TOBACCO DEPENDENCE: EPIDEMIIOLOGY, PREVENTION, AND TREATMENT

A Text for Students

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I. Introduction

Smoking is the leading cause of preventable death worldwide, and one of the highest preventable causes of disease and illness. More than half of current tobacco smokers will eventually die due to a disease caused by smoking if they are unable to quit. Aside from causing death, smoking greatly reduces the quality of life, leading to numerous chronic diseases. Sensitivity to the constituents in tobacco smoke varies by the individual, but many of these constituents are uniformly harmful to humans.

According to the World Health Organization (WHO), people who are killed by tobacco smoking lose an average of 15−20 years of life expectancy as compared to non-smokers. On average, one cigarette costs about 11 minutes of life. Tobacco induced diseases currently kill about 6 million people worldwide every year. As the consumption of cigarettes is presently increasing on the global level, the total number of related deaths may reach eight million people per year by 2030. The greatest burden from tobacco smoking will be concentrated in low- and middle-income countries, where regulations and restrictions on tobacco are fewer, and education and attitudes regarding tobacco are typically more limited. As a result, deaths from tobacco in these countries are expected to account for over 80% of worldwide tobacco-related deaths. Over the course of the 20th century, tobacco caused 100 million deaths worldwide. If current trends continue, tobacco may cause one billion deaths in the 21st century. The American Cancer Society relates that the cigarette is the only consumer product, which when used in accordance to its intended purpose, causes death in half of its users. Making matters worse, over half of tobacco smokers wish to quit.

In the Czech Republic, about 16,000 people die from diseases caused by smoking each year, including 7,000 deaths due to cancer, and overall these numbers equate to roughly 40 deaths per day. Well over half of these deaths occur within people of middle age, who also suffer the greatest burden of diseases and illnesses caused by smoking tobacco.

Smoking cessation is an effective way to reduce the risk of death and the impact of diseases, even in middle age. After quitting, people experience immediate improvements in respiratory function and reduced susceptibility to some illness and diseases, and face lessening risks of cardiovascular diseases and cancers as years pass. Importantly, stopping smoking before developing cancer and other serious diseases helps to avoid much of the risks of death from tobacco, and may add 2−3 months of life expectancy for each year after smoking has stopped.

Quitting smoking at a younger age is particularly beneficial, as people who quit before the age of 35 can expect to experience a life expectancy rate close to that of non-smokers.

Unfortunately, it is now late from the perspective of prevention to influence the total number of deaths caused by tobacco in 2050 (see Figure I), but treatment provides an opportunity to reduce the overall number more quickly. The typical model of the tobacco epidemic is generally the same in all countries (see Figure II), as it was framed in the USA around 1900. Nationally, people begin to smoke, first males, then females, and the rates of diseases and deaths begin to rise. The prevalence of smoking among the overall population peaks at between 40−60%, before gradually beginning to decrease, first among men, than among women. The same pattern occurs in regards to mortality due to smoking, but with about 30−40 years of delay following its prevalence.
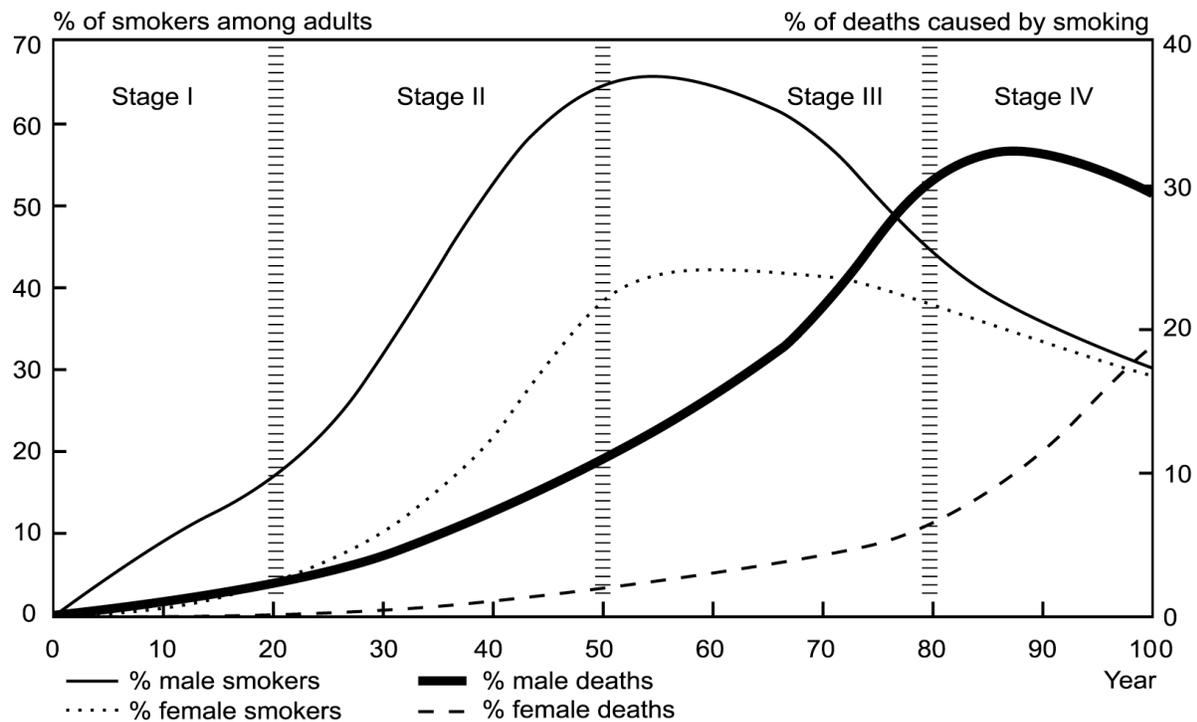
In 1950, two large epidemiological studies were published on the health hazards of smoking, providing the first true evidence about its dangers (at this time the research was only focused on male smokers). However, today, there have been well over 100,000 scientific publications about tobacco and health, and this topic receives a good deal of attention across most of the world.

