

## Article

# Prevalence of and Influential Factors for Waterpipe Smoking among School-Attending Adolescents in Bissau, Guinea-Bissau

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**Abstract:** The marketing of sweetened and flavoured tobacco in the early 1990s resulted in an upsurge in waterpipe smoking (WPS), mainly among young people and women. Here, we estimate prevalence rates among school-attending adolescents aged 14–19 (girls 52%) for a lifetime experience of WPS and within the last 30 days (WPS < 30 days) and identify influential factors for such smoking in Bissau, Guinea-Bissau. A random sample (N = 2039) was drawn from a class-based register created for 16 schools in Bissau; attending students in June 2017 were invited to respond to a locally adapted Planet Youth questionnaire. Descriptive statistics, odds ratio with 95% confidence interval, and multinomial logistic regression analysis were used to identify influential factors for WPS. The prevalence rates for a lifetime experience of WPS and within < 30 days were high, 17.7% and 15.0%, respectively, with no significant gender difference. For both groups, a multinomial logistic regression analysis identified attending higher grades in school, use of alcohol and being a victim of sexual violence as significant, influential factors. The overlapping of influential factors suggests preventive work against substance abuse should focus on less stigmatising behaviour, such as WPS and firmer implementation of the Framework Convention of Tobacco Control (FCTC).

**Keywords:** Africa, South of the Sahara; water pipe smoking; peer influence; surveys and questionnaires; socioeconomic factors; adolescents health; health risk behaviours; social determinants of health; exposure to violence



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## 1. Introduction

Waterpipes, also known as shisha, hookah, maassel, narghile, and argileh, are used to smoke a type of combustible tobacco [1]; the most commonly used term is hookah, followed by waterpipe and shisha, depending on the setting [2]. Tobacco is originally from Mesoamerica and South America and was introduced to West Africa in the late 15th century, most likely through French or English intermediaries rather than Portuguese ones [3]. While archaeological research indicates that waterpipe smoking (WPS) of cannabis was practised in Eastern and Southern Africa before the introduction of tobacco [3], the origin of WPS of tobacco is likely to be in Persia [3,4]. According to historical sources, in Moghul, India, in the early 17th century, the Persian healer Hakim Abul Fath introduced the waterpipe to avoid the damaging effects of smoking tobacco [5]. Later, WPS spread first to North Africa, the Middle East, Asia, and gradually worldwide [4]; however, its spread was not without moral indignation and repeated attempts to prohibit the practice [6].

The marketing of sweetened and flavoured tobacco in the early 1990s resulted in the revival of WPS, first among young people in the Middle East, but spread with expatriates opening WPS cafés and restaurants elsewhere in the world [7,8]. The friendly

social atmosphere of WPS, characterised by sharing pipes in family gatherings and among peers at bars and cafés, was also a contributing factor, as well as the later promotion of WPS through the internet and social media and the lack of policies and regulations of its consumption [7,9]. The motives reported globally for WPS, most commonly incited by peer pressure, curiosity, and fashion, are the attached social, pleasurable, and entertaining atmosphere and the relaxing effect [10,11]. Consumers are often misguided by the popular misconception that WPS of tobacco is safer than smoking cigarettes and less addictive, yet daily use results in addiction and severe effects on health similar to those of cigarette smoking [10,12–14]. Research on the health risks of WPS for adolescents and youth is, however, lacking; nonetheless, studies identify consistently damaging effects on lung function and the oral cavity, and lung injury and lung infection, as well as systemic carbon monoxide poisoning [15].

According to the most recent Global Youth Tobacco Survey (GYTS) on WPS from 72 countries in 2010–2019 and comparable US data for 2019, the global prevalence of WPS is 6.9% among adolescents aged 12–16. The survey included 11 African countries; prevalence on the continent was 4.2% for WPS at least once during the past 30 days, 4.5% for boys and 3.9% for girls. Europe had the highest prevalence (10.9%), followed by the Eastern Mediterranean Region (10.7%). WPS has been positively associated with parental cigarette smoking, friends' cigarette smoking, second-hand smoke exposure, tobacco advertisement exposure, and not being educated about the dangers of smoking [16]. GYTS 2017 data among Ghanaian adolescents aged 13–15 years from northern, middle, and coastal zones found a prevalence of 3.1% for ever smoking WP, with higher rates for boys than girls [17]. The prevalence of current WPS (at least a day or two in a month) was 1.7%, with a higher prevalence among girls (2.1%) than boys 0.9%; 46.9% of the users smoked at home and usage was most common in the northern rural regions of the country.

A few recent studies examined the prevalence of WPS among adolescents in Africa, and some include an analysis of determinants for the practice. In Khartoum State, Sudan, the lifetime experience among school-attending adolescents aged 14–17 was 13.4%, more so among boys (16.8%) than girls (10.9%) [18]. Significant factors were the low level of performance at school, peer pressure and being with friends engaged in WPS, smoking cigarettes, and restriction of selling “shisha” to minors. Among South African students in grade 8, 26% had ever engaged in WPS [19]; the prevalence was 70% in grade 12 and significantly higher for boys than girls. For grade 8, a factor associated with WPS were family members engaged in such smoking. In contrast, for both grades, significant factors included appealing taste and smell, having WPS friends, and attending parties. In The Gambia, the usage of WP is referred to as shisha. In a countrywide study among school-attending students in grades 7–12 (aged 12–20), the prevalence of WPS for the whole sample was 8.1%, with more smoking among boys (11.4%) than girls (5.4%) [20]. This gender difference is less than for smoking cigarettes in the country. Significant determinants for ever smoking shisha were higher age, attending private schools, living with parents, smoking permitted at home, and having family members or one or more friends who smoked cigarettes, cigars, or pipes.

