Article

Prevalence of cigarette smoking and influence of associated factors among students of the University of Banja Luka: a cross-sectional study

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**Abstract:** *Background and Objectives*: Cigarette smoking among the youth population has increased significantly in developing countries, including Bosnia and Herzegovina. However, no extant literature assesses the prevalence of tobacco use, nor identifies factors associated with smoking. This study determined the prevalence of cigarette smoking among a specific cohort of students and assessed factors related to tobacco use in this population. *Materials and Methods*: A cross-sectional study includes 1200 students at all faculties of Banja Luka University. Data were collected from adapted questionnaires based on the Global Youth Tobacco Survey (GYTS) and the Global Health Professional Student Survey (GHPSS) standardized questionnaires and were analyzed using descriptive statistics, Pearson’s χ2 test, and logistic regression. *Results*: When the prevalence of cigarette smoking within the last thirty days was recorded, we found that 34.1% of students smoked within this period. Nearly three-quarters (74.9%) of the student population had smoked or experimented with cigarette smoking. However, medical students were 27.2% less likely to smoke than their counterparts from other faculties. Overall, 87% of all students were aware of the harmful effects of cigarette smoking, 79% were aware of the harmful effects of secondhand smoke, and 65% reported that it was difficult to quit. Increased spending of personal money was associated with a higher probability of smoking, while exposure to secondhand smoke increased the odds of smoking by 62%. *Conclusion*: Policies, strategies, and action plans should be introduced in order to reduce the prevalence of smoking among university students and to create a smoke-free environment at the various universities involved.

**Keywords:** Cigarette smoking; students; prevalence; risk factors; secondhand smoke

1. Introduction

Smoking is a major public health problem worldwide, resulting in many tobacco-associated deaths. It has been more than half a century since scientists first pointed out the dangers of tobacco use [1]. According to the World Health Organization (WHO), over one billion people are smokers globally, and 80% of them are from developing countries. It has been suggested that by 2030, tobacco smoking will kill more than eight million people each year [2]. Scientific data indicated the harmful effects of smoking and identified its contributions to the emergence of various types of cancers [3]. Smoking causes about 90% of all lung cancer deaths in the United States [4,5], and more women die from lung cancer each year than from breast cancer [6].

Trends in developed countries indicate that tobacco use decreases in adult populations whereas in developing countries tobacco use increases as the population reaches adulthood [3]. According to the Republic of Srpska data, the smoking prevalence in a population aged 15 to 65 was 24.6%, and tobacco use among the young population continues to rise [7]. The Global Youth Tobacco Survey (GYTS) results from 2013 and 2018 showed a significant increase over this time period in the use of tobacco and other tobacco products among 13 to 15 years old students who consume cigarettes from 7.9% in 2013 to 9.1% in 2018. In all students who ever smoked, there was an increase from 36.5% in 2013 to 38.9% by 2018 [7,8].

Worldwide, tobacco use prevention measures remain focused on adolescents and young people. Although various social and behavioral factors of smoking have been identified globally, there is a need to understand country-specific risk factors of smoking, especially among young people. The majority of adult smokers started smoking in their teenage or adolescent years, and it is essential to identify the factors associated with youth smoking behavior and take measures to reduce them [9]. In adolescence, cigarette smoking also contributes to other risk behaviors, such as risky sexual behavior, drug and alcohol consumption, as well as nutrition and dietary risks [9,10].

The aim of this study was to assess the prevalence of cigarette smoking among students at the University of Banja Luka, their attitudes concerning tobacco use and contributing factors associated with cigarette smoking.

2. Materials and Methods

This research was conducted as a cross-sectional survey at the University of Banja Luka, in the Republic of Srpska, Bosnia and Herzegovina, during April and May 2020. An adapted questionnaire, based on a standardized Global Health Professional Student Survey (GHPSS) and a Global Youth Tobacco Survey (GYTS), was used for data collection [11,12].

Sample size

The young adult population of this study was estimated (CI of 95%) to establish that the sample size was no more than 5% from the actual figure in the source population. Out of nearly 16000 students from 16 faculties of the University of Banja Luka, the sample of 1200 students were subjects in our study.

