

## SPECIAL ARTICLE

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# Cigarette smoking and medical students

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### Summary

Despite its well known harmful effects on health, tobacco use is widespread throughout the world. Approximately one third of the global population become smokers at the age of 15 years or more. The prevalence of smoking between genders is lessening. Earlier, men used to smoke three to four times more than women globally. The nicotine content of cigarette is small (10 to 12 mg) and a smoker inhales about 1.1 to 1.8 mg of nicotine from each cigarette smoked to its entire length; this plant alkaloid stimulates the central nervous system, causes either ganglionic stimulation in low doses or ganglionic blockade in high doses, and smokers can develop a moderate to heavy physical dependence. Among other numerous substances, several are cancerogenic, and about 98 percent of lung cancer deaths are caused due to tobacco smoke. Nicotine addiction is often more severe than alcohol addiction. Smoking also may complicate anesthetic management, and passive smoking increases the rate of periopera-

tive airway complications in the children of smokers, too. Preoperative abstinence from tobacco is required for surgical patients and it offers an opportunity for smokers to quit permanently. Physicians have an important role in helping smokers to quit tobacco or e-cigarettes, but if a doctor is a smoker himself, his antismoking influence may be deficient. Since a significant percentage of medical students are smokers, it is worth influencing them to stop the habit. The best way is to introduce tobacco modules, stimulating students to participate in anti-smoking campaigns, offer non-smoking hospitals, non-smoking university campuses, non-smoking dormitories, and to provide medical assistance to student smokers who wish to quit

**Key words:** tobacco, smoking, cigarette, e-cigarette, nicotine, 5A's, smoking cessation, medical students

Tobacco-related deaths and disabilities present the largest health problem of our time. Despite its well known harmful effects on health, tobacco use is widespread throughout the world. Approximately one third of the global population become smokers at the age of 15 years or more. Smokers in both developed and undeveloped countries begin right after high school graduation.

The prevalence of smoking between genders is lessening. Earlier, men used to smoke three to four times more than women globally. While smoking rates have decreased recently in developed countries, at the same time rates are increasing in developing countries [1]. The prevalence of cigarette

smoking appears to decrease in advanced age, primarily because a number of smokers die before reaching old age.

Medical professionals should persuade their patients to quit smoking and influence their home communities to prevent initiation of this habit [2]. It has been repeatedly shown that even brief advice of a primary care physician to his patients results in as many as 5 to 10 percent quitting smoking, while more comprehensive interventions can result in abstinence at even higher rates.

One goal of medical education is to prepare students to oppose smoking when they become physicians. Since a significant percentage of medi-

cal students are smokers, it is worth convince a student smoker to quit this harmful habit. Perhaps medical schools should introduce an anti-tobacco module to stimulate interest in anti-smoking campaigns that may decrease the prevalence of student-smokers.

We identify the tobacco industry as a risk factor for various diseases, and strongly support abstinence as a means to prevent premature deaths. We also discuss the history of antismoking campaigns, smoking cessation, didactic modules on nicotine dependence and treatment, and prevalence of smoking among medical students, along with means to help them to quit smoking.

### Tobacco plant, nicotine and the tobacco industry

Tobacco (*Nicotiana spp.*) is an herbaceous plant grown for its leaves. It has been cultivated from antiquity and used in the Americas by native American tribes who traditionally smoked socially and ceremoniously. Tobacco fails to survive outside of cultivation [3]. More than 70 species of tobacco are known, but *N. tabacum* is main commercial product. Another more potent variant, *N. rustica* is also used in some countries. Smoking of tobacco requires burning it and inhaling the smoke, as is done with cigarettes, or smoke may be sucked into and out of the mouth, as is done with pipes and cigars. The e-cigarette was invented in 2003 by a Chinese pharmacist; it usually contains both nicotine and potentially toxic additives. E-cigarettes can be used to aid smoking cessation in adults, but their use in adolescents may stimulate smoking behavior.

Cigarette contain approximately 600 chemicals, but smoke from a lighted cigarette has more than 7,000. At least 69 of these chemicals (e.g., hydrogen cyanide, formaldehyde, lead, arsenic,

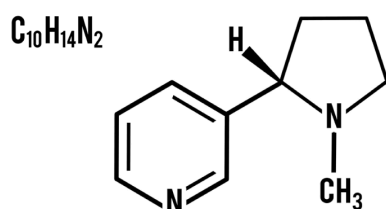
ammonia, polonium-210, benzene) are toxic and most are found to cause cancer. In addition to huge number of natural compounds, tobacco smoke may contain various pesticide residues [4].

Nicotine (Figure 1) is one of the most toxic drugs. Although the nicotine content of cigarette is small (10 to 12 mg), a smoker inhales about 1.1 to 1.8 mg of nicotine from each cigarette smoked to its entire length. Nicotine stimulates the central nervous system, including the vomiting center, and nicotine also releases vasopressin, a hypertensive peptide.

