

# The Irreversible Health Effects of Cigarette Smoking

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## Definition

An *irreversible health effect* is a permanent change in the structure and/or function of an organ system or a permanently increased risk of suffering from a disease or some other threat to health. Irreversible effects vary in intensity and are related both to the amount and duration of exposure and the age at which the person is initially exposed. A risk or effect may diminish over time, but it may also increase; some risk may remain many years after exposure has ended.

## Executive Summary

This report examines the irreversible effects of cigarette smoking on various organ systems and challenges the notion that a few years of exposure to smoking will have no lasting adverse consequences. Our hope is to discourage young people from taking up this deadly habit by appealing to their common sense and better judgment, thereby allowing them to choose for themselves not to smoke. We will not recite the familiar litany of smoking-related health problems such as emphysema, cancer, and heart disease. Rather, we will show that smoking cigarettes for as few as five years can have a permanent effect on the lungs, the heart, the eyes, the throat, the urinary tract, the digestive organs, the bones and joints, and the skin—even if the smoker quits.

We do not mean to dishearten long-term smokers. Despite smoking's irreversible effects, it would be foolish for a smoker to conclude that, after years of smoking, quitting would do him no good. Many studies prove that tobacco-related health effects decline substantially as time away from smoking increases; some of the benefits begin within months after quitting. But after years of exposure to the damaging effects of tobacco, quitting smokers must realize that they have to be realistic in their expectations of recouping their health.

## Introduction

Cigarettes damage the body—gradually and insidiously—in a number of different ways. Over the years, the American Council on Science and Health and others have documented the effects.<sup>1,2,3</sup> Our purpose here is to address the following key questions:

- Does a cigarette smoker who quits return to the health profile of a nonsmoker? If so, when?
- If the smoker’s profile does not fully return to that of presmoking days, what effects are irreversible—and when do they become irreversible?
- What damage can be reversed—and to what extent?

One popular argument the scientific community often makes to encourage smokers to quit stems from the conjecture that all of the health effects of smoking are reversible shortly after cessation, regardless of the duration or intensity of the smoking exposure. Unfortunately, this conjecture is not true. Teenagers, in particular, may be overly complacent about smoking because they believe—incorrectly—that they can smoke for a few years and then quit without suffering any long-term effects. This complacency is especially troubling in light of the recent finding, reported by the Centers for Disease Control and Prevention (CDC), that teen smoking rates have increased by nearly a third within the last six years.<sup>4</sup>

Teen smokers who believe that all the health hazards of cigarettes will disappear in a puff of smoke when they quit—who assume that smoking from, say, age 16 to age 28 will have no long-term effects—often fall back on an “I can always quit tomorrow” (or next month or next year) philosophy. They trust—mistakenly—that any adverse health consequences they may incur during their smoking years will disappear when, eventually, they stop lighting up. But another recent study has reported that the quitting success rate among teenagers is very low: Less than 16 percent of the 633 teen smokers in the study were able to kick the habit.<sup>5</sup> This report will summarize the data on this vital—but rarely covered—topic.

What this report will not do is reexamine issues treated thoroughly elsewhere—issues such as the known deleterious health effects tobacco has in active smokers. These effects—cancers of various organs, heart attacks and strokes, ulcers, and infertility among them—are all major health issues; all provide good reasons not to smoke. They are, however, outside the scope of “irreversible effects” we intend to cover here.

## Cigarettes and Public Health

Cigarette smoking is the leading cause of preventable death in the United States. It accounts for almost 500,000 deaths per year, or one in every five deaths. Cigarette smoking contributes to a remarkable number of diseases, including coronary heart disease, stroke, chronic obstructive pulmonary disease, peripheral vascular disease, peptic ulcer disease, and many types of cancer.<sup>6</sup> Of the 46 million smokers in the United States, 34 percent try to quit each year—but less than 10 percent succeed.<sup>6</sup>

According to the CDC, approximately 80 percent of current adult smokers began smoking before their 18th birthday.<sup>7</sup> Each day over 3,000 teenagers light up for the first time. Most teens are aware of smoking’s hazards, but few are worried about them. Moreover, most teen smokers quickly become addicted to nicotine: They report that they want to quit but are unable to do so. And teen smokers experience high relapse rates and debilitating withdrawal symptoms.<sup>8</sup>

The bottom line is that smoking is costly, both to individual smokers and to society as a whole: Recent long-term studies indicate that about half of all regular cigarette smokers will eventually die from their addiction.<sup>9,10</sup>

## Irreversible Health Effects

With smoking, the reversibility of health effects is influenced by many factors. Among those factors are smoking exposure (the number of cigarettes per day and the duration of smoking) and physiologic susceptibility. The presence of other diseases, genetic variables, and even nutritional factors also enter into

susceptibility assessment.<sup>11</sup> Quitting brings benefits at any age, but there are “threshold” amounts of smoking that irreversibly increase the risk for some diseases.<sup>1</sup>

The good news is that quitting prolongs life and reduces the risk of tobacco-related cancers, myocardial infarction, cerebrovascular disease, and chronic obstructive pulmonary disease (COPD). Current knowledge of the irreversible effects of smoking, organized by organ systems, follows.