Data collection

Snowball sampling was used for data collection [13]. The first step of the survey was to identify and recruit the student representatives, one or more, from each faculty of the University of Banja Luka to whom the research team had previously submitted an electronic questionnaire. These students were the initiators of the survey and disseminated the electronic questionnaire to others, the new participants in the survey. The questionnaire used included the following: socio-demographic characteristics, use of tobacco products, exposure to secondhand smoke, smoking cessation, and attitudes regarding smoking.

Ethical Consideration and Confidentiality

This study was approved by the Ethics Committee of the University of Banja Luka (Decision No 18/4.17/19) and it was conducted in accordance with the principles of the Helsinki Declaration [14]. Prior to entering this study, all participants were fully informed about the reasons for conducting the study, how their data will be used, assured of anonymity, and the risk-free nature of the study.

Statistical Analysis

The Statistical Package for the Social Sciences (SPSS), Windows version 25.0 was used to analyze the data obtained. Descriptive statistics analyzed demographic characteristics. The Pearson chi-square test was used for the frequencies, means, and the association of demographic variables with the prevalence of cigarette smoking. Multivariate logistic regression analysis was used to identify the relative importance of each predictor to the dependent variable by controlling the effects of other variables. The 95% confidence interval (CI) was estimated, and the P-value <0.05 was considered significant.

3. Results

The study involved 1200 students aged between 18 and 26 years, with most students in the age group 20–21 (35.4%). Majority of study participants were medical students (41.4%) and the rest were students from other faculties (58.6%). Most of the survey participants were females, almost twice the number of male students, which is in accordance with the gender distribution of students at the University of Banja Luka (Table 1).

**Table 1.** Students’ smoking status and socio-demographic characteristics.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variables** | **Smoking** | |  |  |
| **Yes (%)** | **No (%)** | **χ2** | ***P-value*\*** |
| **Gender** |  |  |  |  |
| Male | 34.7 | 65.3 | 0.081 | 0.777 |
| Female | 32.8 | 67.2 |  |  |
| **Age** |  |  |  |  |
| ≤19 years | 27.3 | 72.7 | 5.843 | 0.558 |
| 20 years | 34.6 | 65.4 |  |  |
| 21 years | 35.9 | 64.1 |  |  |
| 22 years | 34.2 | 65.8 |  |  |
| 23 years | 32.8 | 67.2 |  |  |
| 24 years | 38.1 | 61.9 |  |  |
| 25 years | 28 | 72 |  |  |
| ≥26 years | 38.6 | 61.4 |  |  |
| **Year of faculty** |  |  |  |  |
| year 1 | 29 | 71 | 8.037 | 0.090 |
| year 2 | 38.5 | 61.5 |  |  |
| year 3 | 37.3 | 62.7 |  |  |
| year 4 | 31.3 | 68.7 |  |  |
| year ≥ 5 | 31.6 | 68.4 |  |  |
| **Faculties** |  |  |  |  |
| Medical students | 27.8 | 72.2 | 15.067 | < 0.001 |
| Non-medical students | 38.5 | 61.5 |  |  |
| **Weekly Expenses** |  |  |  |  |
| Do not have | 22.1 | 77.9 | 64.217 | <0.001 |
| <10 BAM\*\* | 29.3 | 70.7 |  |  |
| 11-20 BAM | 41.5 | 58.5 |  |  |
| 21-30 BAM | 49.4 | 50.6 |  |  |
| 31-40 BAM | 47.8 | 52.2 |  |  |
| 41 BAM and more | 24.2 | 75.8 |  |  |

\*P-value significant at ≤ 0.05, χ2 = chi-square. \*\*BAM-official code for Bosnia and Herzegovina currency (1Euro = 1.95 BAM).

A chi-square test of independence examined the relationship between demographic data and the prevalence of cigarette smoking among students. Of the five independent variables tested, only two were strongly associated with cigarette smoking; these were the faculty type and weekly expenses χ2=15.067, dF =1, P< 0.001 and χ2=64.217, dF =1, P< 0.001, respectively; (Table 1).