Smokers can develop a moderate to heavy physical dependence, because nicotine is an addictive compound. The pharmacological actions of nicotine were first described by Langley and Dickinson as early as 1889 [5]. Nicotine is a ganglionic stimulant, and, like other drugs from the same group, e.g. dimethylphenyl - piperazonium (DMPP), it stimulates both parasympathetic and sympathetic ganglions. Although the actions of the two systems usually oppose one another, within a given organ, one system usually predominates over the other. Nicotinic drugs stimulate the adrenal medulla to release adrenaline (and noradrenaline) into the bloodstream. Adrenalin then interacts with the adrenergic (sympathetic) postganglionic receptors in blood vessels, and the heart and lungs. Such complex and non-specific responses, ganglionic stimulants, are never used clinically. However, ganglionic (nicotinic) blockers may be used for therapeutic purposes. Small doses of nicotine stimulate the heart rate; large doses first increase, then decrease, the heart rate. Catecholamines released from the adrenal medulla and adrenergic nerves result in vasoconstriction. Stimulation of skeletal muscles is followed by paralysis associated with increased bowel tone and motility.

Nicotine is used primarily as an insecticide. In humans, its poisonous properties are characterized by nausea, vomiting, initial rise of blood pressure due to induced ganglionic stimulation and noradrenaline release. Ganglionic paralysis soon follows and blood pressure falls. Death is a result from respiratory paralysis. Chronic toxicity of tobacco or nicotine causes nasopharyngeal and bronchial irritation, pulmonary emphysema, cardiovascular effects, salivation, thromboangitis and tobacco amblyopia. There is no specific antidote for the drug [3].

Until the 1960s, the United States grew, manufactured and exported most of the tobacco in the world. Tobacco can grow in every country of the world where the warm and moist climate permits [2]. Now, tobacco is produced in China, and also in India, Brazil, the USA and Indonesia. Among about 130 tobacco producing countries are some Europe-



**Figure 1.** Structural formula of nicotine. This chiral alkaloid has an essential role in tobacco plant protection, sprouting and growing. It stimulates the central nervous system and causes ganglionic stimulation in low doses or ganglionic blockage in high doses. Nicotine acts as an agonist at nicotinic cholinergic receptors in the autonomic ganglia, at neuromuscular junctions, and in the adrenal medulla and the brain. It is primarily metabolized by two hepatic cytochrome P450 (CYP) enzymes: CYP2A6 and CYP2B6.

an countries, including Turkey, Italy, Poland, Spain and Greece. Brazil is the largest exporter of tobacco leaf. The Russian Federation and the USA are the largest importers. Philip Morris is the world's largest transnational tobacco company, and their Marlboro brand is the world leader in sales.

Different types of tobacco are grown in Serbia; these are mostly Virginia, Burley, Oriental and Semi-Oriental varieties, but the already small tobacco production in Serbia has declined since 2000, and tobacco imports are on the rise. The annual yield of 17,000 tons of tobacco grown in Serbia in 2000 was reduced to 7,000 tons in 2018 [6]. Tobacco, processed tobacco, and final tobacco products are imported to Serbia by 14 companies: Philip Morris - Niš, British American Tobacco - Vranje, JT International - Senta, and others.

### **Tobacco as a risk factor for various diseases**

The risk of lung cancer (squamous cell carcinoma, adenocarcinoma, large cell carcinoma, and small cell carcinoma) is related to the number of years smoking. About 98 percent of lung cancer deaths are caused by tobacco smoke. Clinical presentation requires anywhere from 15 to 20 years from the initial exposure to cigarette smoke. This risk is greater in older individuals because cellular DNA repair decreases significantly with aging. Lung cancer rates vary around the world, but its incidence is increasing [7]. Chronic obstructive pulmonary disease (COPD) is caused by a combination of genetic predisposition and environmental exposure [8]. Cigarette smoking causes COPD in more than 80% of cases; it intensifies ischemia because carbon monoxide in smoke reduces the oxygen-carrying capacity of hemoglobin.

Nicotine is a direct arteriolar vasoconstrictor that decreases distal blood flow. The incidence of limb amputation is ten times higher in persons who continue to smoke after developing arterial occlusion than in those who quit. Nicotine and other substances in cigarette smoke affect vascular smooth muscles and platelets and may initiate thrombotic events, especially in those individuals who have already developed atherosclerosis. Smoking may trigger ventricular arrhythmia by increasing sympathetic tone and decreasing the threshold for ventricular fibrillation, a cause of sudden cardiac death in vulnerable persons.

The increasing use of electronic nicotine delivery systems (ENDS) or electronic cigarettes is of concern due to the emergence of multiple adverse health effects. Most harmful chemicals in cigarette smoke target metals or carbonyls generated

by thermal decomposition of carrier liquids such as propylene glycol, which one of the main ingredients in the liquid used in electronic cigarettes, where it serves as both the carrier for nicotine and cannabinoids, and the means of producing vapor which resemble smoke.

