Tobacco use among 11-16 years old students of Sousse Tunisia: A cross-sectional study with the GYTS method

Rania Bannour¹, Sana Bhiri¹,²; Asma B. Cheikh¹,², Hela Ghali¹,², Salwa Khefacha¹, Mohamed B. Rejeb¹,², Houyem S. Laatiri¹,²

AFFILIATION
1 Department of prevention and security of care, Sahloul University Hospital of Sousse, Tunisia
2 Faculty of Medicine of Sousse, University of Sousse, Tunisia

CORRESPONDENCE TO
Rania Bannour. Department of prevention and security of care, Sahloul University Hospital of Sousse, 4052, Sousse, Tunisia
E-mail: raniaa.bannour@gmail.com

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ABSTRACT

INTRODUCTION Despite tobacco control prevention programs, many adolescents start smoking at school age. The main objectives were to assess the prevalence of smoking, secondhand smoke exposure, and susceptibility to smoking among 11-16-year-old middle-school students in Sousse using the Global Youth Tobacco Survey (GYTS) in 2020.

METHODS A cross-sectional study was conducted among 306 students aged 11-16 years enrolled in 12 classes from 2 middle public schools in Sousse, Tunisia, during the school year 2020-2021. A Global Youth Tobacco Survey (GYTS) self-administered questionnaire on smoking was used to assess their smoking habits.

RESULTS In total, 35.3% of students reported that they had tried cigarettes in the past, while 17.6% reported currently being cigarette smokers, with a higher prevalence among boys (30.6%) than in girls (7.6%) (p<10^{-3}). Of the students, 59.2% % had been exposed to secondhand smoke at home and 66% in public places. Of the current cigarette smokers, 47.2% usually purchased their cigarettes in a store or market, and 34.5 % had not been prevented from purchasing them despite their age. Overall, more than half (54%) of current cigarette smokers wanted to stop smoking immediately, and 66.7% had tried to quit smoking.

CONCLUSIONS The prevalence of smoking among adolescents in the study is high. The results suggest that adolescents have relatively easy access to cigarettes and are regularly exposed to secondhand smoke in public places. Implementing measures to stop tobacco use and its new forms of consumption among adolescents is imperative.
INTRODUCTION

According to the World Health Organization (WHO), smoking is one of the main risk factors for several non-communicable diseases, such as cancer, lung disease and cardiovascular disease\textsuperscript{1}. The WHO report 2018 announces that smoking kills more than 7 million people each year, and mortality is expected to reach 8 million victims in 2030, constituting a real threat to public health and weighing heavily on the global health system\textsuperscript{2}. Approximately 80% of smokers worldwide live in low and medium income countries with a significant burden of tobacco-related diseases\textsuperscript{1}.

The average age of smoking onset has been previously noted to be around 13 years\textsuperscript{3}, in the North African countries, we witness a significant increase in addition to the precocity of the onset of this scourge. A report on smoking in Morocco stated that the prevalence among schoolchildren aged 13 to 15 years was 7.8% in 2012, of which 30.6% started smoking before the age of 10, and 16.3% of non-smokers tend to become regular tobacco users\textsuperscript{4}.

Similarly, according to the WHO, Tunisia reached the highest prevalence of tobacco consumption among Arab countries. Almost 7,000 children aged between 10 and 14 years and nearly two million people over 15 years use tobacco daily. The prevalence of tobacco consumption among students aged 13 to 15 years in Tunisia in 2017 was 10.1%, and 30% of them had started smoking cigarettes before the age of 10 years, and 35.1% have started smoking between the age of 12 and 13\textsuperscript{5}. An international collaborative survey enrolling schoolchildren from 131 countries showed that adolescents have the highest risk for smoking initiation, with an overall prevalence of schoolchildren who are active smokers at 8.9\textsuperscript{6}.

Adolescence is a significant period of growth and physical development, marked by a psychological transition where the child expresses the need to demonstrate his capacity as an adult. This vulnerable age, known for its high sensitivity to the effects of nicotine, can be a gateway period for smoking behaviour in adolescents who can quickly become addicted\textsuperscript{7}.

