

Smoking habits among medical students: use of traditional and alternative products

Doctoral (PhD) Thesis

Dr. Erika Balogh

Clinical Medical Sciences Doctoral School

Head of the Doctoral School: Prof. Dr. Lajos Bogár

Head of the Doctoral Program: Prof. Dr. István Kiss

Supervisors: Prof. Dr. István Kiss

Prof. Dr. Zsuzsanna Füzesi



Doctoral Council and Habilitation Committee of Medical and
Pharmaceutical Sciences of the University of Pécs

Pécs

2022

Introduction

Accumulating evidence reveals the harmful effects of tobacco use, yet today approximately 1.3 billion people around the world use tobacco products. Smoking increases the risk of many diseases and is responsible for the deaths of more than 8 million people every year. The current expansion of tobacco and nicotine products and the emergence of new technologies deserve increased attention and targeted investigation, and every effort must be made to ensure that the advance of new products (e.g. electronic cigarettes, heated tobacco products) does not jeopardize efforts to reduce smoking.

Health professionals, especially medical doctors, have a key role to play in the fight against smoking. This role is multifaceted: as the most knowledgeable professionals, they can provide information to patients and the general public on the harms of smoking and the adverse health effects of using different products; they can help patients to quit smoking and overcome dependence; but they can also be promoters and facilitators of tobacco control programs and measures. In doing so, they act as role models for their immediate and wider communities and for society as a whole. It is therefore essential that our doctors, as non-smokers, are able to perform their duties credibly and set an example by their lifestyle, and take an active part in promoting healthy lifestyles.

Given the prominent role of medical students as the future generation of doctors in the fight against smoking, systematic assessment of their smoking habits, and the prevalence of traditional and alternative forms of smoking, is essential to detect changes in smoking patterns, which can better help tailor prevention and smoking cessation policies. Today, with the unprecedented expansion of the range of tobacco products, it is important to investigate new products in addition to the

traditional ones, as there is limited data on their use in the general population and especially among medical students.

Aims

- 1.) The primary objective of our study was to assess and compare the prevalence of cigarette, waterpipe and e-cigarette use in an international sample of medical students at German and Hungarian universities and to investigate associations between tobacco use and a series of socio-demographic characteristics (gender, age, academic year, nationality, religiosity and financial situation).
- 2.) Furthermore, we aimed to compare the prevalence of e-cigarette use between 2016 and 2018 in an international sample of medical students and to investigate associations between e-cigarette use and cigarette smoking status.
- 3.) We also investigated the prevalence of smokeless tobacco products (snus and chewing tobacco) among our medical students, with special focus on students from Norway, where smokeless tobacco products are widely used in the general population.
- 4.) The aim of our survey was also to investigate whether the use of heated tobacco products, which have recently become available, is prevalent among medical students.
- 5.) The aim of our study was also to examine cigarette smoking and the use of new alternative products between 2016 and 2020 among first-year Hungarian medical students studying at the University of Pécs.

Methods

Since 2014, we have conducted a cross-sectional questionnaire survey every two years, entitled "Health behaviour and career plans of medical students", in an international sample studying at Hungarian and German universities. The study was designed and developed in cooperation between four institutes of three universities: Department of Public Health Medicine and Department of Behavioral Sciences, University of Pécs, Medical School, Department of Public Health, Faculty of Medicine, Semmelweis University Budapest and Department of General Practice, University Hospital Carl Gustav Carus, Technische Universität Dresden. Our aim was to include all first, third and fifth year medical students from the participating universities in the survey. At the German institutions students studying only in German participated in the survey, whereas at the Hungarian institutions students studying in Hungarian, English and German were included in the study. Data was collected anonymously, and it is not possible to determine the identity of individual participants on the basis of the completed questionnaires.

The focus of our study was on current tobacco product use, but in some of our analyses we also used data on experimentation, past use and quitting the use of tobacco products. In addition to the age and gender of the participants, we also asked about their nationality, country of origin, self-reported health status, religiosity and financial situation.

In 2014, we defined current users of tobacco and nicotine products as those who currently used the product at least once a month. In 2014, the questionnaire included questions on e-cigarette and waterpipe use in addition to cigarettes. From 2016 onwards, the range of products covered was extended (cigars, pipes, chewing tobacco, snus), and from then on, current product users were defined as those who

have used the product at least once in the 30 days preceding the survey. The question on heated tobacco product use was added to the questionnaire in 2020.