## Respiratory System

Smoking directly irritates and damages the respiratory tract. Each year a one-pack-a-day smoker smears the equivalent of a cup of tar over his or her respiratory tract. This irritation and damage cause a variety of symptoms, including bad breath, cough, sputum production, wheezing, and respiratory infections such as bronchitis and pneumonia. These effects can be reduced, but not entirely reversed, by quitting.<sup>12</sup>

Smoking is the principal risk factor for developing COPD—i.e., chronic bronchitis and emphysema.<sup>9</sup> Emphysema is characterized by permanent structural changes in the lung tissue. The deterioration in lung function associated with COPD is directly related to duration of smoking and the number of cigarettes smoked (“pack-years”).<sup>13</sup> Smoking during childhood not only increases the risk of developing COPD in adulthood but also lowers the age of its onset.

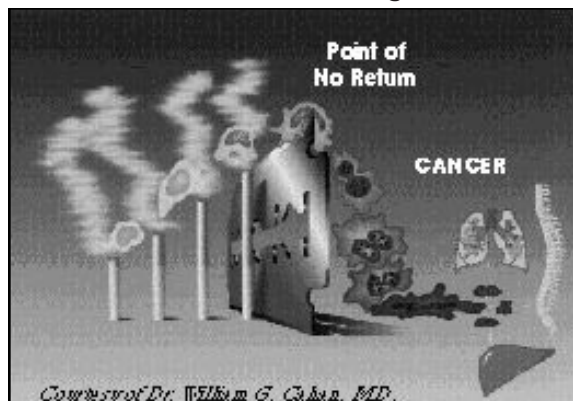
Cigarette smoking during childhood and adolescence increases the number and severity of respiratory illnesses. It also causes retardation in the rate of lung development and in the level of maximum lung function<sup>8</sup>—and retardation in lung growth during childhood means that the lungs may never attain normal function and development.

Everyone—smoker and nonsmoker alike—experiences a slow decline in lung function starting at about age 30. In smokers this gradual decline starts both from a lower baseline and at an earlier age. Smokers suffer from decreased lung reserve: They are unable to run—or even walk—as far or as fast as their peers who have never smoked. Smokers thus can

expect permanently impaired lung function relative to their nonsmoking peers.

With sustained abstinence from smoking, the rate of decline in pulmonary function among smokers returns to normal; but lung reserve remains decreased relative to those who have never smoked. Quitting improves pulmonary function by about 5 percent within a few months of cessation, and COPD mortality rates decline among quitters versus continuing smokers.<sup>12,13</sup> A recent study in more than 10,000

## The Razor’s Edge



boys and girls aged 10 to 18 confirmed that cigarette smoking is associated with mild airway obstruction and slowed growth of lung function. The study, which covered a period of 15 years, also demonstrated that girls are more susceptible than boys to smoking’s adverse effects on the growth of lung function.<sup>14</sup>

Smoking-induced chronic irritation of the respiratory lining and the wide variety of carcinogens in cigarette smoke induce permanent changes in the cells lining the respiratory tract. These changes can lead to cancer.<sup>9</sup> Cigarette smoking is, in fact, the major cause of lung cancers of all major histologic types (see illustration, above).

During the past half century, lung cancer rates have dramatically increased in women, to the extent that lung cancer is now the leading cause of cancer death in women,<sup>15</sup> exceeding both breast cancer and colon cancer. (Smoking has, of course, been the leading cause of cancer death in men for decades.) This increased female mortality parallels the increase in

cigarette smoking among women.

Smoking cessation reduces lung cancer risk by 30 percent to 50 percent 10 years after quitting, and the risk continues to decline with further abstinence. The risk in ex-smokers always remains increased compared to that in nonsmokers, however. It is now known that almost 50 percent of all lung cancers are diagnosed in ex-smokers, and this finding is not surprising in view of the fact that there exist a “plethora of studies demonstrating a lag between smoking initiation and increased incidence of lung cancer of several decades.”<sup>16</sup>

One recent study noted that 75 percent of ex-smokers showed changes in their DNA indicative of precancerous lesions, as compared to only 3 percent of people who had never smoked.<sup>17</sup> At the May 1998 meeting of the American Lung Association, data were presented showing that former smokers continued to develop lung cancer at rates 11 to 33 times higher than nonsmokers.<sup>18</sup> The data also showed that the shorter the time since quitting, the higher was the ex-smoker’s risk.<sup>18</sup> Increased risk was still noted in former smokers after more than 20 years of abstinence, however.