Therefore, assessing the smoking risk factors is an essential step toward tobacco prevention. In this sense, it seems relevant to study the problem of smoking behaviour among schoolchildren to better comprehend this complex phenomenon to prevent it. Hence, this paper aimed to assess smoking prevalence, secondhand smoke exposure, and susceptibility to smoking among 11-16-year-old middle-school students in the city of Sousse in 2020.
Methods

Study design and population

A cross-sectional study on smoking behaviour was conducted among middle-school students in two public colleges in the governorate of Sousse, Tunisia. Adolescents aged 11 to 16 years attending school in 2020 and residing in the governorate of Sousse were included. The sampling was based on the Global Youth Survey Tunisia GYTS 2017 (Global Youth Tobacco Survey)\textsuperscript{5}. It was a two-stage stratified sampling. For the first level, two colleges were randomly drawn from the list of all colleges in the city of Sousse. The number of clusters (classes) needed to form the calculated sample was drawn for the second level.

The sample size was defined using the SCHWARTZ formula\textsuperscript{8}, which is suitable for calculating the sample size for a descriptive study. The minimum sample size comes down to 263. Dividing this number by the average cluster size (class of 25 students), we found 11 clusters.

The sample elements are therefore divided into clusters (Classes) of 25 students: two classes of each level in each college, so a total of twelve classes. Therefore, the study was conducted in the colleges "Ajmi Ben Saad" of Kaala Kebira and "Mohamed el Aroui" of Jawhara Sousse and included 12 classes in the two colleges. The number of secondary school students registered in the classes concerned by the survey was 325.

Variables definitions

Frequent Cigarette Smokers were defined as students who reported smoking cigarettes on 20 or more days out of 30 days, current Cigarette Smokers as those who reported any cigarette smoking during the past 30 days, while ever cigarette Smokers as those who have ever smoked cigarettes, even if only once or briefly. With regards to electronic cigarette use a similar approach was followed with frequent Electronic Cigarette Smokers those who reported using electronic cigarettes on 20 or more days out of 30 days, current Electronic Cigarette Smokers those who reported using electronic cigarettes at any time during the past 30 days. Similarly, frequent Hookah Smokers as those who reported using a Hookah on 20 or more days out of 30 days, current Hookah Smokers as those who reported using a Hookah any time during the past 30 days.
Data collection We used a self-administered questionnaire, validated in the Arabic version, used in the national survey on smoking among young people attending public colleges (GYTS) in Tunisia in 2017².

Data collection was carried out during the second week of March 2020. We surveyed at the start of each hour, with the teacher's permission, before he started class. The self-administered questionnaires were completed under the supervision of a medical doctor to clarify and explain some points when needed.

The legal guardians of the adolescents were notified through the college administrations before the investigation took place. In addition, Data analysis was conducted respecting the anonymity and confidentiality of schoolchildren.

Data Analysis Statistical analysis was performed using SPSS.24. The results of continuous variables were presented as mean ± standard deviation or median and interquartile range. Categorical variables were presented as percentages. A chi-square test was performed for categorical variables in independent samples. P values lower than 0.05 were considered statistically significant.

RESULTS
The total completed questionnaire was 306, with a response rate of 94.2%. The socio-demographic characteristics of participants are summarised in Table I below.

Table 1: Socio-demographic characteristics of 11-16 years old students of Sousse, Tunisia, participating in the tobacco cross-sectional survey with the GYTS method in 2020 (N=306)

<table>
<thead>
<tr>
<th>Socio-demographic characteristics</th>
<th>n</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;13 years</td>
<td>48</td>
<td>15.7</td>
</tr>
<tr>
<td>13-15 years</td>
<td>231</td>
<td>75.5</td>
</tr>
<tr>
<td>≥16 years</td>
<td>27</td>
<td>8.8</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boy</td>
<td>134</td>
<td>43.8</td>
</tr>
<tr>
<td>Girls</td>
<td>172</td>
<td>56.2</td>
</tr>
<tr>
<td><strong>Grade</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7th</td>
<td>94</td>
<td>30.7</td>
</tr>
</tbody>
</table>
Tobacco Use

In total, 35.3% of participants reported frequent cigarette smoking (boys, 49.2%; girls, 24.4%), whereas 82.4% reported ever having smoked even one or two puffs (Table II).