In the analysis of the change in e-cigarette use between 2016 and 2018, we also looked at the association between e-cigarette and cigarette use. In this comparison, participants who had smoked at least 100 cigarettes in total and smoked cigarettes at least once in the past 30 days were classified as current smokers.

In our analysis of the current use of smokeless tobacco products (chewing tobacco or snus) and the various types of combustible tobacco products (cigarettes, waterpipe, cigars, pipes), we have sought to use consistent definitions. In this analysis, we did not restrict the group of current cigarette smokers to those who had smoked at least 100 cigarettes in their lifetime, as we did not have this kind of data in case of the other products. Respondents who smoked cigarettes, cigars, pipes or water pipes at least once in the past 30 days were considered current users of any combustible tobacco products including exclusive users of the individual tobacco products as well as dual- or poly-tobacco users.

In 2020, a question on the use of heated tobacco products (e.g. IQOS) was added to the questionnaire. The use of e-cigarettes and heated tobacco products was also examined in combination, and referred to as "new alternative products". Trying new alternative products was defined as trying either e-cigarettes or heated tobacco products or both, and new alternative product users were defined as those who had used e-cigarettes or combustible tobacco products or both on at least one occasion in the 30 days prior to the survey.

Statistical analysis

IBM-SPSS v.20 software was used for statistical calculations. A significant difference was defined as $p < 0.05$. The normality of the distribution of metric variables was assessed by Kolmogorov-Smirnov test. For variables with a normal distribution, a t-test was used to compare the data. For variables with a non-normal distribution, we used the Kruskal-Wallis test and the Mann-Whitney U-test. Where the Kruskal-Wallis test found a significant difference between subgroups, the subgroups were compared pairwise using the Mann-Whitney U test.

Pearson's χ^2 -test was used to compare nominal variables. Where the χ^2 -test showed a significant difference between subgroups, the subgroups were compared pairwise using the Bonferroni-corrected Z-test. The results of consecutive tests performed every two years were analyzed using the Cochran-Armitage trend test. Multivariate binary logistic regression analysis was used to examine the determinants of smoking status and health status, and the resulting beta coefficients were used to derive the adjusted odds ratios.

Results, discussion

1.) In the first year of our research, a total of 2,935 students completed the questionnaire at the four universities. The largest subpopulations were formed by German (n = 1289), Hungarian (n = 1055) and Norwegian (n = 147) students. Mean age was 22.5 ± 3.3 years. Females represented 61.6% of the sample. In the whole sample prevalence of cigarette smoking was 18.0%, prevalence of waterpipe use was 4.8%, that of e-cigarette 0.9%. More males (22.0%) than females (15.5%) reported cigarette smoking (χ^2 -test, $p < 0,001$). The lowest prevalence of cigarette smoking was found among Norwegian students (6.2%). Cigarette smokers were older, waterpipe users were younger than non-users. The mean age of cigarette smokers was higher than that of non-smokers, while the mean age of waterpipe users was lower than that of non-users. The use of electronic cigarettes was not associated with the age of the students. Those who considered themselves very religious had a lower prevalence of cigarette smoking compared to other students. Cigarette smoking and the use of waterpipe and e-cigarettes were not associated with students' financial status. The proportion of medical students who considered their health to be very good or excellent was lower among cigarette smokers compared to non-smokers (58.9% versus 68.1%, χ^2 -test, $p < 0,001$) and among e-cigarette smokers compared to non-smokers (37.5% versus 66.8%, χ^2 -test, $p = 0,002$).

Summarizing the data recorded in 2014, we observed a significant difference in the proportion of smokers among medical students across nations with respect to cigarettes. There were fewer cigarette smokers among Norwegian students than among students in other subgroups. In addition to cigarettes, the use of waterpipe

and e-cigarettes was also observed. E-cigarette use among medical students was much less common than waterpipe use or traditional cigarette smoking.

2.) In our study investigating changes in the prevalence of e-cigarette use among medical students between 2016 and 2018 sample sizes were 2297 and 1514, respectively. In the whole sample, past-30-day use of e-cigarettes increased from 4.5% to 8.0% (χ^2 -test, $p < 0.001$). The increase in e-cigarette use was significant in both genders (from 3.6% to 5.6% among females, χ^2 -test, $p = 0.028$, and from 5.9 to 11.4% among males, χ^2 -test, $p < 0.001$). Prevalence of e-cigarette use was higher among Hungarian students than among German students (5.7% versus 2.2% in 2016, and 10.5% versus 4.1% in 2018, χ^2 -test, $p < 0.05$ for both years). The ratio of e-cigarette users increased significantly among current cigarette smokers but not among non-smokers. We could not detect any reduction in the prevalence or frequency of cigarette smoking.