Predicted toxicity of nicotine-propylene glycol relates to fetal development in pregnant women who use e-cigarettes, to children exposed to second hand ENDS aerosols, and to teenage e-cigarette users whose brains are still developing [9]. However, heavy smokers, i.e. those with physical nicotine dependence, describe a certain benefit when e-cigarettes are used as help to quit smoking.

An *in vitro* study of human lung epithelial cells (BEAS-2B) exposed to cigarette smoke condensate showed significant damage to gene expression profile compared to e-cigarette smoke condensate with an equivalent nicotine level [10]. However, despite the equivalent nicotine content, this finding does not suggest any greater safety of electronic cigarettes. It was obtained *in vitro* with a far less toxic condensate (e-cigarette) rather than the conventional cigarette condensate in cultured human lung epithelial cells. We need studies *in vivo*, with animal models and clinical analysis, in order to obtain definitive indications that electronic cigarettes might be safer than the ordinary kind.

### **Global smoking prevalence & projected premature smoking-attributed deaths**

When tobacco was at first used in Europe, in the sixteenth and early seventeenth centuries, smoking was mainly used as a remedy for various ills, and tobacco was named *Herba Panacea* [11]. At the beginning of eighteenth century tobacco was more often used for pleasure than for some ills. Yet, after the isolation of nicotine from tobacco in 1828 and the demonstration of its poisonous qualities, doctors were careful not to use tobacco for medical treatments. Smoking then became used only for pleasure, even though it was known to be a risk factor for various diseases.

All forms of tobacco usage are harmful, and there is no safe level of exposure. In fact, smoking damages many different tissues in almost every part of the body. From the early-twentieth century, smoking was recognized as a public health threat. Because of the strong addiction to nicotine it is very difficult for most people to stop smoking. Cigarette smoking is the most common form of tobacco use worldwide, but other tobacco products, such as e-cigarettes, cigars, cigarillos, roll-your-own, pipes, and various smokeless tobacco products are also damaging. Passive smoking, or secondhand smoke,

**Table 1.** Smoking prevalence in Serbia and projected premature deaths

Sex	Smoking prevalence (15 years and older)	Premature deaths <sup>†</sup>
Male	37.9%	426.555
Female	31.6%	371.936
	Total smokers: 2,456.896	Total deaths: 798.491

<sup>†</sup>Premature deaths are based on relative risks from large-scale studies of low- and middle-income countries. Based on relative risks from large-scale studies of high-income countries, total deaths in Serbia are estimated at 1,228,448.

is the inhalation of tobacco smoke by persons who are not smokers. This can occur in a closed space where any tobacco product is used. The tobacco epidemic is killing more than 7 million people a year, and around 600,000 deaths are the result of passive smoking [12]. There is no safe level of exposure to tobacco. Table 1 shows the tobacco use in Serbia in 2014, and the number of premature deaths. In 2019, the prevalence of adult smokers was 36.6%. Since 2010, when the prevalence was 40%, there has been a slight decline, due primarily to a fall in the number of male smokers. The number of female smokers remained unchanged at only 1% in several countries, such as in Malaysia, Pakistan and Tunisia, but in China, 53% of adult men smoke and only 4% of women.

The World Health Organization has slightly different data on smoking in Serbia. According to their latest report Serbia has close to 2.8 million smokers over the age of 15, and these will account for an estimated 34.3 per cent of the population by 2025, significantly less than the 51.5% in the year 2000 [13]. Table 1 also shows the projected premature deaths in Serbia [14].

In addition to direct tissue damage, smoking can cause pharmacokinetic and pharmacodynamic drug interactions, mainly due to nicotine [8,15]. Cigarette smoking, as well as its abrupt cessation (e.g. hospitalization), can also contribute to drug side effects. Because older people consume about three times more drugs than younger adults, one should establish their smoking status and their daily consumption of cigarettes.

## History of antismoking campaigns

In the nineteenth century, many medical doctors had personal impressions about the harmful effects of tobacco smoking. For example, A. P. Chekhov in 1886 published a one-act play entitled “On the damaging effects of tobacco.” [16]. But adequate research, based on statistics was absent, and movements to oppose smoking were weak and sporadic. Anti-smoking societies were rarely established, [17] although even lay people recognized smoking as unhealthy.

When the cigarette rolling machine was invented in the 1880s the cigarette industry was revolutionized, and from the beginning of twentieth century more and more smokers used cigarettes. This new tobacco product was made of the milder sorts of tobacco, the smoke could be inhaled, and it was more damaging.