### Table 2: Cigarette smoking characteristics of 11-16 years old students of Sousse, Tunisia, participating in the tobacco cross-sectional survey with the GYTS method in 2020 (N=306)

<table>
<thead>
<tr>
<th>Cigarette smoking characteristics</th>
<th>Overall (%)</th>
<th>Boys (%)</th>
<th>Girls (%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent cigarette smokers¹</td>
<td>108(35.3)</td>
<td>66(49.2)</td>
<td>42(24.4)</td>
<td>&lt;10⁻³</td>
</tr>
<tr>
<td>Current cigarette smokers²</td>
<td>54 (17.6)</td>
<td>41 (30.6)</td>
<td>13 (7.6)</td>
<td>&lt;10⁻³</td>
</tr>
<tr>
<td>Ever cigarette smokers³</td>
<td>252(82.4)</td>
<td>93 (69.4)</td>
<td>159 (92.4)</td>
<td>&lt;10⁻³</td>
</tr>
</tbody>
</table>

1. Smoked cigarettes on 20 or more days of the past 30 days
2. Smoked cigarettes anytime during the past 30 days.
3. Have you ever smoked cigarettes, even one or two puffs?

The prevalence of current hookah smoking was 24.2%, while the prevalence of Current electronic cigarette smoking was 15.6% (Table III).

### Table 3: Other smoking behaviours (other than a cigarette) among 11-16 years old students of Sousse, Tunisia, participating in the tobacco cross-sectional survey with the GYTS method in 2020 (N=306)

<table>
<thead>
<tr>
<th>Other smoking behaviours</th>
<th>n</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic cigarette smokers (N=306)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequent electronic cigarette smokers¹</td>
<td>64</td>
<td>20.9</td>
</tr>
<tr>
<td>Current electronic cigarette smokers²</td>
<td>10</td>
<td>15.6</td>
</tr>
</tbody>
</table>
### Hookah smokers (N=306)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent hookah smokers</td>
<td>91</td>
<td>29.7</td>
</tr>
<tr>
<td>Current Hookah smokers</td>
<td>74</td>
<td>24.2</td>
</tr>
</tbody>
</table>

1. Used electronic cigarettes on 20 or more days of the past 30 days.
2. Used electronic cigarettes anytime during the past 30 days.
3. Used Hookah on 20 or more days of the past 30 days.
4. Used Hookah anytime during the past 30 days.

### Exposure to second hand smoke

More than half of the students (59.2%) were exposed to tobacco smoke at home, and almost two out of three students (66%) reported being exposed to secondhand smoke inside an enclosed public place such as a restaurant, shopping mall, or theatre (Table 4). Most students (78.1%) reported having seen someone smoking inside the school building or outside on school property. Besides, 70.5% of students favoured banning smoking in public places (Table IV).

### Other risk factors

Overall, 71.3% of participants reported having seen an anti-tobacco media message on media during the past 30 days, and 58.2% noticed anti-tobacco messages on tobacco packages (Table IV). However, 77.1% of students reported seeing anyone using tobacco on television, video or movies. Furthermore, Almost half of current cigarette smokers (47.2%) usually purchased their cigarettes in a store or market and, 34.5 % of them had not been prevented from purchasing cigarettes despite their young age (Table IV). Finally, with regards to cessation, over half (54%) of current cigarette smokers wanted to stop smoking immediately. Additionally 66.7,% had tried to quit smoking. Furthermore, 65% of the participant students reported having been taught about the dangers of smoking in school during the past year (table IV).
Table 4: Distribution of tobacco use risk factors among 11-16 years old students of Sousse, Tunisi,a participating in the tobaccocross-sectionalal survey with the GYTS method in 2020 (N=306)

