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RESEARCH ARTICLE

Prevalence of, and perceptions regarding water pipe smoking amongst college students in Johannesburg, South Africa

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ABSTRACT

Background: Water pipe tobacco smoking has similar health risks as other forms of tobacco use, such as increased risk of cardiovascular disease and lung cancer, decreased pulmonary function, as well as various other oral diseases. Because there are perceptions among young people that its health effects are less harmful, its use in this group is reportedly high, though its prevalence is not known. This study purposed to determine the prevalence and perceptions of water pipe smoking amongst Technical and Vocational Education and Training (TVET) college students in Johannesburg, South Africa.

Methods: A cross-sectional quantitative survey was conducted among the students. Using the STATA statistical software, bivariate analysis was used to calculate the prevalence of water pipe smoking, and the chi square test was used to explore associations between socio-demographic variables and water pipe smoking. The quantitative questions on perceptions were analysed using summary statistics.

Results: A total of 479 TVET students, 57.8% females and 42.2% males, with a mean age of 22 participated in the study. The prevalence of water pipe smoking was 61.6%, with more males compared to female students (70.8% vs 54.9%) using the pipe. More than half (62.2%) have a false perception regarding the health risks of water pipe smoking.

Conclusion: There is a high prevalence of water pipe smoking and false perceptions about the health risks of water pipe smoking amongst TVET college students. Thus, the current Tobacco policy should be amended to include the regulation of water pipe smoking as well as increased health education about the dangers of smoking water pipe.

Key words: prevalence; perceptions; water pipe smoking; college students; South Africa

1. Introduction

South Africa is one of the first countries that have regulated tobacco smoking by introducing regulations such as the restriction of smoking in public areas, cutting smoking adverts and increasing taxes to reduce smoking behaviour [1]. As a result of these regulations and other factors, there has been a decrease in prevalence of cigarette smoking (WHO, 2023). This decrease however, has concurrently occurred with the increased popularity of water pipe smoking. For example, a study conducted among 1679 young adults reported a higher prevalence of hookah smoking (46.2%) than cigarette smoking (21 %) among female participants in Jordan [2].

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Other studies, however, have reported the opposite, citing higher rates of cigarette use than water pipe use [3]. Irrespective of these conflicting reports, the increased use of water pipes has been observed in the country, more so among young adults [3-5]. This widespread use is concerning because the current Tobacco policy does not regulate the use of water pipes [3].

Water pipe smoking is described as a practice of smoking flavoured tobacco, such as strawberry, apple, melon and mint through a heated water chamber, which has a mouthpiece[6] This device is also known as a '*hookah*' or '*hubbly bubbly*' in different communities around South Africa. Some of the side effects of water pipe smoking, such as cancer, cardiovascular diseases, oral diseases and decreased pulmonary function have been reported[7-9]. However, there are perceptions regarding the harmful effects of water pipe smoking [10] which makes it to be socially acceptable [11]. This perception is especially common among adolescents and the youth in South Africa [3]. Literature indicates that water pipe smoking is as harmful to health as cigarette smoking, and may actually be more harmful [12-13].

Not much research regarding water pipe smoking has been conducted in the sub-Saharan region, which has resulted in the dearth of published scientific studies on the topic. The few South African studies published include studies amongst university students in the Western Cape [3,14-15] one amongst medical students in Pretoria [16] and one amongst secondary students in Johannesburg [17]. All these studies reported a high prevalence of the use of the water pipe among groups of students. However, there is lack of studies about students in vocational training institutions, hence this study, which focussed on the prevalence and perceptions of water pipe smoking among Technical and Vocational Education and Training (TVET) college students in Johannesburg, South Africa.

2. Methodology

Study design: A cross sectional quantitative research design was adopted as the phenomenon of water pipe smoking is relatively new in the South African context. This design was deemed suitable as it does not seek to change things but describe events as they naturally occur. This study design has been used in various parts of the country [3-5] and globally [18-19] on the same topic and has aided in achieving prevalence rates as well as perceptions, as per the current study objectives.