Germany was the first country who had the strongest antismoking movement [18]. In the 1930s and early 1940s antismoking campaign included bans on smoking in public spaces, workplaces, hospitals and rest homes, government offices, bans on advertising, restrictions on tobacco rations for women, reduced rations to soldiers who even participated in battles. In the 1930s Germany had the world’s most advanced epidemiology; researchers were the first to use a case-control method to document the lung carcinoma hazard from cigarettes [19]. The success of Nazi antismoking campaign was partially due to the protection of the “superior German race.” The fact that Winston Churchill, Joseph Stalin, and Franklin D. Roosevelt were all heavy smokers, and Adolf Hitler, Benito Mussolini, and Francisco Franco were non-smokers, was often used by antismoking activists in Germany during the WWII campaign [20] Hitler declared that Nazism might never have triumphed in Germany if he had not given up smoking [21].

In the post war period, medical historians rejected to study and report the achievements of the German scientists during the Nazi period. The German scientific results were overlooked by the victors, and all good scientific discoveries were put in the same political category with their unacceptable medical programs, such as forcible sterilization, euthanasia, and industrial scale murder, or brutal experiments designed to advance military medicine. If the victors had used the results from this antismoking movement, millions of lives would have been saved globally, including those of US soldiers who received large cigarette donations from their own government.

After the concept of ‘risk factor’ for the development of a disease was created [22], the U.S. Surgeon General, wrote in 1964, a landmark report linking cigarette smoking with dangerous

results, including lung cancer and heart disease [23]. Thus, in addition to early detection and treatment of cancer, epidemiologic studies of smoking suggested additional cancer prevention strategies, especially identifying various carcinogenic substances and reinvented some old concepts, such as that cancer is the outcome of combined factors (constitutional and environmental). The realization that tobacco smoking is carcinogenic influenced many smokers to quit mainly in the USA and developed countries.

In order to support smokers to quit and influence the non-smokers not to start smoking, in 1987 the WHO initiated the May 31st as a "World No Tobacco Day." In addition to this measure, many countries initiated their own national antismoking day selected for a more convenient period of a year. For example, January 31st is a "Non Smoking Day" in Serbia and Bosnia and Herzegovina. This along with the WHO and other local antismoking actions contributed to a decrease in the number of smokers. Unfortunately, teenagers are generally resistant to such measures, and most of them ignore any information related to dangerous effects of smoking. This population needs a different approach. The campaigns of medical students from Tuzla and Banja Luka, Bosnia and Herzegovina in the 1980s and 1990s, until the beginning of the Bosnian war, had some success. They also televised a one minute TV message for, just before the Daily News: "If your parents smoke, persuade them to quit - they will live longer" [24] (figure 2).

Despite these efforts, the number of smokers in some countries is increasing. In the former Eastern bloc countries one reason is the free import of new brands of cigarettes. In 1990 students at the Moscow medical school refused to meet with a group of forty Yugoslav medical students from Tuzla. (One

of us, R. I., was a leader of this antismoking group) to discuss stop smoking methods. The Moscow students explained: "It is the wrong time to consider quit smoking. We have just gotten really nice imported cigarette brands, such as Marlboro, Richmond and Camel. Earlier, we used our ugly local cigarettes!"

Various campaigns and regulations on cigarette use and sales in developing countries are often evaded, making smoking less easy to reduce. Use of e-cigarettes also contributes to the problem.

## Smoking cessation

It is well known that tobacco addiction can be more severe than alcohol addiction. A light smoker (less than 10 cigarettes a day) develops a psychological addiction that includes a habit or a social component. In contrast, heavy smokers (10 or more cigarettes a day) develop both psychological and physical addiction. They usually smoke the first cigarette within minutes of arising, and they smoke more than ten cigarettes a day. Therefore, the best way to assess a cigarette smoking addiction is to establish the time of day the first cigarette is smoked, and the number smoked daily.

Cessation for heavy smokers presents a great challenge. Many heavy smokers quit smoking only after 3 or 4 attempts. Most smokers who quit do so for health reasons (e.g. reduced risks of myocardial infarction, stroke, lung and other cancers, COPD, decline of lung function) or for health benefits during pregnancy and before elective surgery), or for economic reasons, prevention the drug interactions, adverse effects (secondhand smoke) for family members or coworkers, etc., and various social factors, including acculturation [25,26].

A physician should provide regular smoking-cessation advice to every patient in his practice through brief information about the associated health risks. However, in a special circumstance, a high intensity smoking-cessation intervention is needed, e.g. airflow obstruction (COPD and related lung disorders), pregnancy, or at scheduled elective surgery. In such situation, in addition to the regular antismoking intervention, a high intensity smoking-cessation intervention is needed: a biochemical validation test will verify smoking abstinence, the patient may be offered a prescription for pharmacotherapy during a certain period, and he/ she will be asked to sign a declaration of commitment to stop for a period to be determined by the doctor.

Many hospitals now have the means for smoking validation such as the Pulse CO-Oximeter, the instrument for carbon monoxide (CO) determina-



**Figure 2.** Anti-tobacco poster from Nazi Germany. "He does not eat cigarettes, cigarettes eat him! Superscript: the chain smoker".

tion in expired air, and the Tobacco Cotinine/ Nicotine Urine DipTest Device. The latter test should not be done in patients who receive nicotine replacement therapy. Patients with health conditions that require temporarily cessation of smoking (gravidity, myocardial infarction, elective surgery) are good candidates to quit smoking permanently [25,27] (Table 2).