To summarize our survey on changes in the prevalence of e-cigarette use, there was a sharp increase in the prevalence of e-cigarette use between 2016 and 2018. The proportion of e-cigarette users showed a numerical increase in both genders, in all three academic years and in all four subgroups by nation (6 out of 9 subgroups showed a statistically significant increase). This suggests that the increase in e-cigarette use is a general phenomenon among our medical students. However, it was also observed that the largest contributors to the increase in the proportion of e-cigarette smokers were those who used traditional cigarettes, and the strongest predictor of e-cigarette use in 2018 was current cigarette smoking. Our comparative survey between 2016 and 2018 showed that e-cigarette use increased significantly, and this increase was not accompanied by a decrease in traditional cigarette smoking in this sample. On this basis, the results of our study

do not support the view that e-cigarettes as a consumer product are suitable for reducing nicotine-related harms.

3.) The survey investigating tobacco smoking and smokeless tobacco use among medical students in 2018 included 1337 students from Hungary, Norway, Germany, and from other countries (Multinational group). The lowest prevalence of cigarette smoking was found among students from Norway (13.0%) when compared with students from Hungary (21.5%), Germany (34.2%), or with students in the Multinational group (29.5%, χ^2 -test, $p < 0.001$). Conversely, prevalence of smokeless tobacco use was the highest among students from Norway (40.9%) when compared with students from Hungary (1.4%), Germany (2.6%) or with students in the Multinational group (6.2%, χ^2 -test, $p < 0.001$). Among Norwegian students, the use of smokeless tobacco products was a daily practice in half of the cases, while only a small proportion of students from other nationalities used these products on a daily basis. Waterpipes, cigars and pipes were rarely used, mostly 1 to 3 times a month in all groups. More than half of Norwegian students used some form of tobacco (smokeless and/or combustible tobacco).

To summarize our study on smokeless tobacco consumption, tobacco use pattern of students from Norway may be considered less harmful when compared to medical students from other countries, but it is not free of health risks either. Given that all forms of tobacco consumption are addictive, their use should be avoided. This is particularly important for medical students, because their smoking behavior and attitudes can affect not only their own health but also the health of their future patients.

4.) In the study investigating changes in smoking habits and new alternative product use among first year medical students in Pécs sample sizes were 171 in

2016, 168 in 2018, and 147 in 2020. The proportion of those who tried smoking decreased between 2016 and 2018 but did not change significantly thereafter (79% in 2016, 67% in 2018, 69% in 2020; Cochran–Armitage trend test, $p = 0.039$). In 2020, the proportion of those who tried e-cigarettes was 58% among men, 51% among women, and 53% in the total sample, while the proportion of those who tried a heated tobacco product was 27% among men, 11% among women, and 16% in the total sample. Between 2016 and 2018, the prevalence of current cigarette smoking decreased significantly, but no further change was observed between 2018 and 2020 (36% in 2016, 25% in 2018 and 2020; Cochran–Armitage trend test, $p = 0.040$). The proportion of male medical students using new alternative products increased significantly during the study period (5% in 2016, 21% in 2020, Z-test, $p < 0.05$). In 2020, 11.5% of men and 4.3% of women (6.8% of the total sample) used e-cigarettes, whereas 11.5% of men and 3.2% of women (6.2% of the total sample) used heated tobacco products. 12.5% of those who used heated tobacco products used them on a daily basis. Nearly 80% of those who used heated tobacco products also used cigarettes in the 30 days prior to the survey.

Among first year medical students in Pécs, the popularity of cigarettes declined, however, we have found significant interest in new alternative products. We consider it important to provide information and prevention about e-cigarettes and heated tobacco products, as well as to further monitor the use of these products.

Conclusion

University years offer a unique opportunity to try to change the harmful behaviors of future doctors, to encourage them to lead healthier lifestyles and to avoid tobacco and nicotine products. In this way, we can not only contribute to protecting their own health, but also help them to play a more successful role in health

promotion and prevention. Monitoring smoking habits is essential to understand the current situation and trends, given the expansion in the range of tobacco products available today. Understanding these changes will allow for more targeted interventions at individual and community level to be designed and implemented, which can bring us closer to the still elusive goal of a smoke- and tobacco-free campus environment. In this complex process awareness-raising and education play an important role which can help elucidating the risks associated with the use of traditional and new products, active and passive smoking, and exposure to thirdhand smoke.