Figure I. *Cumulative Deaths from Tobacco Worldwide, 1900-2050*
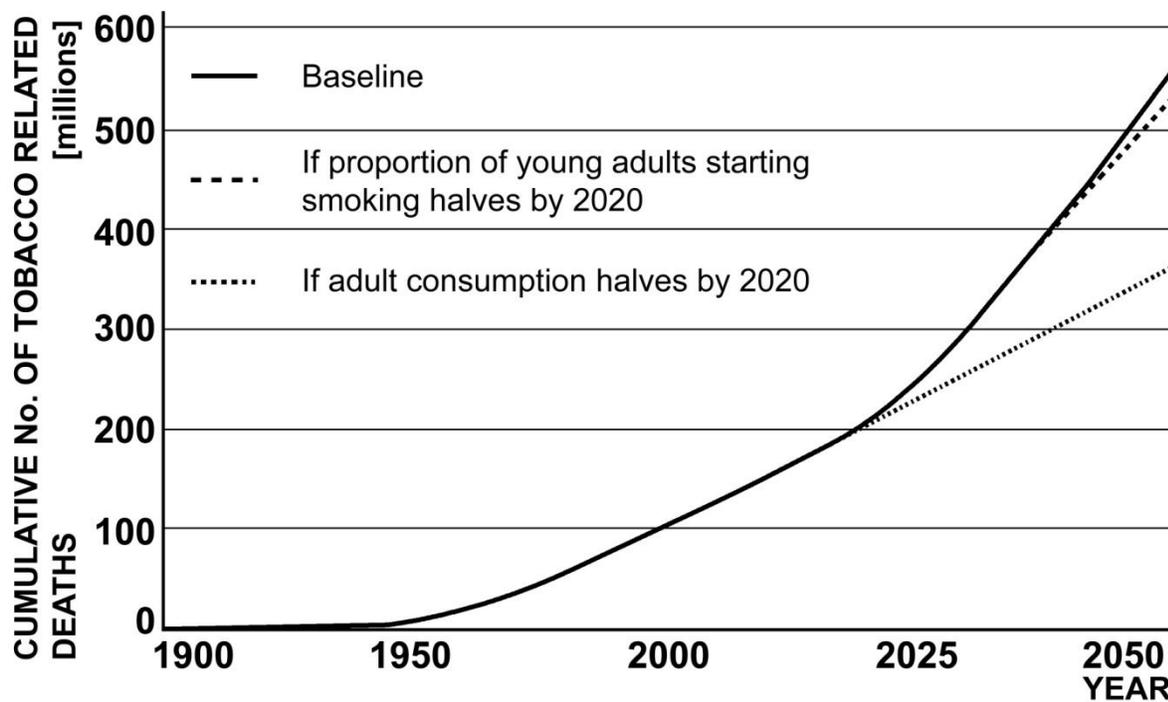
Source: Peto, R., Lopez, A. D.: The future worldwide health effects of current smoking patterns. In: Koop, C. E., Pearson, C. E., Schwarz, M. R., et al.: Global health in the 21st century, Jossey-Bass, New York, 2000.

Figure II. *Descriptive Model of the Tobacco Epidemic*

% of smokers among adults   % of deaths caused by smoking

Stage I   Stage II   Stage III   Stage IV

— % male smokers   ▬ % male deaths
····· % female smokers   – – % female deaths

Source: Lopez, A., Collishaw, N., Piha, T.: A descriptive model of the cigarette epidemic in developed countries, Tobacco Control, 3, 1994, 3, 242-247.

II. Tobacco and Health

Smoking causes numerous diseases, including many different types of cancer, cardiac diseases, respiratory diseases, and a variety of diseases that are not life threatening. Among the most impactful diseases caused by smoke are:

Cardiovascular Disease (CVD)—About 15% of cardiovascular diseases are attributed to smoking. As CVDs comprise about half of the total deaths in the Czech Republic as well as developed countries, this figure constitutes a large portion of the population. In addition to death, CVDs are a leading cause of long-term disability. The exact mechanism through which smoking promotes CVDs is not entirely understood. However, it has been documented that smoking induces vasoconstriction and sympaticotonia, higher blood viscosity, amplification of red blood cells (perhaps due to long-term carbon monoxide exposition), and increases in white blood cells (due to chronic inflammation), fibrinogen, and the endothelium layer. Serum lipids and lipoproteins are negatively affected by smoking as well.