Tobacco smoking may complicate anesthetic management due to increased pulmonary and

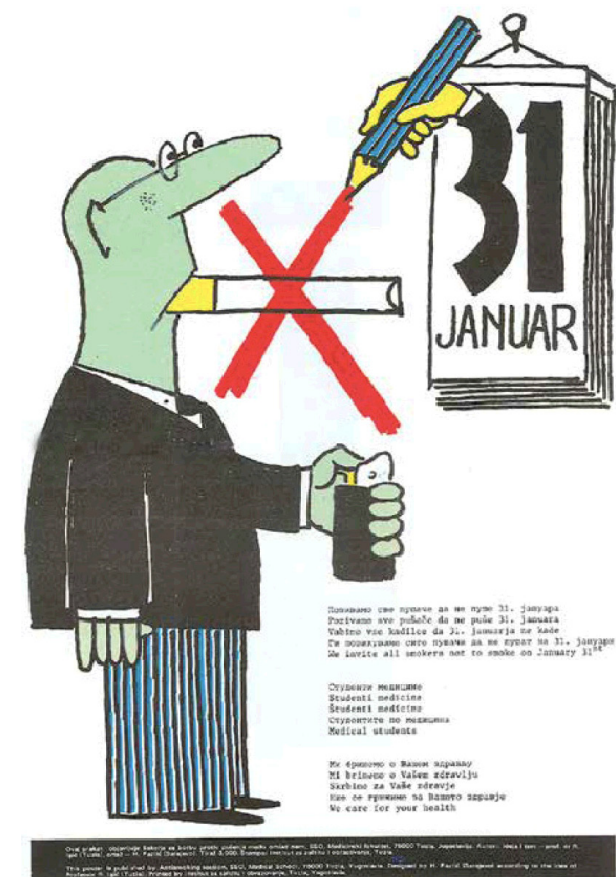
cardiovascular complications, higher incidence of airway and respiratory events (re-intubation, laryngospasm, bronchospasm, hypoventilation), and impaired healing [27-29]. Passive smoking also increases the rate of perioperative airway complications in the children of smokers [30]. Because abstinence from tobacco is beneficial for surgical patients, anesthesiologists and surgeons should strongly recommend that their patients stop smoking [31]. Preoperative abstinence may not only improve immediate surgical outcomes; it could also be an excellent opportunity for a “teachable moment” (Figure 3).

Surgical patients should be advised by the anesthesiologist to stop smoking 14 days preceding surgery; if unable to achieve that goal, they should reduce the daily consumption of cigarettes during the whole preoperative period, and stop smoking for at least 24 hours before surgery.

In addition to minimal intervention, doctor may also provide these interventions: (a) The patient is informed that, in addition to his/ her self-report related to smoking, a biochemical validation test at the time of admission to the surgical facility will confirm preoperative smoking abstinence; (b) The patients should obtain appropriate pharmacotherapy during the preoperative period; and (c) They should to sign a commitment to stop smoking preoperatively [25]. Figure 4 outlines these steps.

### Didactic modules on nicotine dependence and treatment

Physicians can help smokers quit tobacco or e-cigarettes. However, physicians in Bosnia and Serbia rarely counsel smokers to quit. Actually, most of them do not even ask if a patient smoke. However, we recommend that physicians ask each patient if he/ she uses tobacco, then assess readiness to quit, and finally offer assistance in a cessation trial. This approach can sometimes increase cessation to 30% within 6 months.



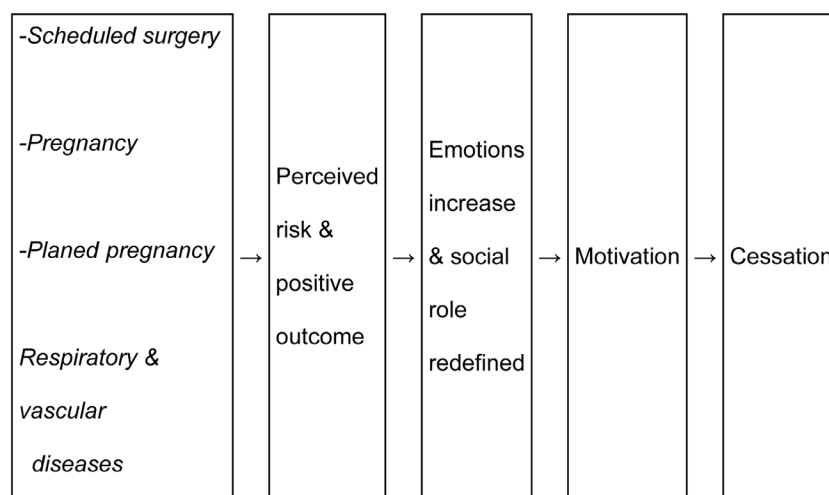
**Figure 3.** A poster (above) designed in 1980 by Medical students from Tuzla and Banja Luka named “January 31st, a non-smoking day”. Twenty years later, January 31st has become a national non-smoking day for Serbia and Bosnia and Herzegovina, and that day is still observed.

