial cancers in North America.

In conclusion, links between *active smoking and cancer are highest for lung cancer. It can be concluded that active smoking may be responsible for a large number of new cases of lung cancer worldwide.*

It is evident that cancers of the respiratory and upper digestive tracts, pancreas, bladder, and kidney can be firmly associated with smoking. Less firmly associated with smoking are cancers of the stomach, liver, anus, vulva, penis, cervix, prostate, leukemia, and lymphoma.

## **b. Passive smoking**

A total of 22 epidemiological studies on passive smoking and cancer were reviewed and produced interesting results for different cancer sites.

In 1993, the Surgeon General's report on the possible role of environmental tobacco smoke (ETS) indicates that it was responsible for approximately 3,000 lung cancer deaths annually among U.S. non-smokers. In a large case-control study of passive smoking and lung cancer the overall RR was 1.9. In

other words, passive smokers have almost twice as high as risk of developing lung cancer as non-smokers not exposed to cigarette smoke. The pooled estimate of RR for all studies combined was 1.14.

Study of lifetime residential and workplace exposure to environmental tobacco smoke and lung cancer in women in Canada who have never smoked shows that lung cancer is associated with residential passive exposure (21 to 63% increased risk).

A review of 7 studies of passive smoking and cancer sites other than the lung revealed a low RR, except for cancers of the nasal and maxillary sinuses. It is interesting that in 3 studies the RR ranged from 0.9 for home exposure alone to 1.8 for multiple environmental tobacco smoke exposure and 4.9 for combined home and work exposure. The latter rate is in the same range as that typically seen between active smoking exposure and cervical cancer.

In summary, the increased risk of lung cancer after exposure of passive smoking ranges from 15% to 77%, suggesting that passive smoking may be responsible for a good proportion of new cases of lung cancer annually world-wide. More detailed studies are needed to determine whether passive smoking causes other cancers.

Of all diseases causally associated with smoking, lung cancer is the most well-known, simply because in most populations almost all lung cancer deaths are due to smoking. However, smoking actually causes more deaths from diseases other than lung cancer.

WHO

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### 3. Risk of Non-Cancerous Respiratory Effects Due to Active and Passive Tobacco Smoking

The deposit of cigarette smoke particles and gases in the lungs is known to affect their defences. The non-malignant effects of active and passive smoking on respiratory health have been examined in various population sub-groups thought to have differing susceptibilities through a review of 84 epidemiological studies carried out in 1991-2001. In general, the annual mortality rate due to respiratory disease among subjects smoking 1-14 cigarettes a day is 86 per 100,000, compared with an annual mortality rate of 112 per 100,000 for subjects smoking 15-24 cigarettes a day, and 225 per 100,000 for heavy smokers (25 cigarettes or more a day).

The risk of death from chronic obstructive pulmonary disease (COPD) for smokers is estimated to be 6 times higher in males and 15 times higher in females than in non-smokers. There is also a 4-fold increased risk associated with post-hospitalization smoking after admission for near-fatal asthma attacks. In terms of respiratory symptoms, the risks associated with smoking are 7-fold for chronic cough and chronic phlegm, 7-fold for wheezing, and 8-fold for persistent sputum production and dyspnea. The loss of forced expiratory volume ( $FEV_1$ ) attributable to smoking is in the order of about 13 ml per year and is related to the number of cigarettes smoked, ranging from 4 ml per year for those smoking less than 15 cigarettes a day to around 14 ml per year for smokers of 25 cigarettes or more a day. The causal role of smoking in COPD is beyond doubt. Smoking causes a rapid decline of  $FEV_1$  among COPD and asthmatic patients, as well as increased mortality, morbidity, and non-cancerous respiratory symptoms.