Cancer—Smoking causes roughly 25-30% of cancer cases in the Czech Republic, which by themselves represent a total of 22% of the deaths in the country. About 85% of lung cancer cases are almost entirely attributable to smoking. Beyond respiratory system cancers, smoking has been known to at least be partially responsible for causing almost all cancers – e.g. cancers of the pancreas, bladder, larynx, esophagus, cervix, oral cavity, kidney, stomach, or leukemia and other types.

Chronic Respiratory Diseases—Although these types of diseases only cause about 1% of the deaths in the Czech Republic, smoking is attributed to 75-85% of them. The most common diseases in this category include chronic bronchitis and emphysema (which are often included under the heading chronic obstructive pulmonary disease, COPD), as well as pneumonia.

Other Diseases—Smoking has been known to cause death and disability across all the different medical disciplines, including numerous chronic diseases that may not cause death, but represent a substantial burden on the population. Such diseases include diabetes mellitus (type II), Crohn's disease, arthritis, osteoporosis, macular degeneration, cataract, gastric ulcer, and many other diseases of all parts of the body.

Fertility and Pregnancy—Both males and females may experience impaired fertility as a result of smoking. This impact manifests itself in a number of ways in the parents, and may result in low birth weight and even intellectual and behavioral impairment of the child. Additionally, evidence exists that smoking during pregnancy may lead to sudden infant death syndrome (SIDS), low birth weight (below 2,500 grams), congenital limb reduction defects, spontaneous abortion, and ectopic pregnancy. Male smokers have lower amount and lower quality of sperms, and about 20% of erectile dysfunction cases are caused by smoking.

Parkinson's Disease, Other Benefits, and Dementia--Smokers have been known to have a slightly lower occurrence of Parkinson's Disease due to nicotine's (not smoking) affect on the brain, and evidence also suggests that smoking may slightly reduce the risks of ulcerative colitis and endometrial cancer after the age of 60, as smoking lowers estrogen levels. A common misconception is that the risk of Alzheimer's disease is reduced by smoking, but this is not true. In fact, the risk of Alzheimer's disease, like other kinds of dementia, is greatly heightened by smoking, particularly for people over age 65, and may reduce the age of the disease's onset by many years.

III. Passive Smoking

Passive smoking, also known as *second-hand smoke* (SHS) or *environmental tobacco smoke* (ETS), which is the exposure to cigarette (or other smoked tobacco) smoke by persons other than the intended smoker, produces a negative health impact upon the non-smoking population. In addition to discomfort and unpleasant short-term effects (such as mucous irritation, headache, and respiratory irritation), passive smoking is associated with roughly the same diseases as active smoking. The WHO reports that passive smoking causes more than 600,000 premature deaths every year. In the Czech Republic, the number of deaths caused by passive smoking is very roughly estimated to be several hundred per year (1,500 – 3,000), based on comparison to rates in other countries. In fact, there is no safe level of exposure to second-hand smoke.

ETS contains thousands of toxic components that pose a risk to everyone in its vicinity. The best indicator for the measurement of ETS in indoor air is nicotine itself, since tobacco smoke is the only source from which it can come. Determining exposure to the other chemicals in tobacco smoke has to be measured by multiplying the nicotine level by their individual coefficients, as they differ greatly for each substance. ETS exposure can be ascertained by measuring cotinine levels in the exposed person's blood, saliva, or urine. Acute impacts of ETS occur via mucous irritation in the conjunctiva and upper respiratory pathways, and by an unpleasant smell. Although the chemical dosage is smaller, ETS may cause the same diseases as active smoking, including cancer, fatal and non-fatal myocardial infarction (a decreased ability to

transport oxygen and to use oxygen for ATP synthesis), upper and lower respiratory inflammation, middle ear inflammation, a slight (but significant) deterioration of pulmonary function in children, increases in the number of new smoking cases, relapses of bronchial asthma, and sudden infant death syndrome (SIDS). Even pets (particularly cats and dogs) that live in homes with smokers typically die sooner.

Surprisingly, very low doses of ETS can cause cardiovascular diseases, especially myocardial infarction (MI) and sudden cardiac death, namely in young people and non-smokers (for people under the age of 60, the relative risk is about 5). A significant decrease of MI can be observed immediately in countries after the implementation of smoke-free indoor public spaces legislation.

A final form of exposure, known as *thirdhand smoke*, consists of small amounts of carcinogens and other substances from tobacco smoke in carpets or other surfaces in rooms where smoke is no longer present in the air. This type of exposure may also occur on the hair, skin, or clothes of people who spent some time in a smoky environment.

IV. Tobacco Smoke Composition and Forms of Tobacco Use

Tobacco Smoke Composition

Tobacco smoke is a dynamic mixture of over 4,000 different chemical and particle components. At least 250 of these chemicals are known to be harmful, and more than 50 of the chemicals are known carcinogens, others as co-carcinogens or suspected carcinogens, altogether about 100.
Among the many dangerous carcinogens in tobacco smoke are dibenz(a,h)anthracene, benzo(a)pyrene, dimethylnitrosamine, diethylnitrosamine, nitrosamines, vinyl chloride, hydrazine, benzene, and arsenic. Mutagens, allergens, and other toxic components are also present in tobacco smoke. Additionally, tobacco smoke contains a high content of carbon monoxide (heavy smokers typically produce up to 5-10% carboxyhaemoglobine, COHb).