Guinea-Bissau, neighbouring Senegal and The Gambia to the north and Guinea (Conakry) to the south, ratified the WHO Framework Convention for Tobacco Control (FCTC) in 2008 and signed the Protocol to Eliminate Illicit Trade in Tobacco Products (PEITP) in 2014 [21]. According to an evaluation of the ECOWAS 2017 directive on tobacco taxation, Guinea-Bissau applies minimal taxation on tobacco [22], and preventive legislation is lacking [23,24]. The overall review score for the country was estimated as zero for anti-tobacco mass media campaigns in 2010–2020 [25].

Here, we aimed to estimate the prevalence rates among school-attending adolescents aged 14–19 for a lifetime experience of WPS and its usage within the last 30 days (WPS < 30 days) and identify influential factors for the practice in Bissau, the capital of Guinea-Bissau. Here, we raise two research questions: How do the prevalence rates for WPS among adolescents in Bissau compare with those in other settings? What adolescents

are at the most risk of WPS? Finally, we raise the question: What preventive measures are feasible to reduce WPS among adolescents in Guinea-Bissau?

## 2. Materials and Methods

### 2.1. The Setting

The Human Development Index 2021/2022 ranked Guinea-Bissau 177 out of 191 countries [26], and on the Kids Rights Index, Guinea-Bissau was ranked 177 out of 193 countries in 2023 [27]. Guinea-Bissau, which gained independence from Portugal in 1974, has been plagued by political instability [28–30] and trafficking of drugs [31,32]. The population is young, with 42% between 0 and 14 years, and 32% are young people aged 10 to 24 years, of the estimated 1.9 million [33]. In 2017, the population in Bissau was just less than half a million, of which about one-quarter was aged 14–19 [34]. While 11–14% speak the official language, Portuguese [35], Portuguese-based Kriol is the lingua franca, and about twenty ethnic languages are spoken in the country. Almost 50% are Muslims, about one-fifth are Christians, and one-third adhere to African religions.

### 2.2. The Sample and Survey

A team of professionals within the Planet Youth collaboration formulated the survey questionnaire implemented in hundreds of communities on five continents, guided by the Centre for Social Research and Analysis (ICSRA) in Iceland. While the survey focuses on the use of tobacco, alcohol, and other drugs, it also includes questions about socioeconomic background, health and well-being, family, peers, school, and leisure activities [36,37]. The authors adapted the survey questionnaire to the sociodemographic context of Guinea-Bissau, translated it to Portuguese, and pilot tested it. The final questionnaire included 312 questions divided into 77 main themes.

In June 2017, we collected data from twelve public schools and four private schools in Bissau, aligning with Planet Youth procedures [38]. Two of the authors (GG, ZJ) compiled a list of 116 classes and 4470 students, targeting classes with the highest number of adolescents aged 15–16. From this list, classes were randomly selected with 2110 students participating, or 47.2% of the original sample. The authors introduced the survey to the attending students at the beginning of each session and explained how to fill in the questionnaire with examples given on the blackboard. In case of a question, the authors/instructors advised the students while taking care not to influence them or see the final response. When the students came into a rhythm to answer, they said they found it enjoyable and easy to answer the survey questions, which took them about 60–90 min. After completing the survey, the students sealed the anonymous questionnaire in an envelope and delivered it to the attending teachers/authors.

The class-based survey included randomly selected classes based on grade in school, not age. Consequently, regardless of age, everyone in each class was invited to participate. Despite targeting adolescents aged 15–16 in class registers, the final sample included participants aged 14–19, as overage students are typical in the setting [39].

### 2.3. Measures

Planet Youth collaborators developed and field tested all the measures used over the years in different settings [36]. Here, we explain specifically the measurements used for WPS and violence.

WPS. The questionnaire used in Bissau included two questions on participant's WPS. The first was "How often have you used waterpipe? (a) In your lifetime; (b) During the last 30 days", with seven response alternatives from never to gradually increasing the number from once or twice to 40 times or more. A lifetime WPS experience was defined as having smoked at least 1–2 times, and usage during the last 30 days was defined as any WPS in the period. Tobacco usage other than WPS was defined by affirmative answers to have lifetime or daily experience of smoking cigarettes, or snuff and chewing tobacco usage during the

last 30 days. An affirmative answer to the question defined experience of indirect smoking: “Does someone [father/mother/sibling] smoke tobacco daily?”

Violence. The variable “Domestic violence” was defined by an affirmative answer to any of the following five experiences after recoding (with experience = 1; no experience = 0): (a) A serious argument with your parents; (b) Witnessed a serious argument by your parents; (c) Witnessed a physical violence in your home where an adult was involved; (d) Witnessed a psychological violence in your home where an adult was involved; or (e) Been involved in physical violence in your home where an adult was involved. The response alternatives were: (a) Yes, during the last 30 days; (b) Yes, during the last 12 months; (c) Yes, more than 12 months ago; or (d) Never.

The variable “Victim of sexual abuse” was defined as an affirmative answer to any of the four questions after recoding (with experience = 1; no experience = 0) to any of the following questions: (a) Been a victim of sexual abuse; (b) Experienced sexual abuse where an adult from within the family was involved; (c) Experienced sexual abuse where an adult from outside the family was involved; or (d) I have been a victim of sexual violence during the last 12 months. The response alternatives for questions (a–c) were “Yes, during the last 30 days”, “Yes, during the last 12 months”, “Yes, more than 12 months ago”, or “Never”. Response alternatives for question (d) were “Never”, “Once”, “2–5 times”, “6–9 times”, “10–13 times”, “14–17 times”, or “18 times or more”. Three additional questions with the same response alternatives as for victims of sexual abuse (question d) enquired about if participants themselves had been involved in sexual abuse: (a) “Force someone to have sex?”; (b) “Force someone to take part in group sex?”; or (c) “Have you exerted sexual violence during the last 12 months?”