Concerning the risk of non-cancerous respiratory effects of passive tobacco-smoking, a review of well-designed epidemiological studies showed that there is a 2-fold increased risk of respiratory symptoms such as wheezing, dyspnea, coughing, and phlegm associated with exposure to environmental tobacco smoke (ETS). The reduction of  $FEV_1$  with ETS exposure is in the order of 30%. Among asthmatics, deficits in  $FEV_1$  linked with ETS are much more

pronounced, on the order of 10%. These rates apply equally to adults and children. It is commonly believed that the respiratory health-related effects of ETS are likely to be greater than those measured in epidemiological studies due to the self-selection of subjects and inaccurate assessment of ETS exposure.

Among men in developed countries, smoking is estimated to be the cause of 40-45% of all cancer deaths, 90-95% of lung cancer deaths, 75% of chronic obstructive lung disease deaths, just over 20% of all vascular disease deaths and 35% of cardiovascular disease deaths in middle age (35-69 years).

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It has been estimated that smokers **have a death rate 3 times higher** than non-smokers in middle age (35-69 years), **and a death rate at least twice as high** from all causes in old age.

## 4. Tobacco-Smoking and Cardiovascular Risk

Review of a large number of well-designed epidemiological studies published between 1970 and 2001 on smoking (58 articles on active smoking and 14 on passive smoking) and its relation to cardiovascular problems showed that tobacco smoking is the leading cause of preventable death in Canada, accounting for 25 to 50% of premature mortality. Tobacco smoking is the principal cause of cardiovascular disease, the number 1 cause of death in Canada and the U.S. Cardiovascular diseases studied in relation to tobacco-smoking include coronary heart disease, nonfatal and fatal myocardial infarction, ischemic heart disease, hypertensive heart disease, angina, stroke, and other circulatory diseases. Tobacco smoking apparently causes earlier manifestation of essential hypertension, produces unfavourable changes in the lipid status, and decreases the efficacy of antihypertensive therapy.

### a. Active smoking

The U.S. Surgeon General's reports have noted that the potential RR for chronic cardiovascular effects from smoking is 1.7, ranging from 1.5 to 2.2. This means that smokers have 70% greater chance of developing chronic cardiovascular disease than non-smokers. Effects varied with the amount of tobacco smoked and showed a clear dose-response relationship. The risk for ex-smokers was intermediate between smokers and non-smokers.

Data from the WHO on national mortality rates from smoking show that an estimated 35% of males aged 35-69 living in developed countries will die from cardiovascular diseases (ischemic heart disease and cerebrovascular disease) due to smoking, with an additional 12% of men aged 70 years or older having the same rate of risk. The equivalent figures for women in the same age groups are 12% and 5% respectively. In North America, 30% of men aged 35-69 years and 15% aged 70 years and older will die from cardiovascular diseases (CVD) resulting from tobacco-smoking. Rates for women are 27% for aged 35-69 years and

11% for those aged 70 years and over. These values indicate that in Canada, every year, 26% of the general population aged 70 years and older will die because of CVD due to tobacco smoking.

There is growing evidence that quitting smoking reduces the risk of cardiovascular and other diseases. Calculating the RR of myocardial infarction by the number of years since quitting smoking, a study conducted in men younger than age 55 revealed that while those who had quit within the past year had a risk not significantly different from current smokers, the risk declined after 2 years to nearly that of non-smokers. This was true regardless of the duration of smoking.

The percentage of older Canadian adults (aged 25 and more) who smoke, declined from 28% in 1996-97 to 24% in 1999.

## **b. Passive smoking**

The health risks of passive smoke inhalation have been studied for several decades, but the focus was primarily on lung cancer and acute respiratory irritation. However, several recent studies in the U.S. and Canada have looked at the effects of second-hand smoking on cardiovascular problems.

A review of 6 studies on cardiovascular risk and environmental tobacco exposure among male subjects and 9 other studies on women exposed to tobacco smoke showed a 30% greater risk for death from coronary heart disease, while a large study examining both sexes together found a 2-fold increased risk. The overall pooled RR of death from congestive heart disease related to passive smoke exposure was again around 1.3, implying a 30% increase in risk. Four out of 10 studies reviewed noted a dose-response relationship between the level of exposure and the level of risk.