Different Forms of Tobacco

Tobacco is consumed through several different mediums. Smoked tobacco is inhaled via a *pipe, cigar, or cigarette*. Tobacco from cigars and pipes generally has a higher pH level and the nicotine is largely absorbed in the oral cavity, whereas nicotine from cigarettes must be inhaled and is absorbed in the lungs due to lower pH levels.

Smokeless tobacco includes snuff and oral tobacco, which is also known as chewing tobacco and *moist snuff, or snus* (which has been banned across the European Union since 1992, with the exception of Sweden).

Waterpipe (shisha, narghile) usage is becoming very popular overall, namely among young people and even kids, who often do not believe that it is comparable to smoking. Nevertheless, it is a form of smoking, and is very dangerous; the burning temperature is very low, so the pyrolysis is of a low quality and the smoke itself is very concentrated as a result. In terms of the dosage (consisting of carbon monoxide and tar) received from using a waterpipe, one waterpipe session (typically about 50 minutes) is equal to several tens of cigarettes. In waterpipe smokers, researchers often find roughly a 20% level of carboxyhaemoglobine, which is close to clinical intoxication. Its symptoms (vertigo and dizziness) are typically not recognized

as intoxication by smokers, who simply assume it is the standard waterpipe effect. In addition, the spread of infections is very common in shared waterpipe use, even among people who use a personal mouthpiece.

E-cigarettes, electronic cigarettes or nicotine vaporizers are currently viewed as a controversial source of nicotine, and are regulated very inconsistently—varying from being used as medication in some countries to being entirely banned in others. In those devices, a liquid (glycerin or propylene glycol, both of which mostly contain nicotine) is warmed and vaporized. Since there is no smoke production, and thus no pyrolysis products, the risk compared to smoking is at least 95% lower, and close to zero for other people in the smoker's vicinity. Moreover, they produce no toxic waste in the form of discarded cigarette butts. On the other hand, there is no sufficient regulation of these products, and in some samples, toxic substances were identified (but in substantially lower concentrations compared to cigarette smoke), and they may promote or exacerbate nicotine dependence. So far, e-cigarettes are primarily used by smokers with the aim to stop smoking, to reduce their health risks, or due to their lower price. In some cases, they may help people to stop smoking, especially for those who use the forms of products that are not similar to cigarettes (such as containers). There are several hundred of these products on the market with several thousand flavors. Tobacco companies, who are also e-cigarette producers, lobby for their regulation as medication, which would offer them a chance to promote the cigarette-likes forms of these products, and increase their price.

V. Definitions

The WHO published its *Guidelines for Controlling and Monitoring the Tobacco Epidemic* in order to establish smoking-related definitions for international use, in addition to other purposes. Among the definitions presented in this text are the following:

- **Smoker**—A person who smokes any tobacco product either daily or occasionally, at the time of the survey.
- **Daily Smoker**—Any person who smokes a tobacco product at least once per day (people who abstain from smoking for religious holidays, but who smoke daily otherwise, are included in this category).
- **Occasional Smoker**—A person who smokes, but not every day. This group may include people reducing their cigarette consumption, continuous occasional smokers, and experimenters.
- **Non-Smoker**—A person who does not smoke at all, at the time of the survey.
- **Ex-Smoker**—A person who was formerly a daily smoker, but currently does not smoke at all.
- **Ex-occasional Smoker**—A person who was formerly an occasional smoker, but never a daily smoker, and who has not smoked more than 100 cigarettes in his/her lifetime.

VI. Smoking Prevalence

In developed countries (such as the USA, Canada, the UK, Australia, some of the European Union, and some East Asian countries), the rate of smoking for people over 15 years of age is below 20%, although this rate varies widely by country. In the Czech Republic about 30% of the

population between the ages of 15−64 use tobacco. The rates in men are somewhat higher than in women, at about 34% and 23%, respectively. Currently, rates of smoking are gradually decreasing among older men, but they are significantly increasing among teens and youth, and particularly among girls, as about 40−50% of girls between the ages of 13−18 years of age smoke.

Physicians, nurses, and some other health professionals play an extremely important role as behavioral models, both in their social environment, and especially with their patients. Unfortunately, in the Czech Republic about 15% of physicians and about 40% of nurses are smokers, making them less effective when offering patients tobacco cessation support.

Global data related to the ongoing tobacco epidemic may be found at the WHO's Tobacco Free Initiative website: http://www.who.int/tobacco/en/.

VII. Tobacco Use Prevention

Preventing tobacco use requires a complex network of collaboration, realized namely in the frame of legislation and state control, and among family members, and school and health care professionals. The main six points, in order of importance, include:

- Price increases via higher taxes on cigarettes and other tobacco products
- Bans/restrictions on smoking in public and work places
- Better consumer information, including public information campaigns, media coverage, and publicising research findings
- Comprehensive bans on the advertising and promotion of all tobacco products, logos, and brand names
- Large, direct health warning labels on cigarette boxes and other tobacco products
- Treatment to help dependent smokers stop, including increased access to medication

(Source: Joosens, Raw, 2014:
http://www.europeancancerleagues.org/images/TobaccoControl/TCS_2013_in_Europe_13-03-14_final_1.pdf*)*

Price remains the most important factor in preventing tobacco use. For more information on this topic, see: www.tobacconomics.org. In addition, the website of the Framework Convention on Tobacco Control, which is the only legally binding threat under WHO, offers many resources: www.fctc.org.