Study setting: The South West Gauteng TVET College in Johannesburg, which is operating under Department of Higher Education and Training (DHET), was the study setting. The particular college was chosen because (1) it is one of the biggest colleges around Johannesburg and it comprises of six campuses located both in suburbs and townships, and (2) a TVET college was chosen because according to literature the behaviour of water pipe smoking rises during college and university years.

Study population: Only students registered with the selected South West Gauteng College in Johannesburg at the time of the study, who were attending day classes regardless of the year of study, were eligible to participate in this study. Unregistered, part-time students, who were not attending day classes, were excluded. According to the personal communication with the management information centre officer, the total number of students registered across the six campuses at the time of the study was approximately 20300. This number included both National Certificate Vocational (NCV) and National Accredited Technical Education Diploma (NATED) students. The Dobsonville campus had approximately 4440 registered students, followed by Roodepoort central with 4300 and Roodepoort West with 3600 students. Other campuses included George Tabor with approximately 3300 registered students, Molapo campus with 3300 students and, lastly, Technisa with 1300 students.

Sampling： Cluster random sampling was used in this study to select the campuses and different classes, respectively. Firstly, the Roodepoort central campus, Roodepoort West and Molapo campus were selected through simple random sampling. Amongst the three campuses, Roodepoort central campus and Roodepoort West are situated in the suburb of Roodepoort and Molapo is situated in the township of Soweto. The three campuses combined had approximately 11 200 registered students. The second cluster used was characterised by randomly recruiting students from different classes regardless of the year of study. The Raosoft sample size calculator (2014) was used to calculate the minimum recommended sample size for this study. Based on a 5% error and 95% confidence interval and a population size of 11 200, 378 participants were the minimum representative sample required for the study. However, 560 questionnaires were distributed across all campuses as many students responded to the invitation to participate in the study.

2.1. Data collection tool and data collection

A 40-item self-administered questionnaire was used to collect data. To augment the reliability and validity of the study, the data collection tool was adopted from two previously-published articles [14, 20] which either measured the perception of the participants about water pipe smoking or the practice of water pipe smoking. All the material was published in the public domain and the authors were credited. The questionnaire comprised of three sections. Section A comprised of seven demographic questions such as age, sex, race, residence, current level of schooling, highest level of schooling and course registered for. Section B consisted of 14 questions, which examined the water pipe smoking practice. The questions in this section asked participants about their use of water pipes; for example, if they are using, how often, when they started, where they smoke and how many coals per session. Section C consisted of 17 questions, which examined the perception of water pipe smoking. The responses to this section were on a three-point Likert scale, namely "Agree", "Don't agree" or "Not sure" and "less", "equal" or "more".

Data collection： Posters and announcements provided by student support invited the students to participate. Lecturers assisted by assembling students in the hall where the researcher provided the student target group with information leaflets and further explained the study and its purpose. All students who agreed to participate in the study remained in the hall while those not interested were free to leave. Those who remained behind signed the informed consent form before they received the questionnaires to be completed.

2.2. Validity and reliability

The questionnaire used was pre-tested through the pilot study done at the Technisa campus, and certain adjustments were done, such as rephrasing of questions for the purpose of clarity and relevance to the study as some questions asked the same question in different ways. The results of the pilot study proved that the questionnaire was suitable for the study.

Data management: Data collected from the three campuses were inspected for completeness and consistency. From the 560 questionnaires which were distributed across the three campuses, 81 were discarded as they were incomplete. The remaining 479 questionnaires were entered into Microsoft excel spreadsheet (Microsoft office, 2010), then coded and validated. Thereafter it was imported to statistical software, Small Stata version 13.0 for analysis.