In a 1999 meta-analysis on passive smokers in Canada, it was found that approximately 8% of the Canadian adult population (aged 25 years and more) were passive smokers with rates ranging from 3% in British Columbia to 12% in Newfoundland and Quebec. Although the rate of active smoking among men (26%) aged 25 years and more was slightly higher than for women (22%), the percentages of non-smoking men and women exposed to ETS in their

home were almost the same (7% of all men and 8% of all women aged 25 and more). Based on these figures, the study concluded that in 1997 over 800 Canadian died from CHD as a result of exposure to environmental tobacco smoke at home.

Laws are changing to restrict exposure to environmental tobacco smoke, but it is clear that many people are still exposed to ETS in their homes and work-places, posing risks that could be avoided.

### c. Smoking harms the heart and blood vessels

- The nicotine and carbon monoxide in tobacco smoke have multiple adverse effects on the cardiovascular system. Nicotine tends to make the heart beat more rapidly and therefore work harder, increasing the demand for oxygen. Carbon monoxide decreases the amount of oxygen in the blood, prompting the heart to beat even faster. A vicious circle is established and reinforced with each inhalation of tobacco smoke.
- Smoking causes narrowing of the blood vessels, which raises blood pressure. Nicotine can increase the speed of the build-up of deposits on the inner lining of the arteries build-up, impairing blood flow and encouraging the development of atherosclerosis.

Smoking can also modify lipid levels, decrease fibrinolysis, increase fibrinogen levels and cause changes in endothelial and platelet functions, which are known risk factors for atherosclerosis.

The WHO estimated that there are about 1.1 billion smokers aged 15 and over in the world. The vast majority of these are in developing countries (800 million), and most of them are men (700 million). In China alone, there are about 300 million smokers (90% men and 10% women).

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## 5. Effects of Active and Passive Smoking on Human Reproduction and Pregnancy

A total of 62 scientific articles on the possible role of active and passive smoking on human reproduction and pregnancy published between 1966 and 2002 were reviewed. A summarized conclusion of different outcomes related to smoking (active and passive) is presented.

### a. Active smoking

Currently, between 25% and 30% of North American women smoke. Smoking among young women appears to be increasing, and women are now more likely to die from tobacco-related diseases than from breast cancer. It has been suggested that smoking reduces circulating levels of estrogen and leads to early **menopause**. Women who smoke 20 cigarettes a day or more enter menopause approximately 2 years earlier than non-smokers.

**Fecundity** is reduced by 20-30% among women who smoke 20 cigarettes a day or more and studies suggest that this can be directly related to smoking. Data assessing male smoking and fecundity are limited and their conclusions are contradictory: although smoking may affect some sperm parameters, it does not appear to significantly impair conception.

Studies on the possible impact of smoking on **spontaneous abortion** among approximately 100,000 women show a slight increase (20%) in miscarriage rates with a suggested smoking dose-related effect.

A review of several epidemiological studies indicates no increase in *congenital anomalies* or birth defects related to smoking. However the available data on smoking and birth defects does not take into effect timing, dose effects, and adjustment for confounding variables and biochemical validation.

Two large retrospective studies on the effect of smoking on preterm delivery, reported a slight shortening of gestation in smokers. In a case-control study, smoking was associated with a 60% increased risk of preterm delivery.

Epidemiological studies with different designs and of different smoking patterns consistently point to the effect of smoking on **birth weight**. This effect is dose-related and probably more profound in women over 35 years of age. In a large cohort study of more than 10,000 pregnant women who delivered live infants it was found that those who smoked throughout pregnancy had more than a 2-fold increase in risk of delivering a baby with lower birth weight. When smoking began during the second or third trimester, the risk among smokers was increased to 83%. Another study reported that the babies of those who smoked throughout pregnancy weighed 200 g less at birth, while those whose mothers stopped smoking before 36 weeks had birth weights similar to those of the babies of non-smokers, indicating that discontinuation of smoking at any point during pregnancy is beneficial and that the predominant effect on birth weight seems to be late in the third trimester.