Particular care should also be taken to assess health risk behaviors, such as the use of different tobacco products, so that the students can receive appropriate, personalized advice as soon as possible. In addition to motivating them to quit, it is also important to inform them about the possibilities of cessation support and to encourage them to seek help when needed.

Summary of novel results

Our surveys carried out in four waves between 2014 and 2020, provided insights into the smoking habits of medical students, tracked changes in the use of tobacco and nicotine products, and the emergence of new types of products. Our research highlights the importance of this issue, the role of future doctors, and the need for action to support young people and creating a culture of health in universities.

1. In 2014, the first year of our study, in a sample of medical students mainly from Germany, Hungary and Norway, the prevalence of cigarette smoking was 18.0%, waterpipe use was 4.8% and e-cigarette use was 0.9%. Among the different nationalities, the prevalence of cigarette use was lowest among Norwegian students (6.2%). The prevalence of cigarette smoking was lower among those who

considered themselves very religious, but the prevalence of smoking was not associated with the financial status of medical students. Cigarette smokers and e-cigarette users were less likely to rate their health as very good or excellent.

2. The prevalence of e-cigarette use increased from 4.5% in 2016 to 8.0% in 2018. Significantly more men than women used e-cigarettes. The increase in e-cigarette use was significant for both sexes. The prevalence of e-cigarette use was higher among Hungarian students than among German students. The proportion of e-cigarette users did not change significantly among non-smokers, whereas it increased significantly among current cigarette smokers.

3. In our study focusing on smokeless tobacco use in 2018, we found that it was most prevalent among Norwegian students (40.9%), compared to Hungarian (1.4%) and German (2.6%) students. Among Norwegian students, the use of smokeless tobacco products meant daily use in half of the cases. In this sample, only 13.0% of Norwegian students had smoked cigarettes in the 30 days prior to the survey, compared to 21.5% of Hungarian students, 29.5% of students of other nationalities and 34.2% of German students. Waterpipes, cigars, and pipes were rarely used, mostly only 1–3 times a month in all groups.

4. In our 2020 survey, 6.2% of the first-year Hungarian medical students in Pécs used heated tobacco products, with a higher proportion of men (11.5%) than women (3.2%). 12.5% of those who used heated tobacco products used them on a daily basis. Nearly 80% of those who used heated tobacco products also used cigarettes in the 30 days prior to the survey.

5. When examining the change in smoking habits between 2016 and 2020 among first-year Hungarian medical students in Pécs, we found that the proportion of those who tried cigarettes decreased between 2016 and 2018, then stagnated (79% in 2016, 67% in 2018, 69% in 2020). The prevalence of current cigarette use decreased between 2016 and 2018, with no further decrease thereafter (36% in

2016, 25% in both 2018 and 2020). The proportion of male medical students using a new alternative product (e-cigarette and/or heated tobacco product) increased significantly over the period (5% in 2016, 21% in 2020).

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Acknowledgement

I would like to express my gratitude to my supervisors, *Prof. Dr. István Kiss* and *Prof. Dr. Zsuzsanna Fűzesi*, who not only made the research possible and provided the framework for it, but also helped and motivated my work with their guidance, professional support and encouragement.

I am very grateful to all the members of our research team for their enthusiastic support. In particular, I would like to thank *Dr. Nóra Faubl* and *Dr. Béla Birkás*, colleagues of the Department of Behavioral Sciences, University of Pécs for their helpful attitude and intensive cooperation in all aspects; our research colleagues from Dresden, *Dr. Henna Riemenschneider* and *Dr. Karen Voigt* for their exemplary professional approach; *Dr. András Terebessy* and *Dr. Ferenc Horváth*, colleagues from the Department of Public Health at Semmelweis University, Budapest, for their indispensable support during the research.

I would also like to thank *all the colleagues* who contributed to the implementation of the surveys and thus contributed to the realization of the research. Special thanks are due to *my colleagues at the Department of Public Health Medicine*, University of Pécs, Faculty of Medicine, who we have been able to rely on throughout the research. I would also like to thank the *colleagues of the Department of Behavioral Sciences*, University of Pécs for their help in the organization of the study, especially *Mária Polecsákné Spengler* for her support.

I wish to extend my special thanks to *the students who participated* in the research at all study sites and helped us with their answers and cooperation.

Finally, I would like to thank *my family, my husband and my children* for their love and patience throughout the years. I am also very grateful to my husband for his help in data processing and statistical analysis.

The international research was made possible with the support of the Statutory Health Insurance Saxony (Kassenärztliche Vereinigung Sachsen).