<table>
<thead>
<tr>
<th>Factors influencing tobacco use</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Second Hand Smoke (N=306)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposure to tobacco smoke at home</td>
<td>181</td>
<td>59.2</td>
</tr>
<tr>
<td>Exposure to tobacco smoke inside any enclosed public place</td>
<td>202</td>
<td>66.0</td>
</tr>
<tr>
<td>Students who saw anyone smoking inside the school building or outside on school property</td>
<td>239</td>
<td>78.1</td>
</tr>
<tr>
<td><strong>Knowledge and attitudes (N=306)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students who definitely thought is difficult to quit once someone starts smoking tobacco</td>
<td>50</td>
<td>16.3</td>
</tr>
<tr>
<td>Students who thought other people’s tobacco smoking is harmful to them</td>
<td>176</td>
<td>57.5</td>
</tr>
<tr>
<td>Students who favored prohibiting smoking inside public places</td>
<td>215</td>
<td>70.5</td>
</tr>
<tr>
<td><strong>Tobacco advertising (N=306)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students who saw any one using tobacco on television, video or movies</td>
<td>235</td>
<td>77.1</td>
</tr>
<tr>
<td>Anti tobacco advertising</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students who noticed anti tobacco messages in the media (N=306)</td>
<td>218</td>
<td>71.3</td>
</tr>
<tr>
<td>Students who noticed anti tobacco message on tobacco packages (N=306)</td>
<td>178</td>
<td>58.2</td>
</tr>
<tr>
<td>Students who thought about quitting because of warning label (n=178)</td>
<td>60</td>
<td>33.7</td>
</tr>
<tr>
<td>Students who were taught in school about the dangers of tobacco use in the past 12 months (N=306)</td>
<td>199</td>
<td>65.0</td>
</tr>
<tr>
<td><strong>Access and Availability (N=252)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigarette smokers who bought cigarettes from a store shop, street vendor, or kiosk</td>
<td>119</td>
<td>47.2</td>
</tr>
<tr>
<td>Cigarette smokers who were not prevented from buying cigarettes because of their age</td>
<td>87</td>
<td>34.5</td>
</tr>
<tr>
<td>Students who get cigarettes from other peoples</td>
<td>42</td>
<td>16.7</td>
</tr>
<tr>
<td>Students who bought cigarettes as individual sticks</td>
<td>37</td>
<td>14.7</td>
</tr>
<tr>
<td><strong>Cessation (N=54)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current tobacco smokers who tried to stop smoking in the past 12 months</td>
<td>36</td>
<td>66.7</td>
</tr>
<tr>
<td>Current tobacco smokers who wanted to stop smoking now</td>
<td>29</td>
<td>54</td>
</tr>
</tbody>
</table>
Current tobacco smokers who thought they would be able to stop smoking if they wanted to

1. Percentage of youth who reported having been exposed to tobacco smoke at home during the past 7 days.
2. Percentage of youth who reported having been exposed to tobacco smoke in enclosed public places during the past 7 days.
3. Percentage of youth who reported having seen anyone smoke inside the school building or outside on school property during the past 30 days.
4. Percentage of youth who reported having seen any tobacco marketing at points of sale (such as stores and shops) during the past 30 days.
5. Percentage of youth who reported having seen any one using tobacco on television, video or movies during the past 30 days.
6. Percentage of youth who noticed anti tobacco messages in the media during the past 30 days.
7. Percentage of youth who noticed anti tobacco message on tobacco packages during the past 30 days.
8. Percentage of youth who thought about quitting because of warning label among those who noticed warning labels on cigarette packages in the past 30 days.
9. Outlet from which current cigarette smokers bought cigarettes the last time they smoked cigarettes in the past 30 days.
10. Percentage of youth who were not prevented from buying cigarettes because of their age among those who tried to buy cigarettes during the past 30 days.
11. Percentage of youth who got cigarettes from other peoples during the past 30 days.
12. Percentage of youth who bought cigarettes as individual sticks, based on the last purchase, among those who bought cigarettes during the past 30 days.