Data analysis: The results of the participant's demographic characteristics as well as prevalence of water pipe smoking were analysed using descriptive statistics; such as measures of central tendency expressed as mean or median for continuous variables and percentage for categorical variables. The chi-square tests were used to compare gender differences in smoking prevalence. There were four smoking categories (i.e. water pipe smoking, cigarette smoking, smoking both water pipe and cigarettes or not smoking) and these were

stratified by gender. For the variables that were determining perception, a simple scoring method where a correct answer (or positive response) was scored 1 and incorrect answer (or negative response) was scored 0. The scores of each participant were added and out of a total of 17 questions participants who scored less than 9 out of 17 (<47%) were graded poor, while those who scored between 9 and 10 (53-59%) were graded fair. Those who scored between 11 and 12 out of 17 (64-71%) were graded good, and those who scored above 13 (>76%) were graded excellent.

2.3. Ethical considerations

Permissions to conduct the study: Ethical clearance was obtained from the Sefako Makgatho Health Science University Research and Ethics Committee (SMUREC/H/90/2019: PG). Permission to access and conduct the study at the college campuses was requested from the head office and granted by the college principal. Permission was also received form the management of each of the campuses.

Informed consent and autonomy： All participants were required to voluntarily participate by signing an informed consent form, emphasizing that they had the option of withdrawing from the study at any time without any penalties. No participants were financially rewarded or coerced for participating in the study.

Confidentiality: The data was kept confidential and only used for the purpose of this research.

3. Results

3.1. Demographic information of the participants

Table 1 shows the socio-demographics of the sample. The majority of participants were black (98.5%) with 64.9% between the ages of 18 to 22 years. The mean age of the participants was 22 years (SD = 3.3). There were more female participants (57.8%) than males (42.2%) in the study.

Table 1. Demographic information of participants (n=479).

Characteristic	Frequency	Percentage (%)
Sex		
Male	202	42.2
Female	277	57.8
Race		
Black	472	98.5
White	1	0.2
Coloured	6	1.3
Age (Mean= 22; Mode= 21)		
18-22	311	64.9
23-27	137	28.6
28-32	25	5.2
33-37	4	0.8
38-44	2	0.4

3.2. Prevalence of water pipe and cigarette smoking

The prevalence of water pipe smoking and cigarette smoking is presented in **Table 2**. The results indicate that 61.6% of the participant's smoke water pipe. More males than females (70.8% vs. 54.9%) were water pipe

smokers and more males than females (24.8% vs. 7.6%) also smoked cigarettes, with 14.8% of the participants smoking both the water pipe and cigarettes.

Table 2. Prevalence of water pipe and cigarette smoking according to gender (n=479).

	Male (n=202)	**Female (n=277)**	**Total (n=479)**
	Frequency (%)	**Frequency (%)**	**Frequency (%)**
		Smoking the water pipe	
Yes	143 (70.8)	152 (54.9)	295(61.6)
No	59 (29.2)	125 (45.1)	184 (38.4)
		Smoking cigarettes	
Yes	50 (24.8)	21 (7.6)	71 (14.8)
No	152 (75.2)	256 (92.4)	408 (85.2)
		Smoking water pipe and cigarettes	
Yes	50 (24.8)	21 (7.6)	71 (14.8)
No	152 (75.2)	256 (92.4)	408 (85.2)
		Not smoking water pipe or cigarettes	
Yes	55 (27.2)	124 (44.7)	179 (37.4)
No	147 (72.8)	153 (55.3)	300 (62.6)

3.3. Perceptions about water pipe smoking

Table 3 reflects the responses of the participants on how they perceived the risks of water pipe smoking. The findings show that 30.5% of participants are of the view that the dangers of water pipe smoking are exaggerated. However, most participants (60.1%) agreed that each time they smoke the water pipe it has a harmful effect on the body with 36.1% believing that an occasional cigarette is actually more dangerous than water pipe smoking. Regarding perceptions on the possibility of becoming addicted, most participants correctly perceived that smoking the water pipe is as addictive as smoking cigarettes and that they become more addicted the more they smoke. However, 43.4% think that it is easy to quit water pipe smoking. Regarding the risk of water pipe smoking compared to cigarette smoking, most participants (40.7%) thought that water pipe smoking is socially acceptable. Furthermore, 37.79% of the participants rightfully thought that smoking the water pipe and smoking cigarettes are equally harmful in the long term.