VIII. Treatment of Tobacco Dependence

Principles of Smoking

Smoking is an acquired behavior that is established by the smoker of the course of many months, and often many years. Making a decision to stop smoking mandates a change in behavioral conditioning in the smoker.

Smoking is not merely a bad habit (such as biting one's nails). Rather, smokers are dependent upon their habit, which manifests as a psychosocial dependence, and also as a physical drug dependence on nicotine. Unfortunately, trying to stop without medical help or "cold turkey" is equivalent to placebo effectiveness, with about 5% obtaining validated abstinence in one year.

The modern foundation upon which smoking cessation therapy is based involves influencing the nicotine-dependent person's psychosocial dependence through behavioral therapy, and in addition, by pharmacological therapy. The important message for smokers is to explain that medication *does not work against smoking*, but *against withdrawal symptoms*.

Tobacco dependence is considered to be a chronic disorder (it is diagnosed using code F17.2 in the *International Classification of Diseases, 10th Revision* (ICD-10)). After a person quits smoking, the re-adaptation of their nicotine acetylcholine receptors is a slow process. As a result of the delay, heavily dependent smokers most commonly relapse, even between the third and twelfth month after cessation. Also, patients should be supported not to give up after relapsing and try to stop again as soon as possible.

Successful treatment of nicotine dependence is defined as long-term (for at least 6 months, but 12 months is preferred), proven (as determined by measuring carbon monoxide in expired air, or, more accurately, through measuring cotinine levels in the blood) abstinence. According to the "Russel Standard", up to 5 cigarettes during this time are tolerated.

Psychosocial, Psychobehavioural Dependence

Smoking begins with social dependence. People often have their first cigarette among a group of their peers, usually between the ages of 10−12 years. At first the new smoker is disturbed by the acute, negative symptoms of smoking (especially nausea and gastrointestinal disorders), but tolerance to these symptoms develops very quickly. In the beginning, smoking is often an activity shared among peers, where the ritual of lighting a cigarette, and offering someone else a cigarette, all playing significant roles in developing psychosocial dependence.

After multiple, repeated occasions and situations during which the smoker take a cigarette, a psychological dependence develops. These circumstances vary widely, and are specific to the individual smoker. Common situations include smoking a cigarette while drinking coffee, after a meal, while making a telephone call, while waiting for the bus, etc. Regardless of the exact circumstances under which the person smokes, their dependency on the act of smoking the cigarette grows. Smokers generally develop an association between cigarettes and these certain situations, and their need to continue to smoke cigarettes increases. Therefore, psychobehavioural intervention, in as intensive a manner as possible, is needed.

Physical Drug Dependence

Physical dependence on a drug develops over time, and in the case of nicotine this dependence is caused by the nicotine receptor in the brain, which is influenced by hereditary factors. Not every smoker is physically dependent on nicotine, but around 80% do develop this dependency. From a pharmacological perspective, nicotine dependence resembles that which occurs from cocaine and heroin. Therefore, frequent relapses upon attempting to quit smoking are very likely.

Dependence on nicotine is quite easy to diagnose using two basic question: (1) How many cigarettes do you smoke daily? (an answer of more than 10−15 typically indicates nicotine

dependence) and (2) How soon after waking up in the morning do you light your first cigarette? The second question is insightful because over the course of the night the smoker did not introduce the drug into their system, meaning that the earlier the person needs to smoke in the morning, the greater dependency he/she is showing towards nicotine. In the blood, the half-life of nicotine is about 2 hours. Generally, if they need a cigarette within one hour, they are nicotine dependent. The Fagerström Test of Cigarette Dependence (FTCD) (see Table 1) quantifies the smoker's dependence on nicotine in greater detail.

Nicotine binds to acetylcholine receptors in the brain, and thus has both sympathomimetic and parasympathomimetic effects. These effects are dose-dependent; small doses of nicotine often help the smoker in concentration and stimulation, while a large dose aids in recovery and relaxation. Nevertheless, these tendencies are generalizations, and the effects are specific to the individual. Binding on acetylcholine receptors induces the release of dopamine, which impacts the secretion of catecholamines, serotonine, pituitary hormones, and betaendorphin. These substances generally produce a pleasurable short-term effect in the smoker, and may affect their mood and behavior.

Likewise, nicotine increases dopamine secretion into the neuronal synapse. Another reason for increased dopamine levels in smokers' synapses is that cigarette smoke (not nicotine itself) inhibits monoamixooxidase B (MAO B). As a whole, smokers have about 40% less MAO B than non-smokers. These factors explain the psychiatric and addiction co-morbidity very frequent in tobacco users.

The overall impact of nicotine on humans is subtle, but instantaneous, and a sufficient dose of the drug is very easy to acquire in order to meet an immediate demand, because nicotine reaches the brain in less than 10 seconds after a puff on a cigarette. Extrapolating from this fact, it can be reasoned that if a smoker were to take 10 puffs from each cigarette, while smoking 20 cigarettes per day, that smoker's brain would receive a total of 200 daily doses, or 73,000 doses per year. This constant supply of nicotine repeatedly and continuously influences mood, concentration, and efficiency, thus creating the conditions necessary for dependence to continue to rise. There is no other legal drug that supplies this type of repeated dose so frequently.