The variable “Physical violence” was defined as an affirmative answer to any of the four questions after recoding (with experience = 1; no experience = 0). The participants were asked about how often, during the last 12 months, if ever, they had behaved in the following way: (a) Been a part of a group that punched an individual?; (b) Been a part of a group physically hurting an individual?; (c) Been a part of a group starting a fight with another group?; or (d) Been part of a group that teased another? The response alternatives were “Never”, “Once”, “3–4 times”, and “5 times or more often”.

#### 2.4. Statistics

ICSRA at Reykjavik University scanned the forms and digitised the data for statistical analysis in JMP Pro 16 [40]. In total, out of the 2110 anonymous questionnaires delivered by students during the in-class session, 2039 (96.7%) were successfully digitised and made up the total number of adolescents who participated in the survey; reasons for exclusion included, for instance, non-adherence to the format of the questionnaire that made digitisation impossible or inconclusive answers. Initially, descriptive statistics were derived for all the study variables, and the authors disseminated the results widely to participating schools and national policymakers [41]. The variables were then recoded to nominal variables (exposed to the experience = 1; not exposed to the experience = 0) for bivariate analysis to identify significant explanatory variables for the dependent variable “WPS”. The chi-square test was used ( $p < 0.05$ ) to evaluate statistical significance, and odds ratios (ORs) were calculated with 95% confidence intervals (CIs) to assess the intensity of that association. Potential influential variables for the dependent variable “WPS” were then introduced into a multinomial logistic regression model that considers missing values by coding them as a separate level of that effect [40]. Non-significant variables were gradually removed from the model, and R squared ( $R^2$ ) was calculated for the final model. To evaluate the effect sizes associated with very small  $p$ -values, these were transformed to the LogWorth ( $-\log_{10}(p\text{-value})$ ) scale. The larger the LogWorth value, the stronger the variable’s effect in the model [40,42].

### 2.5. Ethics

Most of the survey participants, aged 14–17, are children as defined by the CRC [43]. CRC highlights children’s right to express an opinion on their situation (Art. 12) and participate as appropriate for their age (Art. 3, 5, and 12). Scholars have highlighted the risk that parental consent requirements in research with children might contribute to biased data and low response rates [44,45]. Others have called for socioculturally responsive ethics reviews [46,47]. Considering the students’ mature age as children and the study’s setting, pre-parental approval was not sought; the adolescents decided on their participation in the survey without any personal identifiers.

The Minister of Education approved the study (No/Ref 250/MEES/GM/2017). Before the implementation, the authors explained the study to school head teachers, who designated two teachers as contact persons for the research team. At the time of implementation, the teachers in randomly selected classes dedicated two class sessions for the survey. The teacher and one of the authors (ZJ) explained the study to the students. They emphasised that it was not an examination, participation was voluntary, and they could choose to answer some or all the questions.

### 3. Results

The total number of participants was 2039, aged 14–19 years, of whom 1024 (51.7%) were girls. The average age for girls was 16.3 years and 16.4 years for boys ( $p = 0.095$ ).

#### 3.1. Socioeconomic Variables

Table 1 lists selected socioeconomic variables by participants’ experience of WPS for a lifetime experience of WPS and WPS < 30 days.

**Table 1.** Socioeconomic background by a lifetime waterpipe smoking (WPS) and WPS < 30 days for school-attending adolescents in Bissau, June 2017 \*.

Survey Questions/Variables	Waterpipe Smoking (WPS)						Total Sample	
	Lifetime			<30 Days			N	%
	n	%	p-Value	n	%	p-Value		
<b>Sex</b>			0.675			0.570		
Girl (1)	162	17.2		119	14.4		1024	50.2
Boy (0)	159	17.9		126	15.4		954	46.8
Missing	12	23.1		7	19.4		61	3.0
<b>School type</b>			0.033			0.191		
Private (1)	179	18.3		122	13.9		976	47.9
Public (0)	154	14.5		130	16.2		1063	52.1
Missing	0	0		0	0		0	0
<b>Age at the time of the survey</b>			0.581			0.768		
14 (0)	19	14.3		12	9.0		133	6.5
15 (1)	66	18.8		46	13.1		351	17.2
16 (1)	78	17.4		65	14.5		449	22.0
17 (1)	88	14.7		69	11.5		598	29.3
18 (0)	49	16.7		37	12.6		293	14.4
19 and older (0)	3	6.5		2	4.3		46	2.3
Missing	30	17.8		18	10.7		169	8.3
<b>Grade in school</b>			0.004			0.002		
7th (0)	8	33.3		70	11.1		46	2.3
8th (0)	103	14.1		141	18.0		778	38.2
9th (1)	179	20.8		24	11.4		927	45.5
10th (1)	32	14.3		7	53.8		231	11.3
Missing	11	23.4		10	25.0		57	2.8

Table 1. Cont.