Table 3. Risk perceptions of water pipe smoking (n=479).

	General risk perceptions of water pipe smoking		
	Agree	**Disagree**	**Not sure**
1	**An occasional cigarette is more dangerous than smoking the water pipe**		
	173(36.1)	116(24.2)	190(39.7)
2	**The dangers of water pipe smoking are exaggerated**		
	146(30.5)	121(25.3)	212(44.3)
3	**Sharing the water pipe is not harmful**		
	125(26.1)	189(39.5)	165(34.4)
4	**Each smoke inhalation of the water pipe has an effect on the body**		
	288(60.1)	44(9.2)	147(30.7)
5	**The smoke of the water pipe contains harmful chemicals**		
	283(59.1)	49(10.2)	147(30.7)

6	**Just like a cigarette, water pipe smoking can cause lung cancer**		
	309(64.5)	32(6.7)	134(28.0)*
7	**Just like smoking a cigarette, water pipe smoking can cause heart diseases**		
	280(58.5)	39(8.1)	160(33.4)
8	**Tobacco for water pipe smoking should not be sold to persons under the age of 18 years**		
	361(75.4)	60(12.5)	58(12.1)
9	**Water pipe smoking should be regulated just like cigarette smoking**		
	209(43.6)	142(29.7)	128(26.7)
	Risk perception on addiction to water pipe smoking		
	Agree	**Disagree**	**Not sure**
10	**The water pipe is as addictive as cigarettes**		
	214(44.7)	125(26.1)	140(29.2)
11	**The more you smoke the water pipe the more addicted the smoker become**		
	257(53.7)	89(18.6)	133(27.8)
12	**Water pipe smokers can quit easily**		
	208(43.4)	102(21.3)	169(35.3)
	Risk perception of water pipe smoking compared to cigarette smoking		
	More	**Less**	**Equal**
13	**Compared to a cigarette smoking how harmful is smoking the water when pregnant?**		
	193(40.3)	113(23.6)	169*****(35.3)
14	**Compared to smoking cigarettes over the long term, how harmful is water pipe smoking?**		
	178(37.2)	114(23.8)	181*****(37.8)
15	**Compared to cigarette smoking, how socially acceptable is smoking the water pipe?**		
	195(40.7)	114(23.8)	159*****(33.2)
16.	**Compared to cigarette smoking there is less exposure to nicotine**		
	65(13.6)	178(37.2)	235(49.1)
17	**Compared to cigarettes the chemicals are filtered out**		
	158(33.0)	99(20.7)	222(46.3)

*** Missing data**

3.4. Summary of scores obtained for perceptions on water pipe smoking

Table 4 shows that the majority (62.2%) of the participants had a score of less than 50% for their combined scores on their perceptions regarding water pipe smoking. The combined score is the summary of the 17 responses to the risk perceptions regarding water pipe smoking.

Table 4. Summary of combined scores on risk perceptions of water pipe smokers versus non-smokers (n=479).

Grading	Score out of 19	Percentage score for perception	Frequency n (%)
Poor	<9/17	<47%	298(62.2)
Fair	9 – 10/17	53 – 59%	88(18.34
Good	11 – 12/17	64 –71%	66(13.8)
Excellent	13 – 17/17	76 – 100%	27(5.6)

4. Discussion

South Africa's tobacco control policies have made great efforts to curb smoking due to the detrimental health effects for the smoker as well as the second hand smoker, but new tobacco smoking products such as water pipe smoking might undermine those efforts due to its increase in popularity as an alternative form of tobacco use [22]. A total of 61.6% of the TVET participants have used this type of tobacco in their lifetime, and 55.59% have used it in the past month, which is consistent with the findings of previous South African studies done amongst university students [3-5]. For many of the participants, water pipe smoking was their first experience with tobacco use as 19.4% were only smoking water pipe and that was much higher than the prevalence of 14.8% for cigarette smoking. These findings support the submission by other studies [7, 23, 24], that this type of tobacco use is becoming an alternative for cigarette smoking with the many false perceptions regarding the dangers of water pipe smoking [20, 21. 25, 26], which increases the popularity and use of water pipe smoking.