## Heart and Circulation

Premature coronary heart disease (CHD) is one of the most important medical consequences of smoking. Smoking acts both independently of and synergistically with other major risk factors for heart disease. Sadly, sudden death may be the first sign of CHD—and sudden death is four times more likely to occur in young male cigarette smokers than in nonsmokers. Women who use both cigarettes and oral contraceptives increase their risk of developing CHD tenfold.<sup>15</sup> The excess risk of coronary heart disease is halved in quitters (as compared to continuing smokers) one year after cessation, but the risk level doesn’t return to that of nonsmokers until 15 years after quitting.<sup>12</sup>

In a recent study of atherosclerosis, the progression of fatty deposits in the carotid artery was found to be dependent on total pack-years of tobacco exposure, rather than on the patient’s current smoking sta-

tus.<sup>19</sup> This finding indicates that atherosclerosis progression may also be cumulative and irreversible, at least after some degree of baseline exposure.

Cerebrovascular accident (CVA), or stroke, causes brain damage that usually leaves its victims with permanent disabilities. Smokers’ excess risk for stroke appears to return to that of nonsmokers within 5 to 15 years of cessation.<sup>12</sup> One recent study suggests, however, that an ex-smoker’s risk remains high for at least 20 years after cessation.<sup>20</sup> In addition, it was recently learned that the incidence of “silent strokes”—events that are harbingers of both severe strokes and dementia—is increased in anyone who has ever smoked.<sup>21</sup>

Finally, smoking is a strong risk factor for several types of blood-vessel disease.<sup>15</sup> Smoking causes poor circulation to the legs by narrowing the blood vessels that supply these extremities. Quitting reduces, but does not eliminate, this risk.<sup>12</sup> Once it becomes symptomatic, such circulatory impairment often requires surgical intervention.

## Eyes and Vision

Two recent studies published in the *Journal of the American Medical Association* tracked 50,000 smokers for approximately 12 years. The studies found a two- to threefold increased rate among both smokers and ex-smokers of developing macular degeneration, an irreversible form of blindness.<sup>22,23</sup> The risk was significant even among those who had quit smoking 15 or more years earlier. Researchers speculate that smoking causes vision loss by restricting blood flow to the eye.

Cataracts (clouding of the lens) are another visual problem associated with cigarette smoking. A recent study showed a 40-percent higher rate of cataracts among 3,600 people who had ever smoked, as compared to nonsmokers.<sup>24</sup>

## Mouth and Throat

Cigarette smoke irritates the eyes, nose, throat, and gums. These tissues respond by thickening and by undergoing cellular changes that can eventually lead to mouth, throat, or esophageal cancer. Gum dis-

ease and tooth loss are also common among smokers.<sup>5</sup> Quitting halves the risk for cancers of the oral cavity and esophagus during the first five years after cessation, but ex-smokers always have an increased risk as compared to the risk in those who have never smoked.<sup>12</sup>

Cigarette-smoke irritants can also permanently damage the tissues of the larynx. The effect of this is a noticeable deepening and hoarseness in the voices of chronic smokers. Quitting reduces the risk of developing laryngeal cancer.<sup>12</sup> Vocal-cord polyps (noncancerous growths) are also strongly related to tobacco exposure, and such polyps rarely disappear without surgery.

## Genito-Urinary Tract

Smoking causes bladder and kidney cancer. It is, in fact, the strongest risk factor known for developing bladder cancer. An ex-smoker's risk of bladder cancer is reduced by one half within a few years after quitting,<sup>2,12</sup> but a higher risk of developing these cancers remains for decades.

## Digestive Organs

Smoking decreases esophageal sphincter pressure. The decrease in pressure allows acid to reflux from the stomach into the esophagus. This can lead to esophagitis and to permanent esophageal stricture (or narrowing).

Smoking is also a risk factor for pancreatic cancer and colon cancer. The risk of pancreatic cancer is somewhat reduced 10 years after quitting<sup>12</sup>; ex-smokers remain at higher risk indefinitely, however. The relationship between cigarette smoking and colon cancer has only recently become clearer. Two large, prospective American studies have detected such a relationship, but a recent Swedish study detected no such relationship in smokers observed for 20 years.<sup>25,26,27</sup> The American researchers felt that it might take as long as 35 years for the colon cancers secondary to smoking to appear: In a study that looked at a large group of people who had smoked for as few as 10 years, the American researchers detected progressively more severe colonic lesions with increasing time after quitting.