Survey Questions/Variables	Waterpipe Smoking (WPS)						Total Sample	
	Lifetime			<30 Days			N	%
	n	%	p-Value	n	%	p-Value		
<b>Age-appropriate for class at school enrolment</b>			0.318			0.908		
Yes (1)	68	19.8		47	15.1	0.013	355	17.4
No (0)	214	16.6		167	14.5		1389	68.1
Younger than reference	9	26.5		7	21.9		35	1.7
Missing	42	16.5		31	16.9		260	12.8
<b>Living in a 2-headed household</b>			0.228			0.178		
Yes (1)	145	15.9		111	13.6		977	47.9
No (0)	138	18.2		107	16.0		819	40.2
Missing	50	23.4		34	17.9		243	11.9
<b>One or both parents have initiated or completed university education or vocational training</b>			0.163			0.022		
Yes (1)	200	18.8		157	156.5		1127	55.3
No (0)	103	16.2		70	12.3		698	34.2
Missing	30	16.2		25	16.1		214	10.5
<b>One or both parents work outside the home</b>			0.294			0.744		
Yes (1)	275	18.0		205	15.1		1640	80.4
No (0)	45	15.5		36	0.5		315	15.4
Missing	13	18.6		11	13.9		84	4.1
<b>Place of birth</b>			0.362			0.419		
Bissau (1)	218	18.1		161	14.9		1300	63.8
Elsewhere (0)	90	16.3		65	13.4		601	29.5
Missing	25	19.8		26	22.8		138	6.8
<b>Portuguese spoken at home</b>			0.156			0.872		
Yes (1)	23	22.3		5	17.9		111	5.4
No (0)	241	16.0		232	14.9		1622	79.5
Missing	69	25.4		15	16.3		306	15.0
<b>Kriol spoken at home</b>			0.008			0.086		
Yes (1)	193	18.1		145	15.2		1133	55.6
No (0)	71	13.0		56	11.9		600	29.4
Missing	69	25.4		51	20.5		306	15.0
<b>Usage of social media in the last 12 months</b>			0.006			0.017		
Yes (1)	224	19.6		168	15.7		1212	59.4
No (0)	57	13.7		44	10.9		445	21.8
Missing	52	16.0		40	19.3		382	18.7
<b>Family can sometimes, often, or almost always have a car</b>			0.036			0.304		
Yes (1)	159	20.2		92	13.4		830	40.7
No (0)	116	16.0		114	15.3		780	38.3
Missing	58	15.6		46	18.5		429	21.0

\* For the chi-square test: (1) With the experience; (0) Not with the experience.

Out of 1884 adolescents, 333 (17.7%) reported a lifetime experience of WPS; there was no statistically significant difference in prevalence rates for boys and girls. Out of 1676 participants, 252 (15.0%) reported WPS < 30 days; 107 (42.5%) of them had smoked

once or twice within 30 days, and 56 (22.2%) 40 times or more often. No significant difference was observed for boys or girls in their intensity of WPS.

Age was not statistically significant for the prevalence of WPS, neither for a lifetime experience nor for WPS < 30 days. However, those attending grades 9–10 were 1.45 times (95% CI 1.13–1.89) more likely to have a lifetime experience of WPS than those in grades 7–8 and were 1.57 times (95% CI 1.67–2.12) more likely to have engaged in WPS < 30 days than those in public schools.

Adolescents who attended private school were 1.29 times (95% CI 1.02–1.64) more likely to have ever experienced WPS than those in public school; no significant difference was found for school type for WPS < 30 days.

Parents' education was not significantly associated with a lifetime experience of WPS. Those with at least one parent who had started or completed university education or vocational training were 1.43 times (95% CI 1.06–1.95) more likely to have engaged in WPS < 30 days than those with less educated parents.

Adolescents who reported speaking Kriol at home were 2.01 times (95% CI 1.04–3.91) more likely to have a lifetime experience of WPS than those who reported speaking other languages at home; no significant difference was observed for speaking Kriol at home and WPS < 30 days.

WPS was significantly associated with social media usage; adolescents who used social media were 1.53 times (95% CI 1.11–2.11) more likely to have a lifetime experience of WPS than those with no usage. Social media usage was also significantly associated with WPS < 30 days; those with social media experience were 1.54 times (95% CI 1.07–2.21) more likely to have engaged in WPS < 30 days than those without such exposure.

Adolescents who reported that their family could afford to buy a car were 1.32 times (95% CI 1.02–1.73) more likely to have a lifetime experience of WPS than those who reported no financial means in doing so; affording to buy a car was not a significant variable for WPS < 30 days.

Socioeconomic variables that were not statistically significant, neither for a lifetime experience of WPS nor WPS < 30 days, included sex, age at the time of the survey, place of birth, age-appropriate class at enrolment, employment of at least one parent, and speaking Portuguese in the home.

### 3.2. Parental Monitoring

Six survey questions enquired about parental monitoring in the participants' daily lives (Table 2).

**Table 2.** Parental attitudes and participants' answers to the question: "How do the following statements apply to you?" by a lifetime experience of waterpipe smoking (WPS) and WPS experience < 30 days in Bissau, June 2017\*.

Survey Questions/Variables	Waterpipe Smoking (WPS)							Total Sample	
	Lifetime			<30 Days			N	%	
	n	%	p-Value	n	%	p-Value			
<b>(a) My parents set definite rules about what I can do at home</b>			0.196			0.271			
Applies very well to me (1)	128	16.7		94	12.8		810	39.7	
Applies rather well to me (1)	67	17.6		58	15.6		410	20.1	
Applies rather poorly to me (0)	54	21.7		43	17.8		265	13.0	
Applies very poorly to me (0)	18	16.2		13	12.4		115	5.6	
Missing	66	17.6		44	19.4		439	21.5	

Table 2. Cont.