Nearly three-quarters (74.9%) of the students we queried had tried cigarette smoking, while the remaining (25.1%) claimed that they had never smoked. The majority of smoking students (50.1%) were 16–18 years old when they first tried cigarettes, followed by those aged 11–15 years (25.3%). Although most individuals began smoking cigarettes before entering the university a significant number (16.8%) experimented with cigarette smoking once they became students. We also evaluated the number of students who had smoked within the last thirty days. We noted that 34.1% of the group smoked within this period, while rest did not smoke at all (Table 2). Only 0.5% of smokers had used e-cigarettes or similar electronic devices. The results also showed that out of current smokers, most (69%) were ‘light smokers’, while the rest were ‘moderate to heavy’ or ‘heavy’ smokers, and nearly two thirds of students showed at least one sign of smoking addiction (Table 2).

**Table 2.** Student’s cigarette smoking characteristics.

|  |  |  |
| --- | --- | --- |
| **Ever experimented with cigarette smoking** | | **%** |
| Yes | | 74.9 |
| No | | 25.1 |
| **Age at first experience with cigarette smoking** | | **%** |
| <10 | | 7.8 |
| 11 to 15 | | 25.3 |
| 16 to 18 | | 50.1 |
| >19 | | 16.8 |
| **Current cigarette smokers\*** | N | **%** |
| Yes | 410 | 34.1 |
| No | 790 | 65.9 |
| **Smoking status related to the number of cigarettes/day** | | **%** |
| Light smokers (1-10 cigarettes/day) | | 69.0 |
| Moderate-to-heavy smokers (11-20 cigarettes/day) | | 24.1 |
| Very heavy smokers (> 20 cigarettes/day) | | 6.9 |
| **Has a desire to smoke after waking up** | | **%** |
| Always | | 9.5 |
| Sometimes | | 25.1 |
| Never | | 65.4 |
| **Smoking time after waking up** | | **%** |
| 60 minutes | | 20.9 |
| 1 to 2 hours | | 16 |
| 2 to 4 hours | | 9.8 |
| More than 4 hours, less than one day | | 9.3 |
| 1 to 3 days | | 5.1 |
| 4 days and more | | 4.2 |
| Never | | 34.7 |
| **Signs of addiction\*\*** | | **%** |
| Yes | | 61.4 |
| No | | 38.6 |

\* Students who smoked at least one day in 30 days prior to the survey.   
\*\* Students who smoke every day and desired to smoke always or sometimes upon waking up, and where smoking time after waking up was within one day.

Most subjects admitted that they had been exposed to cigarette smoking from others, but also majority of them were exposed to smoking at closed public places like restaurants, cafes or bars; (Table 3).

**Table 3.** Student’s exposure to secondhand smoke.

|  |  |  |
| --- | --- | --- |
| **Exposure to secondhand smoke** | **No %** | **Yes %** |
| Exposed to secondhand smoke (total) | 21.3 | 78.7 |
| Exposed at home | 52.2 | 47.8 |
| Exposed at university | 44.0 | 56.0 |
| Exposed at closed public places | 5.5 | 94.5 |

Analyses of questions related to students’ attitudes towards smoking and its relation to health revealed that most students acknowledged the harmfulness of cigarette smoking for health. As many as 77.4% of smokers and 93.3% of non-smokers believed that cigarette smoking is harmful to their health. Similar findings related to students' concerns about the harmful effects of exposure to secondhand smoke were noticed. In fact, 66.1% of smokers and 85.6% of non-smokers were well aware that secondhand smoke is harmful to their health. The decision to use tobacco within the next twelve months generated an appreciable negative response, with at least half of participants claiming that they would not use tobacco compared to those who were unsure of their decision (50.1%). When asked about the probability of using any tobacco products in the following year, 74.4 of non-smokers and 49.9% of smokers believe they will remain free of cigarettes (Table 4).