In a very large cohort study (more than 53,000 pregnant women), there was a significant increase in **placental abruption** in women who smoked, compared to those who never smoked. This was reflected in a significant increase in perinatal mortality among smokers. In the Ontario Perinatal Mortality Survey of more than 50,000 births, the estimated rates of placental abruption rose from 16 per 1,000 births in non-smokers to 20 per 1,000 births in women who smoked less than 1 pack per day and 27 per 1,000 for more than 1 pack per day. It was calculated that 15% of abruptions were attributable to smoking, increasing the risk of abortion by 40%. Another large study reported a 60% increased risk of abruption in smokers, concluding that 38% of all abruptions were attributable to smoking.

**Perinatal mortality** and smoking were investigated in 2 major North American studies. The data showed that perinatal mortality rose from 23.5 per 1,000 births in non-smokers to 28.2 per 1,000 if less than 1 pack of cigarettes was smoked, rising to 31.8 per 1,000 if more than 1 pack was smoked. Another study examined perinatal death from specific placental complications and found more such deaths from placental abruption in smokers (5.2 per 1,000) than in those who had never smoked (3.3 per 1,000).

## b. Passive smoking

Very few studies have examined the effects of passive smoke on pregnancy outcome. Among those that have the majority found no significant differences in birth weight related to either maternal or paternal passive smoke exposure. In studies with positive findings, infants exposed to ETS were 1.5 to 4 times more likely to be born with low birth weight with the decrease ranging from 25 to 90 g and infants born to women exposed to ETS were generally 2 to 4 times more likely to be born small for their gestational age.

Study of associations between the risk of developing central nervous system (CNS) tumours in children and exposure to passive smoking during pregnancy showed an increased risk of CNS tumours among the children of non-smoking mothers exposed regularly to tobacco smoke in pregnancy (increased risk of around 80% or of 1.8).

In summary, there seems to be a definite increase in perinatal mortality in smokers, associated with placental complications. It has been estimated that 10% of all perinatal deaths are attributable to smoking. Cessation of smoking by the first prenatal visit can reduce the risk of these complications to the same levels as those of non-smokers. The dose-dependent effect of smoking on infant birth weight has been well-documented, with the amount of decrease approximately 10-20 g per cigarette smoked per day, but no increase in mortality has been associated with this difference in birth weight.

Among women in countries such as Canada, Denmark, the UK and the United States, deaths from smoking-related illnesses are rising rapidly and now account for 25-30% of all female deaths in middle age (35-69 years).

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## 6. Overall Summary

In a recent national survey of Canada, it was reported that 5.4 million Canadians, or 22 percent of the population aged 15 years and older, were smokers in the year 2001. Daily smokers consume an average of 16.2 cigarettes per day. Most smokers begin by age 15, which means that they have virtually an entire lifetime of accumulated risk for cardiovascular disease, cancers, and other smoke-related illnesses; encouragingly, smoking rates for youth have begun to decrease in recent years. In addition, 24% of Canadians aged 15 years and over are former smokers. Statistics also show that 11% of non-smokers are exposed to ETS at home and 38% in the workplace.

In general, 74% to 91% of cases of lung cancer can be linked to active smoking. Regular active smokers have 2.8 to 16.9 times more chance of developing lung cancer than non-smokers. Lung cancer now kills more women in North America each year than breast cancer, causing one-third of all deaths among middle-aged women. The best estimate of increased risk of lung cancer for passive smokers is 1.9. It can thus be concluded that active smoking is responsible for 14,500 to 18,200 new cases of lung cancer annually in Canada. Smoking is also associated with many other cancer sites, particularly upper airway-digestive tract cancers (39%-79%), pancreatic cancer (27%-50%), and bladder cancer (32%-61%).