Survey Questions/Variables	Waterpipe Smoking (WPS)						Total Sample	
	Lifetime			<30 Days			N	%
	n	%	p-Value	n	%	p-Value		
<b>(b) My parents set definite rules on when I should be at home at night</b>			0.012			0.000		
Applies very well to me (1)	152	15.6		108	11.5		1043	51.2
Applies rather well to me (1)	46	20.9		35	16.4		229	11.2
Applies rather poorly to me (0)	32	23.2		32	24.1		146	7.2
Applies very poorly to me (0)	36	22.8		33	21.4		168	8.2
Missing	67	17.0		44	18.9		453	22.2
<b>(c) My parents know whom I am with in the evenings</b>			0.107			0.008		
Applies very well to me (1)	162	17.1		125	16.2		813	39.9
Applies rather well to me (1)	39	22.8		43	18.4		254	12.5
Applies rather poorly to me (0)	22	19.8		28	18.7		158	7.7
Applies very poorly to me (0)	30	15.4		62	21.0		311	15.3
Missing	80	17.5		75	20.9		503	24.7
<b>(d) My parents often talk to the parents of my friends</b>			0.885			0.784		
Applies very well to me (1)	71	15.6		60	13.6		490	24.0
Applies rather well to me (1)	70	20.4		53	15.7		362	17.8
Applies rather poorly to me (0)	44	15.4		38	13.8		304	14.9
Applies very poorly to me (0)	66	19.0		48	14.2		363	17.8
Missing	82	18.1		53	18.7		520	25.5
<b>(e) My parents follow what I do in my recreational time</b>			0.023			0.000		
Applies very well to me (1)	117	15.5		87	12.0		806	39.5
Applies rather well to me (1)	53	19.3		31	11.8		288	14.1
Applies rather poorly to me (0)	38	19.0		36	18.3		215	10.5
Applies very poorly to me (0)	63	23.2		57	21.4		287	14.1
Missing	62	23.2		41	18.5		443	21.7

\* For chi-square test: (1) With the experience; (0) Not with the experience.

Adolescents who reported that their parents set rules about when to be at home at night were less likely to have a lifetime experience of WPS; the odds were 0.66 (95% CI 0.49–0.91) and 0.48 (95% CI 0.35–0.67) for WPS < 30-days. The odds for WPS < 30 days were also lower for those whose parents knew with whom their children spent evenings or 0.65 (95% CI 0.48–0.89) than those whose parents did not know; for a lifetime experience of WPS, there was no significant difference ( $p = 0.107$ ). Parental monitoring of participants' recreational activities decreased the WPS of their children. The odds for WPS were 0.72 (95% CI 0.55–0.95) for a lifetime experience of WPS and 0.54 (95% CI 0.40–0.72) for WPS < 30 days.

No statistically significant difference was found for a lifetime WPS and WPS < 30 days for adolescents whose parents set definite rules regarding what to do at home, nor those with parents who talked to their friends' parents.

### 3.3. Peer Group Influence

Seven questions enquired about health-related behaviour within the peer group (Table 3a–g), and six questions about participants' experience of different forms of violence (Table 3h–m). All were highly linked to WPS smoking, both a lifetime experience of WPS and WPS < 30 days.

**Table 3.** Peer influence on substance usage and violent behaviour by lifetime experience of waterpipe smoking (WPS) and WPS < 30 days in Bissau, June 2017.

Survey Questions *	Waterpipe Smoking (WPS)			
	Lifetime		<30 Days	
	OR (95% CI)	p-Value	OR (95% CI)	p-Value
<b>To what extent do you agree on the following:</b>				
(a) Sometimes, it is necessary to smoke cigarettes in order not to be left out of the peer group	1.91 (1.37–2.65)	0.000	2.87 (2.04–4.06)	0.000
(b) Sometimes, it is necessary to drink alcohol in order not to be left out of the peer group	2.11 (1.58–2.81)	0.000	2.02 (1.46–2.79)	0.000
(c) Sometimes, it is necessary to smoke cannabis (yamba) in order not to be left out of the peer group	2.17 (1.54–3.07)	0.000	2.19 (1.50–3.18)	0.000
<b>How many of your friends do you think do the following?</b>				
(d) Peers smoke cigarettes	2.70 (2.07–3.52)	0.000	2.37 (1.72–3.19)	0.000
(e) Peers drink alcohol (beer, wine, or spirits)	2.54 (1.95–3.31)	0.000	2.42 (1.81–3.24)	0.000
(f) Peers become drunk at least once a month	2.11 (1.62–2.75)	0.000	2.22 (1.65–2.99)	0.000
(g) Peers smoke hash or marijuana	2.74 (1.95–3.84)	0.000	2.96 (2.06–4.26)	0.000
<b>Violence and peers</b>				
(h) Been a part of a group that punched an individual?	2.53 (1.73–3.70)	0.000	2.31 (1.50–3.55)	0.000
(i) Been a part of a group physically hurting an individual?	2.81 (2.01–3.94)	0.000	3.61 (2.51–5.20)	0.000
(j) Been a part of a group starting a fight with another group?	1.71 (1.22–2.39)	0.003	1.91 (1.32–2.74)	0.001
(k) Been part of a group that teased another?	2.10 (1.47–3.01)	0.000	3.26 (2.25–4.73)	0.000
(l) Friends fight with somebody	2.01 (1.54–2.62)	0.000	2.18 (1.63–2.93)	0.000
(m) Friends pick fights or search out for fights	2.32 (1.76–3.05)	0.000	3.42 (1.79–3.28)	0.000

\* The wording of each of the questions is as in the survey questionnaire; for a–c the response alternatives “always”, “at times”, and “seldom” were recoded to 1 (with the experience) and “never” recoded to 0 (no experience); for d–g the response alternatives “few”, “some”, “most”, and “almost all” were recoded to 1 (with the experience) and “none” to 0 (no experience). See Section 2.3 for a description of the information on recoding the questions on violence.

### 3.4. Tobacco, Cannabis, and Alcohol

The survey inquired about using other forms of tobacco than WPS and the use of cannabis and alcohol (Table 4); all were strongly linked to a lifetime experience of WPS and WPS < 30 days.

**Table 4.** Usage of tobacco products, cannabis, and alcohol by a lifetime experience of waterpipe smoking (WPS) and WPS < 30 days in Bissau, June 2017.