**Table 4.** Student’s attitudes concerning tobacco use and exposure to the secondhand smoking.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Questions** | **Probability** | **Non-smokers** | **Smokers** | | **Total** | | **χ2** | **df** | ***P-value*** |
| **%** | **%** | | **%** | |
| Do you think tobacco smoking is harmful to your health? | Definitely not | 0.6 | 1.2 | 0.8 | | 65,962 | | 3 | .000 |
| Probably not | 0.1 | 1.7 | 0.7 | |
| Probably yes | 6.0 | 19.6 | 10.6 | |
| Definitely yes | 93,3 | 77.4 | 87.9 | |
| Do you think exposure to secondhand smoke is harmful to your health? | Definitely not | 0.2 | 1.2 | 0.5 | | 72,818 | | 3 | .000 |
| Probably not | 0.1 | 3.5 | 1.3 | |
| Probably yes | 14.1 | 29.2 | 19.2 | |
| Definitely yes | 85.6 | 66.1 | 79.0 | |
| Once someone has started smoking tobacco, do you think it will be difficult for them to quit? | Definitely not | 2.0 | 2.7 | 2,3 | | 14,266 | | 3 | .003 |
| Probably not | 8.5 | 14.9 | 10.7 | |
| Probably yes | 65.9 | 64.0 | 65.2 | |
| Definitely yes | 23.6 | 18.4 | 21.8 | |
| Are you in favour of banning smoking at faculties and other education facilities? | Yes | 94.9 | 75.5 | 88.4 | | 98,045 | | 1 | .000 |
| No | 5.1 | 24.5 | 11.6 | |
| Are you in favour of banning smoking at restaurants? | Yes | 92.3 | 48.5 | 77.4 | | 368,823 | | 1 | .000 |
| No | 7.7 | 51.5 | 22.6 | |
| Are you in favour of banning smoking at cafes and bars? | Yes | 80.2 | 51.5 | 60.8 | | 292,892 | | 1 | .000 |
| No | 19.8 | 100.0 | 39.2 | |
| Are you in favour of banning the advertising of tobacco and tobacco products? | Yes | 78.6 | 62.5 | 73.1 | | 34,836 | | 1 | .000 |
| No | 21.4 | 37.5 | 26.9 | |
| Do you think you will use any tobacco product in the next 12 months? | Definitely not | 74.4 | 2.2 | 50.0 | | 873,565 | | 1 | .000 |
| Probably not | 21.2 | 9.4 | 17,2 | |
| Probably yes | 2.8 | 44.8 | 17,0 | |
| Definitely yes | 1,6 | 43.6 | 15,8 | |

Various factors appear to be associated with smoking cessation among students. They avoided smoking because they wanted to improve their health (50%), to save money, and other reasons that were personal to them. The majority of students (59.1%) admitted that they have never been advised regarding smoking cessation, while only 2.5% of students have been advised by health care professionals to quit smoking. The majority of students (88%) believed that they could quit smoking if they wished to, and more than 50% had tried to quit within the past 12 months. More than half of the smokers expressed unwillingness to quit (Table 5).

**Table 5.** Student’s attitudes related to smoking cessation (N=410).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Questions** | **Yes %** | **No %** |  |  |
| Would you like to stop smoking? | 43.6 | 56.4 |  |  |
| Did you try to stop smoking in the last year? | 51 | 49 |  |  |
| Do you believe you will be able to stop smoking when you decide? | 88 | 12 |  |  |
| **The reason why would someone like to stop smoking** | **Health %** | **Finances %** | **Friends do not like it %** | **Family does not like it %** |
|  | 50.0 | 18.8 | 0.5 | 30.7 |
| **Did you receive any help in smoking cessation?** | **Yes, from a health professional (%)** | **Yes, from a friend or family member (%)** | **Someone else (%)** | **No**  **(%)** |
|  | 2.5 | 33.1 | 5.3 | 59.1 |

We used multivariable logistic regression to examine associated factors that could impact cigarette smoking. The model contained nine independent variables, and among them, six predictors were statistically significant on single factor logistic regression, and five independent variables were statistically significant in multivariable logistic regression (Table 6). The multivariable logistic regression analysis showed that variables such as the study of medicine, available money, secondhand smoke at home, secondhand smoke at faculty, and secondhand smoke at public spaces can determine whether students smoke or not. The variable ‘medical faculty students’ means that: medical students were 27.2% less likely to smoke than students from other faculties. The variable ‘more money available’ means that if the students had sufficient income, the possibility of smoking increased by 12.4% (Table 6).