**Table 2.** Drugs used for smoking cessation

Drug and method of administration	Dose*	Main contraindications
Transdermal nicotine patch**	21>14>7 mg or 14>7 mg *	Uncontrolled high blood pressure
Bupropion (Zyban) sustained release tablets	150 mg	Convulsions, alcoholism
Varenicline (Chantix) tablets	0,5 mg and 1 mg tablet	Mental disorders
Cytisine (Tabex) tablets	1,5 mg	Vascular disease, pregnancy

\* Dosing for smoking cessation regimen is presented by the producers.

\*\*There is some evidence that e-cigarettes are effective for smoking cessation. However, the use of e-cigarettes in adolescents may be associated with smoking initiation.



**Figure 4.** Elements of a teachable moment related to smoking cessation.

**Table 3.** Five major steps of regular<sup>†</sup> smoking intervention by a physician

Steps	Should be done
1. Ask	Establish and record the status of the smoker for easier follow up.
2. Advise	At each visit, the smoker is given advice to stop smoking.
3. Assess	Is a smoker willing to quit at this time?
4. Assist	Use counselling and pharmacotherapy to help the patient. Provide written information on pharmacotherapy, and offer a declaration form to sign.
5. Arrange	Arrange weekly followup contact, in person or by telephone, optimally within the first week after the quit date.

<sup>†</sup>Intensive smoking intervention is a procedure given at various antismoking institution or medical service.

To avoid the lack of medical education about tobacco, we propose two modules to inform students about nicotine addiction and the clinical approach to withdrawal. The first module should be presented at the beginning of the first year, and the second module during clinical studies. Both modules require testing students with a questionnaire, followed by a lecture on the epidemiology of tobacco use, the threat of cigarette smoking, diagnosing nicotine addiction, treatment of nicotine addiction, and finally how a doctor can help patients by using the “5A’s” [32]. The students then respond to a post-questionnaire designed to reveal whether the surveyed student is a smoker, non-smoker or ex-smoker, with attention to how many cigarettes per day and whether e-cigarettes

are included. Additional notes to the history would include whether or not a doctor’s advice was involved and an emphasis on the well-known “5A’s” approach (Table 3).

### Prevalence of smoking among medical students

The prevalence of medical students’ smoking worldwide varies significantly for both men and women. Smoking by medical students was more pronounced in European than in Asian medical faculties. However, the prevalence of male smokers in Turkey is higher than in Europe as a whole, and it is similar in Japan. Smoking rates of female students in Asia and Africa were lower than for males, because on those continents smoking is considered socially unacceptable for women. Moslem societies consider women’s smoking to be an insult to custom. That is why in some countries, e.g. Bahrain, Saudi Arabia and Pakistan have a low prevalence of female smokers [33]. However, it is different among Muslim women in some European countries, e.g. Bosnia and Herzegovina, and North Macedonia. A reliable study on smoking of medical student smoking was conducted at the Tbilisi State Medical University in Georgia [34]. Prevalence of smoking among the students was 49.5%. Most of the smokers were light smokers (1-10 cigarettes / day). Moderate-to-heavy smokers (11-20 cigarettes / day) made up 21%, and very heavy smokers (> 20 cigarettes / day) were 8%. There were more smokers among males than females, 65% vs 35%. Most smokers stated they had never attempted to quit (63%), but the majority of those surveyed (57%) were willing to quit smoking. There is a big difference in the number of smokers at Italian and

American medical schools. Thus, in Bologna, according to a survey from 2017, about 37% of students smoked, and at Brown University, USA, only 6% smoke. (35)

The ratio of the prevalence of smokers in the general population correlates to the number of medical students who smoke. Only in China is there a notable difference, where 3-6% of medical students are smokers, but in the general population up to 66% of people smoke [36]. When the prevalence of student smokers is lower in relation to the general population, e.g. at the medical schools in China and Republic of Srpska, this indicates that students are willing to eliminate smoking for personal preventive health reasons. Some leaders of medical and other health profession schools suggest that for a candidate who applied to enroll, smoking status should be taken into account.

In Serbia and Bosnia and Herzegovina ten years ago, the prevalence of smoking by men 15 years or older was about 40%, and 30% for women. The prevalence of medical students who smoke in final year of study is just three to five percent lower than smoking prevalence of general population. In the Clinical Center of Serbia, 37% doctors and 52% technicians smoke [37]. In Serbia, about 55 percent of children under the age of 15 try cigarettes, and about 15 percent of girls already smoke every day at that age. These data show the milieu in which students of medicine and other health professionals study in Belgrade.