Variables *	Waterpipe Smoking (WPS)			
	Lifetime		<30 Days	
	OR (95% CI)	p-Value	OR (95% CI)	p-Value
<b>How often have you used?</b>				
Cigarettes, lifetime smoking	3.35 (2.65–4.72)	0.000	3.27 (2.28–4.49)	0.000
Cigarettes, daily smoking	3.28 (1.69–6.37)	0.001	4.40 (2.43–9.10)	0.000
Snuff, lifetime usage	2.65 (1.58–4.44)	0.001	6.20 (3.77–10.20)	0.000
Snuff, usage < 30 days	2.53 (1.41–4.55)	0.003	6.94 (4.00–12.07)	0.000
Chewing, lifetime usage	3.81 (2.18–6.66)	0.000	3.82 (2.09–6.99)	0.000
<b>Cannabis usage</b>				
Lifetime usage	5.15 (3.00–8.84)	0.000	7.91 (4.40–14.24)	0.000

Table 4. Cont.

Variables *	Waterpipe Smoking (WPS)			
	Lifetime		<30 Days	
	OR (95% CI)	p-Value	OR (95% CI)	p-Value
<b>Alcohol</b>				
Lifetime usage	3.66 (2.85–4.70)	0.000	2.7 (2.06–3.61)	0.000
Drinking < 30 days	2.72 (2.05–3.63)	0.000	3.98 (2.95–5.38)	0.000
Drunk, lifetime	3.52 (2.67–4.66)	0.000	3.71 (2.72–5.04)	0.000
Drunk < 30 days	2.97 (2.12–4.16)	0.000	4.93 (3.49–6.98)	0.000

\* The response alternatives “1–2 times”, “3–5 times”, “6–9 times”, “10–19 times”, “20–39 times”, and “40 times or more” were recoded to 1 (with the experience) and “none” recoded to 0 (no experience).

### 3.5. Violence, Relationships and Delinquency

Several survey questions addressed adolescents’ experience of problematic relationships at home and in school, and diverse forms of violence and delinquency (Table 5). All the experiences were statistically significant, both for an experience of WPS during a lifetime and < 30 days.

**Table 5.** Experience of domestic violence, sexual abuse, problematic relationships, and stealing and vandalising by lifetime experience of waterpipe smoking (WPS) and WPS < 30 days in Bissau, June 2017.

Variables *	Waterpipe Smoking (WPS)			
	Lifetime		<30 Days	
	OR (95% CI)	p-Value	OR (95% CI)	p-Value
<b>Domestic violence: Have you experienced any of the following?</b>				
(a) A serious argument with your parents	1.63 (1.24–2.14)	0.001	1.71 (1.27–2.32)	0.001
(b) Witnessed a serious argument by your parents	2.02 (1.53–2.68)	0.000	2.30 (1.70–3.11)	0.000
(c) Witnessed physical violence in your home where an adult was involved	1.87 (1.40–2.50)	0.000	2.19 (1.61–2.98)	0.000
(d) Witnessed psychological violence in your home where an adult was involved	1.97 (1.47–2.64)	0.000	2.37 (1.73–3.24)	0.000
(e) Been involved in physical violence in your home where an adult was involved	1.91 (1.42–2.57)	0.000	2.11 (1.53–2.90)	0.000
<b>Sexual abuse: Have you experienced any of the following?</b>				
(f) Been a victim of sexual abuse	2.13 (1.46–3.12)	0.000	2.63 (1.77–3.92)	0.000
(g) Experienced sexual abuse where an adult from within the family was involved	2.19 (1.54–3.13)	0.000	2.74 (1.89–3.97)	0.000
(h) Experienced sexual abuse where an adult from outside the family was involved	2.10 (1.58–2.79)	0.000	2.05 (1.50–2.79)	0.000
<b>At what age (if ever) did you have a sexual relationship for the first time?</b>				
(i) Aged 11 years or less	2.70 (1.72–4.23)	0.000	2.31 (1.40–3.81)	0.002
<b>Relationships: Have you experienced any of the following?</b>				
(j) A break-up with a girlfriend/boyfriend	1.96 (1.50–2.54)	0.000	1.84 (1.38–2.46)	0.000
(k) Been rejected by your friends	1.54 (1.14–2.07)	0.005	1.97 (1.43–2.69)	0.000
(l) Been dismissed from class or sent to the disciplinary board	2.39 (1.77–3.23)	0.000	2.60 (1.88–3.59)	0.000
(m) Been expelled from school	1.82 (1.29–2.56)	0.001	2.03 (1.40–2.93)	0.000