The annual mortality rate from respiratory diseases among individuals, who smoke 25 cigarettes or more a day is around 225 per 100,000. This falls to 86 per 100,000 among subjects who smoke 1 to 14 cigarettes a day. In general, smokers have 2 times more chance of developing non-cancerous respiratory problems than non-smokers.

In Canada, every year, among those who die, about 57% of those aged 35-69 years and 26% of those aged 70 years and older will die from cardiovascular disease related to tobacco-smoking. In general, smokers have 1.7 times more chance of dying from cardiovascular disease than non-smokers.

Women smoking more than 20 cigarettes a day show a 20%-30% reduction in fecundity, and smokers have 1.6 times more chance of pre-term delivery than

non-smokers. Women who smoke throughout pregnancy have babies with lower birth weights and there is a significant increase in spontaneous abortion among smokers as compared to those who have never smoked.

The prenatal mortality rate increases to 31.8 per 1,000 if 1 pack of cigarettes is consumed per day during pregnancy compared to 23.5 per 1,000 for non-smokers.

It is clear that besides spending millions of dollars on cigarette consumption every year, millions of people are exposed to the risk of chronic diseases such as cancer and cardiovascular disease, resulting in premature death. The negative effects of both active and passive smoking are apparent in every epidemiologic study, leading to greatly increased health care costs.

#### Overall smoking-associated relative risk of different diseases and symptoms

Diseases or symptoms	PAF*	RR
Cancer sites showing firmly established positive associations with active smoking:		
Lung cancer	74-91%	2.8-16.9
Upper airo-digestive tract cancers	39-79%	1.9-6.3
Pancreatic cancer	27-50%	1.2-2.6
Bladder cancer	32-61%	1.8-3.1
Renal cancer	28-64%	1.6-3.9
Cancer sites with less firmly established positive associations:		
Stomach cancer	36-38%	1.8
Liver cancer	13%	1.4
Anal cancer	56%	3.2
Vulva cancer	8-54%	1.2-3.3
Penis cancer	39-42%	1.9-2.0
Cervical cancer	17-32%	1.4-1.9
Prostate cancer	38%	0.9-1.9
Leukemia	5-36%	0.8-2.1
Lymphoma	35%	1.4-1.8
Cardiovascular diseases		1.3-2.0

### Overall smoking-associated relative risk of different diseases and symptoms (cont'd)

Diseases or symptoms	PAF*	RR
Other conditions:		
Spontaneous abortion		1.0-1.8
Congenital malformation		0.8-2.7
Preterm delivery		1.2-1.6
Low birth weight		1.1-5.1
Placental complications		1.3-1.6
Perinatal mortality		1.3-1.4
Reduction in fecundity	20-30%	
Non-cancerous respiratory diseases among smokers:		
Chronic obstructive pulmonary disease (COPD)	6 times higher in males and 15 times higher in females	
Chronic cough and chronic phlegm	6 times higher in males and 15 times higher in females	
Wheezing	6 times higher in males and 15 times higher in females	
Persistent sputum production and dyspnea	8 times higher in males and 15 times higher in females	
Cigarettes/day	Annual mortality	
<14	86/100,000 (0.09%)	
15-24	112/100,000 (0.11%)	
>25	226/100,000 (0.23%)	

\* Smoking-associated population-attributed fractions.

### Major reference

*Canadian Tobacco Use Monitoring Survey*, February to December 2001, Health Canada, 2002.

# 7. Tips for Quitting

## a. Getting ready to quit

- Set a date for quitting. If possible, have a friend quit smoking with you.
- Notice when and why you smoke. Try to find the things in your daily life that you often do while smoking (such as drinking your morning cup of coffee or driving a car).
- Change your smoking routine: Keep your cigarettes in a different place. Smoke with your other hand, Don't do anything else when smoking. Think about how you feel when you smoke.
- Smoke only in certain places, such as outdoors.
- When you want a cigarette, wait a few minutes. Try to think of something to do instead of smoking; chew gum or drink a glass of water.
- Buy 1 pack of cigarettes at a time. Switch to a brand of cigarettes you don't like.