### **Quitting smoking while studying medicine**

Most medical students, if they smoke at all, use cigarettes more frequently during medical studies despite their knowledge of the damaging effects of smoking tobacco or e-cigarettes. However, withdrawal from tobacco is difficult for every severely addicted smoker. They may experience unpleasant symptoms, including craving tobacco, restlessness, headache, anxiety, drowsiness, stomach upset, and irritability. Drugs for smoking cessation may significantly help reduce or eliminate physical addiction. Light smokers may quit smoking their habit more easily, and because they do not have a physical addiction, they do not need medication.

Many tobacco addicts relapse after their first attempt at smoking cessation. On average two to

four failures precede success. Therefore, the first failure should not discourage the smoker. In repeated attempts, different strategies of behavioral modification and various treatment modalities should be applied. Exercise may reduce the craving for tobacco. Modified dietary plans and physical exercise can prevent weight gain, a particular concern for women who may gain 5 kg over the first six months. Depressed persons who attempt to quit smoking should be alert to depression. A physician should prescribe bupropion, an antidepressant medication, at the beginning of smoking cessation to prevent this.

Cessation is not an easy procedure for a heavy smoker. However, students rarely use pharmaceuticals or counseling service during the quitting process [39]. Recently, the 25-day treatment efficacy of cytosine was shown to be equal to the 84-day treatment of varenicline for help in smoking cessation [40]. In addition to strong motivation, a student should seek help from medical professionals. A signature declaration of commitment may help those who decide to quit to stop smoking. This form, available from the student health service, may be offered to those who have decided to quit.

A significant increase in motivation for smoking cessation comes from the proper local environment, e.g. when all hospitals and university campus are smoke-free. Medical professionals and other experts should advise the government how best to mobilize public media, educators in every school, youth organizations, universities and others to keep schools and universities smoke-free [41]. In addition to better milieu, a student who decides to quit needs support of colleagues and family members. For example, if student dormitories are not smoke-free, smokers should be accommodated in one and non-smokers in another.

In conclusion, cessation of smoking requires many different modalities. The majority of smokers who gave up smoking had their own approach to quitting smoking, and they rarely ask for doctor's advice. However, counselling, pharmacotherapy and weekly follow-up contact may help to many smokers during smoking cessation.

### **Conflict of interests**

The authors declare no conflict of interests.