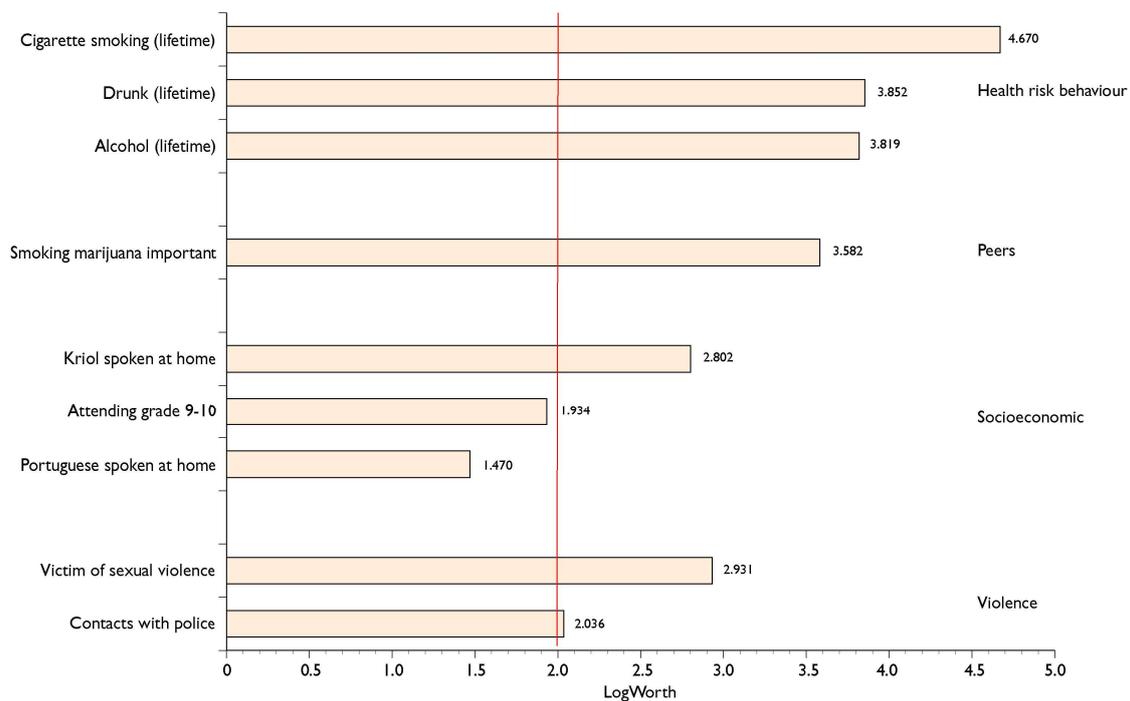
Table 5. Cont.

Variables *	Waterpipe Smoking (WPS)			
	Lifetime		<30 Days	
	OR (95% CI)	p-Value	OR (95% CI)	p-Value
<b>Stealing and vandalising: How often (if ever) have you done any of the following during the last 12 months</b>				
(n) Stolen something worth less than three normal movie tickets	2.50 (1.47–4.23)	0.001	2.65 (1.50–4.69)	0.002
(o) Stolen something worth more than three normal movie tickets	2.84 (1.74–4.65)	0.000	4.27 (2.55–7.13)	0.000
(p) Used physical violence to rob/steal	2.65 (1.62–4.34)	0.000	3.74 (2.24–6.24)	0.000
(q) Broken into a building or a car to steal	2.40 (1.42–4.06)	0.002	3.83 (2.24–6.53)	0.000
(r) Damaged or vandalised things that did not belong to you	2.40 (1.67–3.44)	0.000	3.01 (2.04–4.42)	0.000

\* For questions a–h, see Section 2.3; for questions j–m, the response alternatives “yes, during last 30 days”, “yes, during last 12 months”, and “yes, more than 12 months ago” were recoded to 1 (with the experience) and “never” recoded to 0 (no experience); questions n–r, the response alternatives “1–2 times”, “3–5 times”, “6–9 times”, “10–19 times”, “20–39 times”, and “40 times or more” were recoded to 1 (with the experience) and “none” recoded to 0 (no experience).

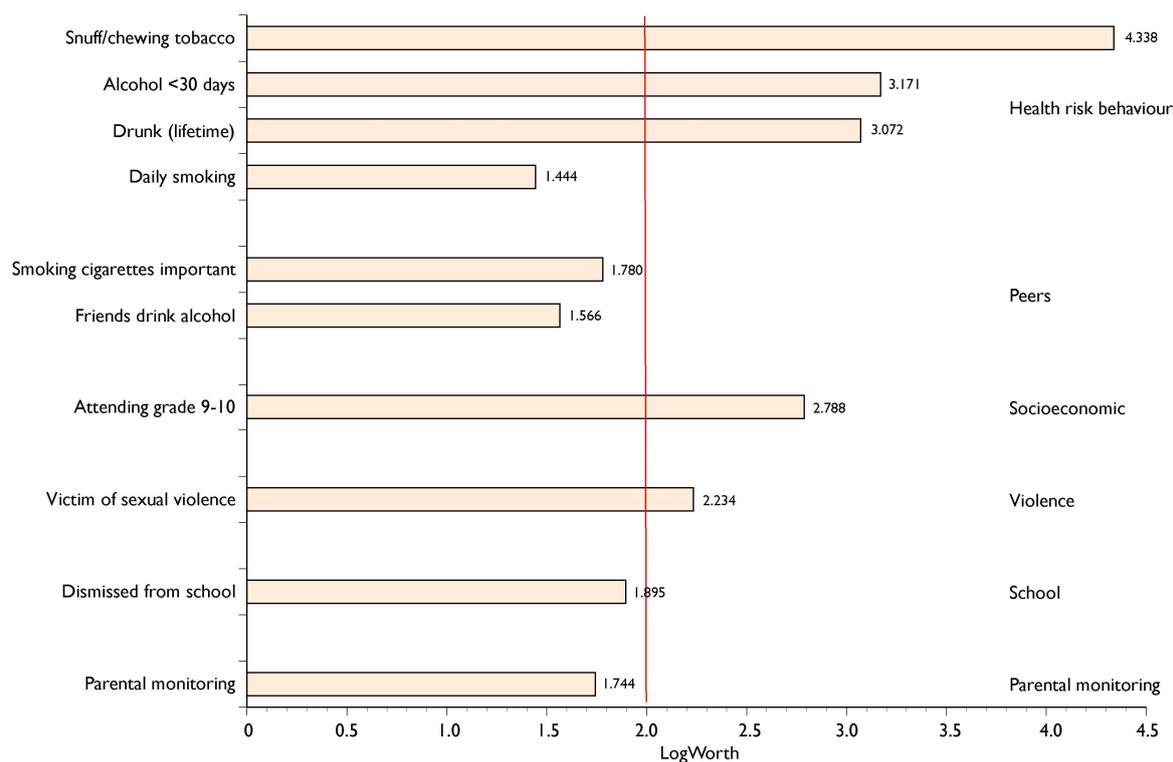
### 3.6. Multinomial Logistic Regression

Following the bivariate analysis presented above, 48 variables were introduced into the multinomial logistic regression model to identify explanatory variables for the dependent variables for a lifetime WPS and WPS < 30 days. For a lifetime experience of WPS, the final model ( $R^2 = 0.1164$ ;  $p < 0.0001$ ) included nine variables that were statistically significant in the model (Figure 1).