## b. On the day you quit

- Get rid of all your cigarettes. Put away your ashtrays.
- Change your morning routine. When you eat breakfast, don't sit in the same place at the kitchen table. Stay busy.
- When you get the urge to smoke, do something else instead.
- Carry other things to put in your mouth, such as gum, hard candy, or a toothpick.
- Reward yourself at the end of the day for not smoking. See a movie or go out and enjoy your favourite meal.

### c. Staying off cigarettes

- Don't worry if you are sleepier or more short-tempered than usual; these feelings will pass.
- Try to exercise, walk or ride a bike.
- Consider the positive things about quitting, such as how much you like yourself as a non-smoker, the health benefits to you and your family, and the example you set for others around you. A positive attitude will help you through the tough times.
- When you feel tense, try to keep busy, think about ways to solve the problem, tell yourself that smoking won't make it any better, and go do something else.
- Eat regular meals. Feeling hungry is sometimes mistaken for the desire to smoke.
- Start a money jar with the money you save by not buying cigarettes.
- Let others know that you have quit smoking – most people will support you. Many of your smoking friends may want to know how you quit. It's good to talk to others about your quitting.
- If you slip and smoke, don't be discouraged. Many former smokers tried to stop several times before they finally succeeded. Quit again.

# 8. The Benefits of Quitting Smoking

## a. Health benefits

Smoking cessation decreases the health risks associated with tobacco use, thereby benefiting both individual and public health by decreasing the burden of heart, pulmonary, and respiratory diseases and cancers. Individuals can benefit directly from their decision to quit smoking. Smokers who quit by their early thirties avoid almost all of the risk of premature death from smoking-related diseases, and there are clear health benefits, even for those who quit at age 60 and over. The pattern of health benefits from smoking cessation varies by disease. Smoker's risks of lung cancer are related both to how heavily they smoke and, in particular, how long they smoked. The risk incurred from 20 years of smoking is not great, but increases exponentially with each additional year after that. Stopping smoking cannot reduce the accumulated risk of lung cancer to that of someone who has never smoked, but since risks escalate rapidly, there is a major reduction in risk for ex-smokers in comparison with the risk of continuing to smoke. With heart disease, there is a rapid benefit, with the risk of heart attack decreasing after just 1 day of abstinence. One year after quitting, the risk of coronary heart disease is half that of a smoker; after 15 years, the risk of coronary heart disease is that of a non-smoker. No matter how heavily a person smokes, how impaired their health, or their age, quitting smoking will decrease the health risks associated with smoking.

## b. Personal benefits

Individual benefits gained from quitting smoking include improved health, better taste of food, improved sense of smell, money savings, better self-esteem, and cleaner smelling breath, home, and car. Within weeks of quitting, people experience lower levels of perceived stress. Individuals who stop smoking can set a good example for their children, have healthier babies, not worry about exposing others to smoke, feel better physically, and attain freedom from addiction.

### **c. Financial benefits**

Tobacco use is a major drain on the world's financial resources and has been called a major threat to sustainable and equitable development. A World Bank study, "The Economic Costs and Benefits of Investing in Tobacco," estimated that the health care costs associated with smoking-related illnesses result in a global net loss of US\$ 200 billion per year, with half of those losses occurring in developing countries. The same study indicates that smoking prevention ranks among the most cost-effective of all health interventions, particularly as research shows that tobacco is fast becoming a greater cause of death and disability than any other single agent. It follows that efforts to help people stop smoking, which decrease health risks in the same way as efforts to prevent people from beginning to smoke are also costs effective: individuals who quit smoking save substantially through lowered health care cost and decreased expenditures.

Research indicates that smokers impose significant costs on employers through higher rates of absenteeism, inflated insurance premiums, reduced productivity, and higher maintenance costs, as well as exposing non-smoking colleagues to ETS. Studies show that workplace restrictions help limit cigarettes consumption, which can serve as a significant step towards smoking cessation.