**Table 6**. Logistic regression analyses

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variables** | **Univariable** | | **Multivariable** | |
| **P-value** | **OR (95% CI)** | **P-value** | **OR (95% CI)** |
| Gender | 0.777 | 0.964 (0.746-1.245) |  |  |
| Age | 0.362 | 1.08 (0.915-1.276) |  |  |
| Year of faculty | 0.995 | 1.00 (0.910-1.099) |  |  |
| Medical students | <0.001 | 0.613 (0.478-0.785) | 0.023 | 0.728 (0.554-0.957) |
| More money available | <0.001 | 1.340 (1.201-1.494) | 0.004 | 1.193 (1.058-1.346) |
| Secondhand smoke at home | <0.001 | 1.385 (1.284-1.494) | <0.001 | 1.195 (1.099-1.300) |
| Secondhand smoke at faculty | <0.001 | 1.575 (1.429-1.736) | 0.004 | 1.182 (1.056-1.323) |
| Secondhand smoke in public spaces | <0.001 | 1.946 (1.745-2.169) | <0.001 | 1.623 (1.435-1.837) |
| Banning smoking in buildings | 0.007 | 1.409 (1.096-1.811) |  |  |

4. Discussion

The results of this study showed that the prevalence of cigarette smoking among the students within the last thirty days was 34.1%. The most important independent factors associated with cigarette smoking in the present study were the exposure to secondhand smoke, sufficient income, and the type of study students were engaged in. Additionally, this survey revealed that 74.9% of the participants have ever tried or experimented with cigarette smoking, which is similar to studies from Lithuania, Poland, and Slovakia but higher than in Belarus and Russia [15]. Our own data relates to students’ attitudes and beliefs regarding tobacco and tobacco product use and indicates that most (87.9%) of our cohort admitted that cigarette smoking is very harmful to their health, similar to the Polish study [16].

Whatever the leading risk factor is, the prevalence is higher than in the general population in the Republic of Srpska (24.6%) and among school-age children (9.1%) [7,8]. However, it should be noted that the above-mentioned studies by others involved people of a wider range, including adults 15 to 65 years, and adolescents of 13 to 15 years, while our study was limited to university students aged 18 to 26 years. The present study also suggested an increased odds of age with smoking. Specifically, there was a higher prevalence among students aged 16–18 years when they first tried cigarettes, followed by those aged 11–15 years, as well as a significant number of students experimenting with cigarette smoking at the age when they entered the university. These results are consistent with other studies conducted in Yemen [17], Turkey [18], Brasil [19], Ethiopia [20], Greece [21], and Serbia [22] where an association of age with cigarette smoking was noticed. The strongest association with cigarette smoking in our study was the exposure to secondhand smoke at home, faculties, and closed public places, which have increased the possibility of smoking by 62,3%. Our results are consistent with previous studies that showed a significantly higher occurrence of smoking amongst students exposed to secondhand smoke [23-25].

Another interesting finding of our study clearly showed that students with sufficient money are more likely to smoke cigarettes, increasing the possibility of smoking by 12,4%. This is similar to the results of the study in Yemen, a low-income country where family income is a significant predictor of smoking among university students [17]. Additionally, the study conducted in Turkey found a direct relationship between cigarette smoking and socioeconomic status [26]. In most studies, teens from families of better socio-economic status were at additional risk for cigarette, alcohol, and substance use than those from households of lower socio-financial status [17,26]. On the contrary, in developed countries like Germany and Hungary, it was found that the financial situation had no association with any tobacco consumption among students [27].

In contrast, we found that the smoking prevalence among medical students was statistically lower (27.2%) than from other faculties (38.5%) but similar to results among university students in Serbia23 and Greece [15,28]. The systematic international review of tobacco smoking habits among medical students showed that low smoking rates were found in Australia and the United States of America (USA), while Spain and Turkey reported higher rates [29]. Medical students in Italy had a higher prevalence (37%) than students in the USA (6%) [30]. In China, a remarkable variance was found between rates of smoking by the general population (66%) and medical students (3–6%) [31].