Table I. *Fagerström Test of Cigarette Dependence*

Question	Answer	Points
1. How soon after waking up do you smoke your first cigarette?	within 5 mins	3
	6-30 mins	2
	31-60 mins	1
	after 60 mins	0
2. Do you find it difficult to refrain from smoking in places where it is forbidden, e.g. in church, at the library, in the cinema, etc.?	Yes	1
	No	0
3. Which cigarette would you most hate to give up?	the first in the morning	1
	any other	0
4. How many cigarettes do you smoke daily?	10 or less	0
	11-20	1
	21-30	2
	31 or more	3
5. Do you smoke more frequently during the first hours after waking up than during the rest of the day?	Yes	1
	No	0

| **6**. Do you smoke when you are so ill that you are in bed most of the day? | Yes | 1 |
| | No | 0 |

After adding up all the points, nicotine dependence is assessed as follows:	none or very low	0-2
	low	3-4
	high	5-10

Source: Heatherton et al., 1991, Fagerström, 2012.

Nicotine Withdrawal Symptoms

One of the most widely used scales is the Minnesota Nicotine Withdrawal Scale (Hughes, https://www.uvm.edu/medicine/behaviorandhealth/minnwsdefault.html), which includes the following feelings and effects: (1) anger, irritability, and frustration; (2) anxiety and nervousness; (3) a depressed mood and sadness; (4) desires or cravings to smoke; (5) difficulty concentrating; (6) an increased appetite, hunger, and weight gain; (7) insomnia, sleep problems, and awakening at night; (8) restlessness; (9) impatience; (10) constipation; (11) dizziness; (12) coughing; (13) dreams or nightmares; (14) nausea; and (15) a sore throat.

Motivations to Stop Smoking

In order to break the practice of turning to cigarettes, smokers generally need to identify another form of behavior to replace or change their habits. Smokers report numerous reasons for wanting to quit smoking, but the most frequently cited reasons are to improve their health (especially among older smokers), and to experience social or financial benefits. Naturally, there are many other reasons that smokers identify, and no single motivation is better or worse than another; any reason that motivates the smoker to stop is the right reason for that person.

Since individuals reasons vary, physicians should ask patients about their particular motivation, and support their reasons for smoking cessation. For patients who lack the motivation to stop smoking, it is the physician's duty to help them to find one according to the '5R' method (see Table II).

Table II. *The 5Rs Method*

1. Relevance—Finding motivation relevant to health status, family and social situations, age, sex, education, etc.
2. Risks—Discussing the potential risks of smoking. It is important to make it clear that limiting the number of cigarette's one smokes, smoking 'light' cigarettes, or using any other form of tobacco, does not mean that the risk is being reduced. *Examples:*   - Acute risks—Shortness of breath, bronchial asthma deterioration, impotence, sterility, and higher carbon monoxide levels in the blood.   - Long-term risks—Myocardial infarction and stroke, cancer (lung, throat, oral cavity pancreas, bladder, larynx, esophagus, cervix, kidney, stomach, and leukemia), chronic obstructive pulmonary disorders (chronic bronchitis and emphysema), and a number of other non-life-threatening diseases.   - Environment—Higher lung cancer risk for spouses and children, a higher probability that children will smoke, an increased risk of sudden infant death syndrome, bronchial asthma,

middle ear infection, and a greater number of respiratory infections among the smokers' children.

3. Rewards—Help the patient to find his/her most important potentially benefit(s) to stopping smoking.

Examples:

- Improving health, improving appetite, saving money, feeling better, being able to breathe better, having a fresher home, car, and breath without cigarette odor, no longer need to worry about quitting smoking, being a good example to children, no longer worrying about being an inconvenience in the neighborhood, improving fitness and athletic performance, and eliminating nicotine dependence.

4. Roadblocks–Assist the patient in identifying their barriers to quitting smoking, and finding out why they may not want to stop smoking.

Examples:

- Bad past experiences, including withdrawal symptoms (which could be minimized by pharmacotherapy) and weight gain.

5. Repetition—Repeatedly intervening with support and motivation in accordance with the individual's needs.

Source: Fiore et al., 1996.

Psychosocial Support

Most critical in the physician's role is their ability to help the smoking patient to understand his/her dependence and to identify smoking triggers and rituals. Once these answers are found, the physician and patient work to find ways to be prepared for these moments, primarily by identifying substitute activities. Additionally, it is important that physicians help patient identify their 'D Day'—the day from which the smoker will permanently give up smoking. Choosing the best D Day varies greatly by patient; for some smokers it is best to begin immediately, while others prefer to prepare in advance and become accustomed to the upcoming day. However, once a smoker becomes nicotine dependent, it is very challenging to stop smoking completely and forever. In fact, among people who satisfy a craving by having just one single cigarette, the majority will relapse and return to smoking.

An example of intensive intervention (lasting about two hours) can be found at: http://www.slzt.cz/intervention-structure.

Pharmacological Therapy

Pharmacological therapy is the type of treatment that is indicated for smokers who are physically dependent on nicotine or for those unable to stop without medication. According to current guidelines, effective first-line pharmacotherapy includes varenicline, bupropion and nicotine replacement therapy. All kinds of pharmacotherapy should be used at least 3 months, preferably longer.