DISCUSSION

Adolescence is an auspicious period in life characterized by the need to explore the unknown and adopting risky behaviors, such as cigarette smoking. However, although not all adolescents who try cigarettes become smokers, experimentation is the first step toward future adherence to regular consumption of tobacco products.
We aimed to assess the prevalence of smoking, secondhand smoke exposure, and susceptibility to smoking among 11-16 year-old middle-school students in the city of Sousse in 2020. The findings of the current study shed light on several significant trends in youth tobacco use. A concerning 35.3% of participants were identified as frequent cigarette smokers, with an increasing prevalence among girls (24.4%). Additionally, the study unveiled prevalence rates of 24.2% for current hookah smokers and 15.6% for electronic cigarette users. The pervasiveness of tobacco exposure emerged as a significant concern, with 59.2% of students encountering secondhand smoke at home and 66% facing it in enclosed public spaces. Media influence was also pronounced, as 77.1% of students reported witnessing tobacco use in television shows, videos, or movies. The research also underlined a disconcerting lack of age-related purchasing restrictions, with unrestricted access to cigarettes noted. Encouragingly, 54% of current cigarette smokers expressed an immediate intention to quit, while 66.7% had attempted smoking cessation. These findings underscore the pressing need for targeted interventions to address the complex factors influencing youth tobacco use behaviors.

Overall, the majority of participants fell within the age range of 13 to 15 years, with a slight preponderance of females. Our study cohort consists of college students, and their educational distribution is fairly even: 30.7% in 7th grade, 35.9% in 8th grade, and 33.3% in 9th grade.

Comparing our findings with prior research, it's noteworthy that adolescents aged 13 to 15 years who initiate tobacco use are more susceptible to becoming habitual consumers and facing tobacco-related risks compared to those who start smoking later in life. This highlights the vulnerability of the majority of our participants to the adverse effects of smoking.

Regarding financial aspects, approximately one quarter of students receive weekly pocket money ranging from three to nine dinars (equivalent to 1-3 USD), and another quarter receive more than nine dinars. Multiple studies have indicated that having access to pocket money is associated with an increased risk of smoking among adolescents.

The definition of a smoker used in the present study was the one recommended by the WHO. The prevalence of smoking among students was recorded at 35.3%, with 17.6% reporting daily smoking. Notably, smoking prevalence was significantly higher among boys compared to girls. Our results unveil not only a rise in smoking prevalence but also an upsurge among girls compared to the 2017 national tobacco use survey. This alarming trend
signifies a considerable increase in smoking prevalence among the youth, escalating from 7.6% in 2002 to 10.1% in the 2017 national survey. This surge underscores the persistence of tobacco use among young individuals in Tunisia, which ranks the highest in tobacco consumption among Arab countries.

Our investigation revealed a fourfold increase in the prevalence of current electronic cigarette users in Tunisia compared to the 2017 national survey (4.9%)\(^5\). This global trend is evident elsewhere; a study in Canada noted an increased prevalence of electronic cigarette users from 8.4% to 14.6% between 2017 and 2018\(^{14}\). The WHO explains the use of electronic cigarettes worldwide as an emerging trend among young people\(^{15}\).

The second prevalent form of tobacco consumption among our participants was hookah, with 24.2% currently using it. Globally, hookah affects over 100 million people daily, predominantly in Africa, Asia, and the Middle East, particularly among adolescents aged 15 to 20\(^{16}\). In Tunisia, the hookah use rate was 20.5% in 2017\(^{17}\). Adolescents are often enticed to experiment with hookah due to its allure, novelty, packaging aesthetics, diverse flavors, and social opportunities\(^{18}\).

Concerning exposure to passive smoking, a substantial proportion reported exposure at home, while two thirds of the students experienced secondhand smoke in enclosed public spaces, and 78.1% witnessed smoking within the college premises. Passive smoking, according to the WHO, endangers both smokers and non-smokers with lung cancer and coronary artery disease due to the inhalation of exhaled smoke in confined spaces\(^{19}\). Our survey underscores the significant exposure to passive smoking among students, particularly at home and in public spaces, emphasizing the need for interventions targeting both families and the general population\(^{20}\). A majority of college students were cognizant of the health risks associated with passive smoking, with 70.5% supporting public smoking bans. Effective tobacco control strategies should encompass smoke-free environments, public smoking bans, and heightened awareness among families regarding smoke exposure.