## Musculoskeletal System

Smoking is associated with osteoporosis (thinning of the bones due to loss of bone minerals) in women, and with spinal disk disease in both sexes. Lost bone calcium cannot be fully recovered, and degenerative bony changes are irreversible. Osteoporosis predisposes to fractures and is responsible for much disability, especially in elderly women. A recent meta-analysis of 29 studies involving almost 4,000 hip fractures concluded that one of every eight fractures was attributable to smoking, although the rate was lower for ex-smokers than for current smokers.<sup>28</sup>

## Reproduction

Infertility is more common among smokers but is not irreversible. The damage done to smokers' babies during pregnancy often is irreversible, however. Smoking during pregnancy is associated with dire consequences for the baby as a fetus, as a newborn, and even as a child. Recognition of the evidence of this damage has prompted researchers to designate it as "fetal tobacco syndrome."<sup>29</sup>

Miscarriage is two to three times more common in smokers, as are stillbirth due to fetal oxygen deprivation and placental abnormalities induced by the carbon monoxide and nicotine in cigarette smoke.<sup>30</sup> Smokers have a fourfold risk of having a low birth-weight baby; such babies are more likely than normal-weight babies to have impaired physical, emotional, and intellectual development.<sup>2,31</sup> The authors of a 1996 study found that women who smoked during pregnancy were 50 percent more likely to have a child with mental retardation of unknown cause than were nonsmoking women.<sup>32</sup>

Sudden infant death syndrome is significantly associated with smoking,<sup>9,24</sup> as is impaired lung function at birth.<sup>33</sup> Women who quit smoking as late as the first trimester may diminish some of these risks, but the risk of certain congenital malformations—such as cleft palate—is increased even in women who quit early in pregnancy.

## The Skin

Smoking causes premature facial wrinkling through vasoconstriction of the capillaries of the face (vasoconstriction decreases the flow of oxygen and nutrients to facial skin cells).<sup>34,35</sup> The effect of this reduced blood flow is visible in deep crow's feet radiating from the corners of the eyes and pale, grayish, wrinkled skin on the cheeks. These effects may emerge after as few as five years of smoking and are largely irreversible, except through costly and traumatic facial surgery.

## Conclusion

There should be no illusions as to the dangers of cigarettes. The combination of a highly addictive, pharmacologically active substance—nicotine—and an array of noxious chemicals cunningly packaged in a highly efficient delivery mechanism can permanently and drastically affect health.

People who smoke for as brief a period as 10 years show a substantially higher rate of death, disease, and disability. Risks to the respiratory system, especially, and risks of cancer continue to plague the ex-smoker for years after quitting. Smokers should not delude themselves that they can smoke safely for 10 to 15 years and then—if they are among the lucky few who *can* quit—become as healthy and risk-free as if they had never smoked at all.

This report has been brief—much briefer, in fact, than we would have liked. The main reason for that brevity, simply stated, is that there should be much more good, scientific information out there than there is about the real risks ex-smokers face. Almost all of the studies conducted on the health hazards of smoking simply compare smokers with nonsmokers; the studies do not differentiate between never-smokers and ex-smokers. (The risks faced by smokers are well-documented; for a truly comprehensive guide to those risks, see the groundbreaking ACSH book, *Cigarettes: What the Warning Label Doesn't Tell You*.<sup>1</sup>)

More controlled studies—studies assessing long-term results in people who have quit smoking at various times in the past—are needed. Until such

studies are performed and reported, researchers can access valuable data on the irreversible health effects of smoking through already-available databases such as those of the Framingham study and the Mayo Clinic.

In summary, the following irreversible health effects have been proven to be associated with smoking:

- Retardation in the rate of lung development and lung function—i.e., decreased lung reserve—in childhood and adolescent smokers, as well as a markedly increased risk of developing COPD.
- Cancer risk: 75 percent of ex-smokers show DNA changes suggestive of tumor development; 50 percent or more of lung cancers are now being diagnosed in ex-smokers.
- Circulatory impairment to the heart, brain, and legs.
- Visual impairment and loss.
- Vocal-cord polyps (growths) and hoarseness.
- Bone mineral loss (osteoporosis), hip fractures, and spinal arthritis.
- Serious health consequences for children born to smoking mothers.
- Premature facial wrinkling and graying of the skin after as few as five years of smoking.

This report is intended for everyone—smokers, never-smokers, and ex-smokers alike—but it is aimed particularly at those who have not yet become addicted to tobacco. To everyone we say, Remember: Only 20 percent of smokers who try to quit are successful on a long-term basis; for four out of five of those who take up smoking, the very decision to begin is itself irreversible.

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