### **d. Self-directed smoking cessation**

The vast majority of smokers who have or who will quit use a largely self-directed program. People who are light smokers or are highly motivated to quit can succeed in quitting even if they have limited access to medical or behavioural cessation programs if they employ an appropriately individualized self-directed cessation program.

Every smoker who quits smoking needs a strategy that will work for him or her in particular. According to a recent study in Britain, 69% of adult smokers would like to quit. Nicotine, however, is a highly addictive drug, so quitting cigarette smoking is not easy, even for highly motivated individuals.

Smoking cessation programs are often expensive or inaccessible. There is, however, a program that health care professionals can recommend that requires no outside expenses or materials – it simply calls for dedication on the part of the smoker and the smoker’s family and friends. The strategy:

1. Commit to quitting: define a specific motivation for quitting and affirm the desire to quit.
2. Choose a quitting date: don’t try to taper off, but aim at complete abstinence from cigarettes from the date of quitting onwards.
3. Get rid of all tobacco-related equipment and clean your clothes and car in anticipation of the quitting date. Immediately stop smoking at home and in your car. Don’t go to places that are frequented by smokers.
4. Enlist the support of co-workers, friends, and family to encourage your efforts to quit and to stay off cigarettes.
5. Learn how to avoid or cope with situations and behaviors that make you want to smoke.

Before attempting to quit the smoker should be aware of likely withdrawal symptoms: irritability, impatience, hostility, anxiety, depressed mood, difficulty concentrating, insomnia, restlessness, increased appetite, and weight gain. Weight gain is a common concern for would-be quitters, especially women. Although the smoker should be warned of the possibility, or even likelihood, of gaining weight, the average weight gain of 5 to 7 pounds poses a negligible health risk compared to the health risks of smoking. Dieting should not be considered until the individual has successfully stopped smoking; otherwise the risk of relapse increases.

## 9. Some Facts About Smoking

- About 1.1 billion people smoke worldwide, consuming around 16.5 billion cigarettes a day.
- Tobacco smoke contains literally thousands of chemical agents, including 60 constituents that are known carcinogens, co-carcinogens or tumor promoters.
- In general, the rate of cancer among smokers is 3 times higher than among non-smokers.
- Quitting smoking greatly reduces the risks of all tobacco-related diseases such as lung cancer, many other cancers, heart diseases and other respiratory illnesses.
- In North America tobacco is the cause of about half of all male deaths from cancer in middle-age and one-third in all age groups.
- Lung cancer related to tobacco use kills more women in North America each year than breast cancer.
- Every year, 4 million people in the world die from diseases and conditions caused by tobacco.
- In 20 years, tobacco will be the leading cause of diseases in the world, associated with approximately 1 death in 8.
- Second-hand smoke from a parent's cigarette increases a child's chance of middle-ear problems, causing coughing and wheezing, and makes asthmatic conditions worse.
- A teenager in a family where both parents smoke is more than twice as likely to smoke as a young person whose parents are both non-smokers.
- Pregnant women who smoke are more likely to deliver babies with lower birth weights, which can damage their health and well-being.
- Ex-smokers have better health than current smokers. Ex-smokers have fewer days of illness, fewer health complaints, and less bronchitis and pneumonia than current smokers.

- Quitting smoking saves money. A pack-a-day smoker who pays \$5.00 per pack can expect to save more than \$1,800 per year. In a 10-year period this is more than \$18,000.
- Smoking harms not just the smoker but also family members, co-workers, and others who breathe the smoker's cigarette smoke.
- Smoking is an addiction. Tobacco contains nicotine, a drug that causes addiction and can make it very hard to quit.
- All forms of tobacco use are hazardous, but the hazards are magnified when smoke from tobacco is inhaled.

China is the top producer of tobacco in the world, producing around 2.9 billion metric tons of tobacco every year, around 42% of world production. The U.S. produces about 10% of the world's tobacco, followed by India (6%). Canada contributes 1% of total tobacco cultivation in the world. Every year approximately 7 million metric tons of tobacco are produced in the world.