## References

1. U.S. Tobacco production, consumption, and export trends. [www.everycrsreport.com](http://www.everycrsreport.com). Retrieved 2021-08-12.
2. Proctor RN. The history of the discovery of the cigarette-lung cancer link: evidentiary traditions, corporate denial, global toll. *Tob Control* 2012; 21:87-91.
3. Goth A. *Medical pharmacology. Principles and concepts*, ninth edition. Saint Louis, Mosby, 1978.
4. Lopez Davila E, Hobraeken M, De Rop J et al. Pesticides residues in tobacco smoke: risk assessment study. *Environ Monit Assess* 2020; 192:615. doi: 10.1007/s10661-020-08578-7.
5. Langley JN, Dickinson WL. On the local paralysis of peripheral ganglia, and on the connection of different doses on nerve fibers with them. *Proc R Soc Lond* 1889; 46:423-31.
6. Zubović J, Đukić M, Jovanović O. *Ekonomski aspekti kontrole duvana i empirijski nalazi u Srbiji*. Beograd, Institut ekonomskih nauka, 2020. (Serbian).
7. Torre LA, Siegel RL, Jemal A. Lung Cancer Statistics. *Adv Exp Med Biol* 2016; 893:1-19.
8. Igić R. *Osnovi gerijatrije*. Banja Luka, Medicinski fakultet, 2020 (Serbian).
9. Carroll Chapman SL, Wu LT. E-cigarette prevalence and correlates of use among adolescents versus adults: a review and comparison. *J Psychiatr Res* 2014; 54:43-54. doi: 10.1016/j.jpsychires.2014.03.005.
10. Wang L, Wang Y, Chen J et al. Comparison of biological and transcriptomic effects of conventional cigarette and electronic cigarette smoke exposure at 2. toxicological does in BEAS-2B cells. *Ecotoxicol Environ Safety* 2021;222:112472.
11. Stewart GG. A history of the medicinal use of tobacco 1492-1860. *Med History* 11:228-68.
12. Global Burden of Disease [database] Washington, DC: Institute of Health Metrics; 2019. IHME, accessed 9 August 2021.
13. WHO (2019). <https://www.who.int/news-room/detail/19-12-2019-wholaunches-new-report-on-global-tobacco-use-trends>.
14. Boričić K, Vasić M, Grozdanov J et al. Results of the national health survey of the Republic of Serbia 2013. Belgrade: Institute of Public Health of Serbia; 2014 (<http://www.batut.org.rs/download/publikacije/2013SerbiaHealthSurvey.pdf>).
15. Lukas C, Martin J. Smoking and drug interactions. *Australian Prescriber* 2013; 36:102-4.
16. Igić R. *Anton Pavlovich Chekhov. Doctor and writer*. Generis Publishing, 2021.
17. Walker RB. Medical aspects of tobacco smoking and the anti-tobacco movement in Britain in the nineteenth century. *Med History* 1980; 24:391-402.
18. Proctor RN. The anti-tobacco campaign of the Nazis: a little known aspect of public health in Germany, 1933-1945. *BMJ* 1996; 313:1450-3.
19. Schairer E, Schoniger E. Lungenkrebs und Tabakverbrauch. *Z Krebsforsch* 1943; 54:261-9.
20. Bauer D. So lebt der Duce. *Auf der Wacht* 1937; 54:19-20.
21. Picker H. *Hitlers Tischgespräche im Fahrerhauptquartier*. Bonn, Athenaum-Verlag, 1951.
22. Terry LL. The health officer and medical care administration. *Am J Public Health Nations Health* 1964; 54:1799-803. doi: 10.2105/ajph.54.11.1799.
23. Kannel W B, Dawber T R, Kagan A, Revotskie N, Stokes J. Factors of risk in the development of coronary heart disease—six-year follow-up experience. *Ann Intern Med* 1961;55:33-50.
24. Igić R. *Pušenje i zdravlje*. Tuzla, Medicinski fakultet, 1990 (Serbian).
25. Stojaković N, Jonjev ŽS, Igić R. Apstinencija od pušenja kod pacijenata predviđenih za elektivne hirurške zahvate. *Scripta Medica* 2013; 44:97-9 (Serbian).
26. Plužarev O, Igić R. The influence of the American environment on cigarette smoking among the immigrants from the former Yugoslavia 2005;10:529-31.
27. Pearce AC, Jones RM. Smoking and anesthesia. Preoperative abstinence and perioperative morbidity. *Anesthesiology* 1984; 61:576-84.
28. Moores LK. Smoking and postoperative pulmonary complications: an evidence-based review of the recent literature. *Clin Chest Med* 2000; 21:139-46.
29. Moller AM, Villebro N, Pedersen T et al. Effect of preoperative smoking intervention on postoperative complications: a randomized clinical trial. *Lancet* 2002; 359:114-17.
30. Skolnick ER, Vomvolakis MA, Buck KA et al. Exposure to environmental tobacco smoke and the risk of adverse respiratory events in children receiving general anesthesia. *Anesthesiology* 1998; 88:1144-53.
31. Warner DO. Helping surgical patients quit smoking: why, when, and how. *Anesth Analg* 2005; 101: 481-7.
32. Castello LM, Airoldi C, Baldrighi M et al. Effectiveness and feasibility of smoking counselling: a randomized controlled trial in an Italian emergency department. *Eur J Public Health* 2021 Jul 12; ckab114. doi: 10.1093/eurpub/ckab114. Epub ahead of print. PMID: 34252178.
33. Smith D, Leggat P. An international review of tobacco smoking among medical students. *J Postgrad Med* 2007;53:55-62.
34. Chkhaidze I, Maglakelidze N, Maglakelidze T, Khaltaev N. Prevalence of and factors influencing smoking among medical and non-medical students in Tbilisi, Georgia. *J Bras Pneumol* 2013;39:579-84. doi: 10.1590/S1806-37132013000500008.
35. Armstrong GW, Veronese G, George PF, Montroni I, Ugolini G. Assessment of Tobacco Habits, Attitudes, and Education Among Medical Students in the United States and Italy: A Cross-sectional Survey. *J Prevent Med Publ Health [Internet]*. 2017; 50:177-87. Available from: <http://dx.doi.org/10.3961/jpmp.15.061>
36. Smith DR, Wei N, Wang RS. Tobacco smoking habits

- among Chinese medical students and their need for health promotion initiatives. *Health Promot J Austr* 2005; 16:233-5.
37. Domić A, Tahirović H, Čížek-Sajko M. Cigarette smoking among school adolescents in the Brčko District of Bosnia and Herzegovina: A cross-sectional study. *Liječ Vjesn* 2016; 138:194-9 (Bosnian).
38. Kilibarda B, Krstić M, Horozović V, Sulović M Z. Smoking among health professionals in Serbia. *Tobacco Preven & Cess* 2020;6(Supplement): A50. doi:10.18332/tpc/128403.
39. Igić R, Pavlić VŽ, Vujić VŽ, Ilić SB. Smoking and periodontal disease in pregnancy: Another chance for permanent smoking abstinence. *Hospital Pharmacol* 2014; 1:76-82.
40. Courtney RJ, McRobbie H, Tutka P, Weaver NA, Petrie D, Mendelsohn CP. Effect of cytisine vs varenicline on smoking cessation: A randomized clinical trial. *JAMA* 2021; 326:56-64. doi: 10.1001/jama.2021.7621.
41. Žižić-Borjanović S, Jerinić M, Igić R. Twenty five years of antismoking movement started by medical students: some further goals. *JBUON* 2007; 12:181-4.