Varenicline

Varenicline is a drug invented for the treatment of tobacco dependency, but it is different in that it does not contain nicotine. However, it binds to alfa4beta2 acetylcholine-nicotinic receptors like

nicotine—these types of receptors are typically present in heavily dependent smokers. The drug has both an agonistic and antagonistic effect. As a nicotine agonist, it causes the release of dopamine from the nucleus accumbens, which occurs over the course of several hours, rather than at an intense peak. In response, patients typically state that they do not feel too bad without cigarettes, do not feel the need to smoke, and feel as though they have received their dose. As a nicotine antagonist, varenicline blocks the acetylcholine-nicotinic receptors so that nicotine from tobacco cannot bind to those sites any longer, whereby the release of dopamine after a puff cannot happen. Patient who smoke while taking varenicline typically express that they do not perceive the usual reward or sensation after taking a puff. Varenicline has the potential to triple success rates, depending on the intensity of the intervention.

Bupropion

Bupropion is an antidepressant, blocking reuptake of dopamine and adrenaline in synapses. Bupropion SR (Wellbutrin) was used as an antidepressant beginning in the late 1980s, but since the 1990s has been used to fight tobacco dependence (Zyban SR is a brand name for this drug in tobacco dependency indication – currently not available in the Czech Republic), and is available only by prescription. As NRT, it doubles the success rate depending on the intensity of intervention.

Nicotine Replacement Therapy (NRT)

Nicotine replacement therapy (NRT) is available in most countries OTC (over the counter, without prescription) in pharmacies in a transdermal form (as a patch) with a slow release of nicotine, and in oral forms with quick release of nicotine (in the form of a gum, inhaler, lozenge, nasal or oral spray, oral film, and other forms). Studies have found that NRT doubles the average success rate of people attempting to quit smoking. In Europe, mostly Nicorette, Niquitin, or Nicotinell are available.

VIII. Validation of Tobacco Consumption

The three primary methods used for measuring and quantifying a person's nicotine intake are through carbon monoxide (CO), cotinine, and thiocyanate. Carbon monoxide can be measured in a person's expired air for about 15 seconds after a deep breath followed by maximum expiration into a CO-monitor, which measures the alveolar aspect of the expired air. These machines are able to find evidence of the burning of tobacco products (smoking) within the preceding twelve hours. Furthermore, it enables an assessment of the intensity of that smoking. Pollution or smog in cities may impact the readings, where the limit for a non-smoker would be under 8-10 ppm, whereas heavy smokers may display readings over 10-20 ppm. COHb (carboxyhaemoglobin) may be estimated via this system as well. Measuring this indicator helps to assess the extent and intensity of the patient's smoking, including the number of cigarettes smoker per day, and the time since their last cigarette.
  Cotinine is an inactive nicotine metabolite with a half-life of about 20 hours, making it a useful substance in assessing smoking. Cotinine levels can be obtained through the blood, and also via urine or saliva, but these measurement methods are not always reliable for people with

strong nicotine dependency. Testing for cotinine is a very specific and effective method, with the exception of NRT use which may also test positive. Additionally, cotinine may be found in a newborn's blood if the mother was smoking during her pregnancy.

Lastly, thiocyanate is a metabolite of the cyanate that is present in tobacco smoke. This chemical compound can be identified in the patient's serum or urine. Thiocyanate has a half-life of about one week, enabling it to provide evidence of a patient's smoking over a longer period of time. Thus, measurement and detection of thiocyanate are relatively easy, and furthermore, the concentration of the chemical is proportional to the number of cigarettes one has smoked. However, it is unfortunately not specific to tobacco smoke alone.

IX. Health Care Professionals and Tobacco

Evidence-based guidelines for the treatment of tobacco dependence recommend that each clinician perform a short intervention (up to 10 minutes) with each smoker (see Table III for more information). For those smokers who need further assistance beyond this intervention, the possibility of intensive tobacco dependence treatment center is the next option.

In any country, treatment of tobacco dependency should be offered to each smoker by each health professional including doctors, nurses or pharmacists during each clinical contact.

Table III. Brief Intervention—The 5A Method.

The 5A Method:
Every health care professionals should treat every patient who smokes according to the following basic principles. This procedure can be followed at each appointment, and can be completed in five minutes or less. **Ask the patient about their smoking habit:** • At every single patient visit • For all smokers at every control visit • Regarding smoking in the household at every child visit **Advise the patient to stop smoking:** • If the patient is a non-smoker, praise them for their abstinence • For smokers, point out the necessity of stopping smoking, and personalize the health risks by connecting them to the patient's disease and/or condition **Assess the patient's motivation to quit:** • If the patient does not want to stop smoking, try to motivate them to quit (explain the impact of smoking on their current health or diagnosis, prognosis, symptoms, and personalize the risk) – see 5Rs Method above, Table II • If the patient is undecided about whether or not they want to stop smoking, repeatedly repeat the process at each visit, asking them about their smoking, and advising them to stop, while sympathizing with the patient's difficult situation   For patients who have decided they want to stop smoking, the health care professional moves on to the next two stages of the 5A Method.

Assist the patient in their effort to quit:
- Assist the patient in determining when their 'D Day' will occur (the day from which the smoker will permanently give up smoking)
- Help the smoker to overcome difficult situations and smoking triggers without resorting to a cigarette. Helpful techniques to overcome cravings may include drinking a full glass of water, putting one's hands in water, taking a deep breath and holding it as long as possible, exercising, and anything else that works for that patient. Additionally, encourage the patient to avoid common triggers, and other situations where they may want to smoke, such as while drinking coffee or alcohol.
- Recommend pharmacotherapy, such as varenicline, bupropion, nicotine replacement therapy (NRT), or combination.