#### Annual tobacco production, 1994

Countries	Metric tons	Percentage of world production
1) China	2,899,700	41.6
2) USA	667,146	9.6
3) India	436,535	6.3
18) Canada	62,758	0.9
World	6,971,738	100.0

Source: WHO, 1996

China tops the list for the total number of cigarettes consumed. Every year, 4,545,728 (2,899,700 non-manufactured and 1,646,028 manufactured) cigarettes are smoked in China. This represents around 32% of the total world's cigarette consumption. In the U.S., every year, around 1,176,063 (667,146 non-manufactured and 508,917 manufactured) cigarettes will be consumed, which is about 10% of the world's total cigarette consumption. Japan is third in the world in the number of cigarettes consumed (6% of world production), and Canada accounts for around 1% of the world's cigarette consumption.

### Annual cigarette consumption, 1994

Countries	No. of cigarettes		Percentage of world consumption
	Non-manufactured	Manufactured	
1) China	2,899,700	1,646,028	31.6
2) U.S.A.	67,146	508,917	9.8
3) Japan	190,000	321,038	6.2
18) Canada	62,758	51,047	1.0
World	6,067,661	5,203,417	100.0

Source: WHO, 1996

Countries in Pacific regions appear to have the highest number of male smokers (60%) in the world, and the highest smoking population among females comes from European countries (26%). In general, 42% of adult males and 24% of adult females in developed countries are regular smokers. These proportions for developing countries are 48% and 7% for males and females respectively.

On average, each smoker in the world consumes 15 cigarettes a day. Of these, people from Mediterranean regions and Americans have the highest per capita per day cigarette consumption (18 per day). In general, smokers from developed countries smoke around 22 cigarettes a day, compared with 14 cigarettes a day for smokers in developing countries.

### Percentage of smokers (15 years old and over), 1990

Region	Men	Women	Number of cigarettes/day
Africa	29	4	10
Ameria	35	22	18
Asia (South-east)	44	4	14
Mediterranean	35	4	13
Europe	46	26	18
Pacific	60	8	16
Developed countries	42	24	22
Developing countries	48	7	14
World	47	12	15

Source: WHO, 1996

According to the WHO, in 1990, a total of 1.1 billion people aged 15 and over were regular smokers. Of these, 300 millions were from developed countries, and the remaining 800 millions from developing countries. Although the proportion of male smokers in developed countries is 2-fold higher than that of females, this proportion in developing countries is around 7-fold, indicating that still smoking cigarettes and consuming tobacco are the particular characteristic of the male population in these regions.

#### Estimated number of smokers, 1990

Country	Men	Women	Total
Developed	200 million	100 million	300 million
Developing	700 million	100 million	800 million
World	900 million	200 million	1.1 billion

Source: WHO, 1996

The existing literature and scientific documents indicate that 30% of cancer deaths are due to tobacco consumption, the second leading risk factor after malnutrition.

#### Percentage of cancer deaths attributed to different factors

Rank	Factors or class of factors	Percentage of all cancer deaths
1	Nutrition	35
2	Tobacco	30
3	Infection	10
4	Reproductive and sexual behaviour	7
5	Occupation	4
6	Alcohol	3
7	Geophysical factors	3
8	Pollution	2
9	Medicine and medical procedures	1
10	Food additives	< 1
11	Industrial products	< 1
12	Unknown	3-4

Source: Doll and Peto, Oxford Medical Publications, 1981

Every year (based on 1995 statistics), more than 3 million people die because of tobacco consumption. Of these, 2,535,000 are men and 590,000 are women: 2 million from developed and 1 million from developing countries.

#### Estimated number of deaths due to tobacco, 1995

Country	Men	Women	Total
Developed	1,440,000	475,000	1,915,000
Developing	1,095,000	115,000	1,210,000
World	2,535,000	590,000	3,125,000

Source: WHO, 1996

#### Other major references

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