Looking at media influence, the predominance lot of participants encountered anti-tobacco messages within the past month, noticed such messages on tobacco packages, or received tobacco prevention education within the last year. Conversely, a significant portion saw tobacco advertising messages in the same timeframe. Comparatively, the 2017 Tunisian national survey reported exposure rates of 64.4% for anti-smoking messages and 50.4% for tobacco education\(^5\), yet smoking prevalence rose from 10.1% to 17.6% in our study. The
orientation towards “Health promotion” helps reducing the mechanism of resistance to anti-smoking message, improving anti-smoking communication and enriching young people’s knowledge of their health. This suggests that impactful anti-smoking initiatives might require a shift from fear-inducing messages to emphasizing the benefits of quitting21.

Regarding tobacco acquisition, nearly half obtained tobacco from retail points, 16.7% from individuals, and remarkably, 34.5% of middle school students managed to purchase cigarettes despite their age. Easy access to tobacco has been identified as a key contributor to early smoking initiation22. This parallels findings from a Canadian study in 2016, where a substantial proportion of young smokers bought cigarettes in stores and received them for free23. In Tunisia, the 2017 survey indicated that 63.4% of smokers purchased tobacco from retail shops, with 76.1% managing to buy despite their young age5. When assessing smokers' attitudes toward smoking cessation, more than half of them indicated a desire to quit. Only 18.5% received tobacco cessation education. This contrasts with the 2017 survey's findings, where 74% intended to quit and 73.6% made cessation attempts within the previous year5. Additionally, 72.2% believed they could quit, indicating a promising level of self-confidence that warrants further support.

**Strength and limitations**

When discussing the validity of our results we should notice that our study presents some strengths and limits: As for strengths, the sample size was justified and the sample was chosen at random, which could guarantee a certain representativeness of the population. Besides, the questionnaire used in our study was the one used in the national survey on smoking among young people enrolled in public colleges (GYTS Survey Tunisia 2017), which ensures the validity of the results. However, a number of limitations of this report must be acknowledged. First, the survey was limited to students in two located schools in the city of Sousse. Consequently, the potential for generalizing these findings to encompass all youths aged 11-16 years might be constrained. Second, we must acknowledge that within our study's participant group, the presence of recall or reporting bias cannot be definitively excluded. Finally, the questionnaire was quite long which may hamper the concentration of students when completing it.

**CONCLUSIONS**
Our findings illustrate the prevalence of smoking and other tobacco-related behaviors within the population of adolescent students, accompanied by a notable increase in smoking prevalence among female students. Additionally, the utilization of alternative tobacco products, such as electronic cigarettes and hookah, was also noted. Our observations also indicate a substantial frequency of exposure to secondhand smoke, occurring both within domestic environments and public spaces, including educational institutions. Furthermore, instances of smoking portrayal in diverse media platforms were found to be prevalent. In addition, a majority of students reported having received education concerning the detrimental effects of smoking, and a significant proportion expressed their intention to quit smoking.

The findings emphasize the need for multifaceted interventions targeting various aspects, including awareness, access, prevention, and motivation to quit smoking, to address the growing tobacco consumption trend among the youth. We also recommend to advance tobacco-free educational institutions with active involvement of all stakeholders, to prohibit smoking among educational personnel and tobacco sales to minors, and to strengthen public policies to reduce adolescent exposure to cigarettes through legal measures, age restrictions, marketing bans, and tailored cessation programs.

CONFLICTS OF INTEREST
The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none was reported.

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ETHICAL APPROVAL AND INFORMED CONSENT

DATA AVAILABILITY
The data supporting this research are available from the authors on reasonable request.

AUTHORS' CONTRIBUTIONS
All authors contributed to the manuscript and were involved in study planning, data acquisition, analysis, and interpretation. S.B and R.B participated in research concept and design of the work, the data analysis and interpretation and writing the article. A.B contributed at the collection and assembly of data and the critical revision of the article. H.G contributed at the writing the article and the critical revision of the article. S.K supervised the collection and/or assembly of data and the critical revision of the article. M.B and H.S supervised the critical revision of the article and the final approval of the article.

**PROVENANCE AND PEER REVIEW**

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**REFERENCES**