This study showed a higher smoking prevalence with almost equal proportions among both genders. On the contrary, the studies from Yemen [17], Cameroon [32], Saudi Arabia [33], Ethiopia [34], Greece [21] found that most tobacco consumers were males, especially influenced by their peers. Similarly, in China, the tobacco use by boys (16.5%) was significantly higher than by girls (1.9%) [35]. A Georgian investigation showed high smoking prevalence, with significant gender difference – male smokers 65% and females 35% [36]. Female medical students have a lower smoking rate due to various factors such as religion, cultural and ethnic specificity, or socio-demographic differences, like in Asia or Africa where smoking is considered socially unacceptable for women, or in some Muslim countries, like Bahrain or Saudi Arabia, where it is considered as an insult to custom.29 On the contrary, the results of the GYTS study from Pakistan found that females were more likely than males to be susceptible to smoking [37]. The finding that female students are increasingly prone to cigarettes is important to understand an evolving gender role associated with smoking initiation among adolescents. WHO reported that the prevalence of smoking among females is increasing and women are a major target of opportunity for the tobacco industry [38].

Although many studies investigated the prevalence and risk factors associated with cigarette smoking like age, gender, or peer influence, only a few studies addressed more than one risk factor simultaneously in their research, the exceptions included studies from Gambia [39], Bangladesh [40], Cameroon [32], Saudi Arabia [33] and Ethiopia [34]. Some of the main predictors of cigarette smoking in those studies included peer influence, male gender, age, parental influence (smoking allowed at home), awareness/attitudes/beliefs (poor knowledge of the harmful effects of smoking), intellectual pressure, sufficient pocket money, superiority complex, mass advertisement, attending grant-aided schools, and religion (non-Muslims).

It is interesting to notice that most of our students had never been advised about smoking cessation. Despite several anti-smoking activities regularly performed by the medical students at our University in collaboration with the Public health Institute of the Republic of Srpska, such as a National Day Without a Cigarette (January 31st), World No-Tobacco Day (May 31st), and other measures, the rate of smoking remains high, and smoking is socially acceptable in this European region [41]. Since some non-medical and medical students start smoking during their first year at the university, that is the time when anti-smoking activity should be maximally activated. This is in line with previous worldwide findings that medical students smoke more lately than in the earlier years of study [42]. Therefore, the prevalence of better knowledge did not lessen the rate of smoking. Despite all antismoking actions and policies in developing countries, smoking prevalence remains high, with electronic cigarettes contributing additionally [22]. Because teenagers, in general, ignore any kind of antismoking information, a more effective approach might include strategies to support smoke-free environments.

In addition, tobacco control programs and prevention strategies should be oriented toward the student population. From a public health perspective, as well, students should become familiar with prevention measures. In order to reduce the number of smokers, university health authorities and medical students should develop a specific plan, including the creation of a Stop Smoking Center (Cessation Center) within the university healthcare system. This study should be used as a toll to force national health authorities for final adoption of the Low to ban tobacco smoking at public places. Pursuant to Article 3 of the Law, it has been clearly stated that the legislator imposed a general prohibition of tobacco smoking in public spaces including educational institutions, any institution used by children, school students, and university students, health care institutions and care providers, social institutions, and any other public institution.

Our study has several limitations. First of all, this cross-sectional study on students is not representative for students of the University of Banja Luka since the majority of interviewed participants were medical students. Second limitation of this study is that it relies on self-reporting smoking behavior which is subject to recall bias. Third, the study has focused only on tobacco smoking; no detailed information were collected about non-smoking tobacco use or illicit drug use, and this needs to be explored in the future.

**5. Conclusions**

Our study showed that there is a very high prevalence of cigarette smoking amongst the students at the University of Banja Luka with almost equal proportions among both genders. Smoking prevalence among medical students was significantly lower than from other faculties. The prevalence appears closely related to the availability of pocket money, as well as to the particular faculty (medical vs. non-medical students), and exposure to secondhand smoking. Large majority of the cohort admitted that cigarette smoking is very harmful to their health, but most of our students had never been advised about smoking cessation. These findings emphasize the importance of implementing policies, strategies and action plans related to supporting a smoke-free environment.

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**Institutional Review Board Statement:** The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Ethics Committee of the Faculty of Medicine, University of Banja Luka (Decision No 18/4.17/19, date of approval: 01/03/2019).

**Informed Consent Statement:** This is a non-interventional study, and all participants were fully informed that the anonymity is assured, why the research is being conducted, how their data will be used and that there are no risks associated with participation in this study.

**Data Availability Statement:** All data presented in this study is available upon request.

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