Negative perceptions of risks involved in water pipe smoking: The study findings confirm false negative perceptions surrounding the risks of water pipe smoking where 60.33% of participants had a general negative perception regarding water pipe smoking and the risks involved. Some of these risks will be discussed in more detail.

Socially acceptable: In this study 33.2% of the participants perceived water pipe smoking to be more socially acceptable than cigarette smoking which is consistent with published literature [14,27]. Social acceptance is an important predictor of behaviour and intention and in societies where water pipe smoking is normalised, the use is bound to be high [28]. Due to social acceptance [29], some individuals who normally do not smoke cigarettes are now resorting to water pipe smoking as individuals perceive water pipe smoking to be less stigmatising and risky compared to cigarette smoking [23].

Dangers of water pipe smoking: The results indicate that generally there is a false perception regarding the harmful effects of water pipe smoking, which results in non-cigarette smokers opting to use water pipe as an alternative option to cigarette smoking [25]. Part of the problem is the fact that the health effects of cigarette smoking are known and consumers are informed about the danger of smoking on the packaging of cigarettes, it is different with water pipe smoking as these products are marketed differently leading to the perception that water pipe smoking is a safe alternative to tobacco smoking [30]. Despite misconceptions where participants believed that water pipe smoking is safer evidence shows that water pipe smoking is just as harmful as cigarette smoking [31].

Dangers of addiction: Generally, tobacco products are known to promote dependence and water pipe smoking has been shown to be as addictive as cigarette smoking with water pipe smokers also struggling with withdrawal symptoms [8]. Less than half (44.68%) of the TVET participants thought that water pipe smoking was as addictive as cigarette smoking, with 53.7% having the opinion that the more you smoke the water pipe, the more difficult it becomes to quit. Despite literature reporting that it is actually difficult to quit smoking [8] however, 43.42% thought it was easy to quit water pipe smoking.

In some studies, participants reflected that water pipe smoking was less addictive compared to smoking a cigarette [28-29]. Similar results were found in a Cape Town study [Daniels & Roman, 2013], where participants believed that because water pipe smoking had less nicotine exposure the practice was less addictive than cigarette smoking.

Risk perception and attitude towards water pipe smoking: Risk perception is an important determinant of smoking behaviour and behavioural intention [30]. Participants with negative attitudes or perceptions towards

water pipe smoking had the odds of 4.32 for current water pipe smoking, while others with positive attitude had lower odds [31]. This means that participants with false perceptions or attitudes were four times more likely to smoke water pipes, while those with accurate perceptions were less likely to smoke water pipes. In this TVET study, the summary of the perceptions indicates that only 29.4% had a positive or accurate perception about water pipe smoking on the summary of their perception scores. The implication is that those with accurate perceptions were less likely to smoke a water pipe. Generally, the overall perception of the participants regarding water pipe smoking was negative or false, as 62.2% of participants scored less than 50% for their overall score for risk perceptions. These findings are consistent with others, which suggest that the false perception regarding the harmful effects of water pipe smoking contributes to the popularity of this type of tobacco use [32]. A total of only 29.4% of participants had a positive or accurate perception about water pipe smoking on the summary of their perception scores.

Health effects: Although the majority of participants (60.1%) in this TVET study agreed that water pipe smoking is harmful to the user's health; 30.5% were of the opinion that the dangers of smoking the water pipe were exaggerated. This finding is comparable to another South African study[14]. Moreover, 36.1% of participants in this study believed that smoking an occasional cigarette was actually more dangerous than water pipe smoking as water pipe smokers are also at risk of cancers, infectious diseases, lung disease and other medical conditions [33]. This misconception was also confirmed in other studies [25,26], where young people regard water pipe smoking as less harmful for health.

In 2019, tobacco was reported to have been responsible for 8.71 million deaths and 229 million Daly's[34], with the World Health Organisation [35] estimating that tobacco smoking is contributing to an estimated 9% of deaths worldwide. Although the World Health Organization Global Action Plan has set a target of 25% reduction in tobacco use by 2025 [36], the contrary is true because the tobacco epidemic continues to grow because of nicotine dependence [8].