Arrange for a follow-up meeting with the patient:
- Follow-up is especially important during the first few weeks after the patient's 'D Day' and they should have regular support
- The average amount of time it takes patients to relapse after quitting smoking is three months
- Further follow-up is generally most valuable between three and six months after the patient's 'D Day'

X. Most Frequently Asked Questions

Weight Gain

On average, smokers weigh less than non-smokers. However, when smoking cessation occurs it its typical for the average person to experience a slight weight gain, in most cases between 3−4 kilograms during the first year. This typical weight gain is caused by several reasons, including the lowering of the ex-smoker's basal metabolism, retardation of the peristalsis process (constipation), hunger that occurs as a withdrawal symptom (the stomach empties more rapidly after giving up smoking), replacement of the habit of smoking cigarettes with the need to put something in one's mouth, an improved sense of taste and smell, and an overall increased appetite. Although slight weight gain may be unavoidable in some patients, there are many ways in which it can be limited (See Table IV).

Table IV. Recommendations for Minimizing Weight Gain

Recommendations and advice for limiting weight gain after tobacco cessation:
- Completing a sufficiently intensive and lengthy NRT program will help to stabilize the body during the cessation process.
- In terms of diets, limiting fats and sweets, while consuming more polysaccharides, as well as vegetables and fruit, will help minimize weight gain.
- If there is no health barrier or contraindication to doing so, physical activity is an excellent way to control weight. People who complete a minimum of 45 minutes of intensive exercise three times per week, and who have some basic exercise during the day, will have the best results.

General notes pertaining to weight gain after tobacco cessation:
- Despite the best intentions, current evidence suggests that people who quit smoking will

- gain weight, typically about 3 kg in the first year, if with exercise and a healthy diet.
- Evidence also indicates that smoker swill gain weight once they quit smoking even if they do not eat more. In other words, weight gain is a natural part of the process of quitting smoking, as the body stabilizes. Nevertheless, getting a sufficient dose of NRT, combined with a healthy diet and exercise will keep one's weight gain to a minimum.
- Gaining some weight after quitting smoking presents an incomparably smaller overall health risk than the act of smoking itself.
- Maintaining a normal weight is very important to many people, but clinicians should not focus on this problem until the patient has successfully quit smoking. In the meantime, they may advise the patient to eat more fruits and vegetables, avoid eating sweets and fatty meals, exercise regularly, and get plenty of sleep.
- During tobacco cessation, ex-smokers should not be focused on weight gain, and realize that this side effect can be dealt with at a later time. Quitting is difficult enough, and people should devote their energy to that task, solving one problem at a time. Upon successfully completing the tobacco cessation process, then the ex-smoker can shift their focus back to reversing their weight gain.
- Clinicians should inspire patients not to focus on the potentially negative aspect of weight gain, and instead, convey the numerous health benefits of quitting smoking. They can point to the longer, healthier life the patient is likely to enjoy, along with cosmetic effects, such as looking younger with less wrinkles, having whiter, healthier teeth and fresher breath, and the positive feelings associated with the achievement of quitting smoking.

Cigarette Limitation

Simply limiting the number of cigarettes one smokes in an effort to quit is usually not an effective strategy over the long-term. Particularly among smokers who are dependent, this strategy is not recommended for few weeks at the most, at which point it is preferable that they stop smoking completely, and together with pharmacotherapy, which may prevent compensatory smoking.

Psychiatric Illness and Smoking

There is high psychiatric comorbidity in smokers (about 30-40%), and a high prevalence of smoking in patients with psychiatric illnesses (about 60 % on average, and as high as 80 % in schizophrenics). But, even those smokers would benefit from stopping smoking, as smoking worsens their psychiatric diseases, including depression, and after few months of abstinence their psychiatric health will improve. Also, smoking has important pharmacologic interactions, especially in psychiatric medication, as it increases their clearance and metabolism and thus lowers their effectivity.

Oncological Patients

Treatment of tobacco dependency should be recommended and offered even to oncologic ill smokers; it is never too late to stop smoking. Smoking after an oncological diagnosis substantially *worsens* the patient's life expectancy and prognosis via numerous effects (such as

lower immunity, a higher rate of inflammation, and secondary tumors). Moreover, it also increases complications after any surgery (such as longer wound healing time and more complications), and lowers the effectivity of both radiotherapy and chemotherapy, while increasing their negative side effects.

Pregnancy

There is no safe level of smoking during pregnancy (as is the case with any type of smoking), and a clear recommendation to stop smoking as soon as possible should be delivered to all pregnant smokers.

XI. Further Information

Additional information pertaining to smoking, and the numerous related topics covered here, may be found at the following sources:

- The economics of tobacco: www.tobacconomics.org

- The Framework Convention on Tobacco Control, the only one legally binding threat of WHO, offers a wealth of sources: www.fctc.org

- WHO Tobacco Free Initiative: http://www.who.int/tobacco/en/

- Data about economics, epidemiology, demography, and treatment: www.treatobacco.net

- Society for Research on Nicotine and Tobacco: www.srnt.org

- Association for Treatment of Tobacco Use and Dependence: www.attud.org