Water pipe smoking is said to share similar toxicants with cigarette smoking, however, it is argued that cigarette smoking may last for about 5 minutes whereas water pipe smoking lasts for about 45 to 60 minutes[37], which increases the effects of the exposure to with water pipe smoking. Water pipe smoking produces large quantities of polycyclic aromatic hydrocarbons, aldehydes, tar, nicotine and carbon monoxide [6] exposing an individual to about three to nine times more carbon monoxide and 1.7 times more nicotine compared to smoking a cigarette [38]. Furthermore, the smoke from one session of water pipe smoking exposes an individual to about 40 times the tar and 10 times the carbon monoxide compared to a single cigarette [26]

A toxicological study comparing inhaled toxicants from cigarettes and water pipes also found that one session of water pipe smoking is associated with about 74 litres of smoke, compared to a single cigarette that is associated with about 0.6 litres of smoke [26]. It has been shown that using water as a filter during water pipe smoking did not change the level of nicotine in the smoke [39] which could lead to nicotine dependence. It is described how a single water pipe session produces a nicotine level equivalent to 10 cigarettes per day in a 24-hour urine specimen [12] However, in order to understand the quantity of nicotine that the user might be exposed to, it should be remembered that a single puff of water pipe smoking has more volume compared to cigarette smoking [26]. In this TVET study, 33.0% participants believed that these harmful chemicals are filtered out during water pipe smoking. This misconception was also confirmed in a study where participants believed water pipe smoking is safer because it is drawn through water, which filters or removes all the dangerous particles [12].

Lack of water pipe policies: South Africa has introduced smoking control measures such as excessive tax increase to discourage smoking as well as advertisement restriction and restriction in public smoking [40]. Lack

of effective water pipe policies is regarded as a contributing factor to the rise in popularity of this type of smoking [41]. In South Africa, there are strict regulations regarding tobacco smoking; however, it is reported that control measures specifically targeting water pipe smoking are not available yet [15]. Effective policies and regulations are useful in counteracting addictive behaviours, which tends to spread gradually without such policies [42]. This implies that if this phenomenon is not curbed by effective policies it will counteract the efforts South Africa, as a country, has made in decreasing smoking. Less than half (43.6%) of the TVET participants were of the opinion that water pipe smoking should also be regulated and 75.4% agreed that tobacco for water pipe smoking should not be sold to persons under the age of 18 years. Though public health policies that are tailored for cigarette smoking have played a remarkable role in reducing the prevalence of smoking in many countries, there is the view that the very same policies are making water pipe smoking thrive [3]. It is also proposed that effective health programmes that promote negative attitudes towards water pipe smoking will help curb this type of smoking [43].

The cross-sectional nature of the study makes it difficult to clearly provide in-depth perceptions of the students on water-pipe smoking as they were limited to close-ended question, thus future studies can dive deeper into perception through a qualitative study design. Additionally, due to data only being centralised in one institutions, the findings of this study can only be generalised to the TVET College where the sample was collected since it is not a national study. Moreover, because the majority of participants (98.5%) were Black, the sample does not represent the racial composition of the country. All part time students who were not attending day classes were excluded on this study, which is a limitation as those students could have influenced the results of this study differently. Thus, future studies should focus on national coverage in all tertiary institutions for greater representation and generalisation.

Based on the study findings, it is recommended that the South African tobacco control policies should include water pipe smoking in their smoking prevention strategies as this form of tobacco use is becoming more prevalent in our communities. This should include added tax to discourage smoking, as well as reduced social media coverage on the use of water pipes. There is also a need to regulate this smoking in terms of health warnings on the water pipe products that are sold at the particular selling premises. Additionally, there is a need for health education and promotion on water pipe smoking among young adults in tertiary institutions to ensure that the misconceptions are clarified and they are aware of the health risks involved.

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Conflict of interest

The authors declare that they have no conflict of interest.

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