**Figure 1.** Effect sizes of  $p$ -values (LogWorth value scale) for statistically significant explanatory variables ( $p < 0.05$ ) for lifetime WPS, grouped by key influential factors. Multinomial logistic regression model for lifetime experience of smoking ( $R^2 = 0.365$ ). LogWorth value above 2 corresponds to a  $p$ -value below 0.01 (red line).

For WPS < 30 days, the final model ( $R^2 = 0.155$ ;  $p < 0.0001$ ) included ten significant explanatory variables (Figure 2). Both models (Figures 1 and 2) had the variables “Grade 9–10 vs. 7–8”, “Victim of sexual abuse”, and “Drunk lifetime”.



**Figure 2.** Effect sizes of  $p$ -values (LogWorth value scale) for statistically significant explanatory variables ( $p < 0.05$ ) for WPS during the last 30 days, grouped by key influential factors. Multinomial logistic regression model for daily smoking ( $R^2 = 0.458$ ). LogWorth value above 2 corresponds to a  $p$ -value below 0.01 (red line).

Adolescents who have a lifetime experience of WPS and WPS < 30 days have four significant factors in common: they are more likely than non-WPS peers (1) to attend grades 9 or 10 than grades 7 or 8, and more so for WPS < 30 days; (2) to have a lifetime experience of sexual violence; (3) to have been drunk, which is the most important common determinant for both groups; and (4) to have experienced some kind of peer pressure.

The most crucial, significant, influential factors for a lifetime experience of WPS are having a lifetime experience of smoking cigarettes and drinking alcohol and having had contact with the police. Additional significant determinants for a lifetime experience of WPS are speaking Kriol or Portuguese at home rather than other languages.

For WPS < 30 days, the most important significant influential factors are snuffing and chewing tobacco and drinking alcohol < 30 days, being dismissed from school or sent to the disciplinary board, lack of parental monitoring, and friends having been drunk at least once in the last month.

#### 4. Discussion

Here, we aimed to estimate the prevalence of a lifetime experience of WPS and WPS < 30 days and identify influential factors of its usage among school-attending adolescents in Bissau. The study included randomly selected participants ( $n = 2039$ ) aged 14–19, both in public and private schools, equally distributed in the two school types, with about half in the target age group aged 15–16; the broad age range illustrates many over-aged students [39]. The prevalence rates for a lifetime experience of WPS and < 30 days were high (17.7% and 15.0%, respectively), with no significant gender difference. Common significant, influential factors for both groups were linked to the extent of attending higher grades in school, use of alcohol, and being a victim of sexual violence. For a lifetime experience of WPS, additional significant determinants were contacts with police, smoking cannabis, and speaking Kriol or Portuguese at home. For WPS < 30 days, other significant

determinants were the influence of peers, daily smoking of cigarettes, using smokeless tobacco (snuff/chewing), lack of parental monitoring, and dismissal from school.

#### 4.1. Prevalence

In our study, the prevalence of a lifetime experience of WPS was 17.7% and for WPS < 30 days was 15.0% among school-attending adolescents in the capital Bissau. Among African adolescents, rates for WPS varied; for instance, 26% of South African adolescents in grade 8 (mean age 14 years) had ever smoked WP, and 11% were classified as current smokers [19]. In Khartoum State in Sudan, 13.4% of school-attending adolescents (14–17 years) had ever smoked WP [18], and in a countrywide Gambian sample among school-attending students in grades 7–12 (aged 12–20), 8.1% had a lifetime experience of WPS [20]. In Ghana, in a countrywide study, 3.1% of school-attending adolescents (13–15 years) had ever experienced WPS, while 1.7% did so < 30 days. Comparison between studies is complicated by variations in the ages of participants, the times of study, and the varied sampling strategies within the countries. Like the other samples, our sample includes school-attending adolescents; however, in contrast to those mentioned above, it is limited to the capital area.

While the prevalence rates in our study (17.7% versus 15.0%) are at the higher end compared with other studies, the slight difference between the prevalence rates for a lifetime experience of WPS and < 30 days is a cause for concern. This small difference might signal the attractiveness of WPS and accessibility in the urban landscape. Further, of the adolescents smoking WP < 30 days, 22.2% had smoked WP 40 times or more. WPS is a recent phenomenon in Guinea-Bissau; according to information we have gathered, the first shisha bar in Bissau was most likely opened in 2006. Yet, today, there are many shisha bars and pharmacies that provide what is needed for home consumption, which might explain the high prevalence rate of WPS among adolescents. Further, taxation of tobacco products in Guinea-Bissau is minimal [22], anti-tobacco campaigns are non-existent [25], and no laws regulate warnings of health risks from tobacco use, ban advertising or sales of single sticks of cigarettes, or enforce a minimum age of sale [23,24].

We find no significant gender differences in the prevalence of WPS among the school-attending adolescents in Bissau; for a lifetime experience of WPS, the prevalence is slightly higher among boys, while the reverse is true among girls for WPS < 30 days. The prevalence rate contrasts with our study of cigarette smoking in this group of adolescents, in which boys are about four times more likely to be daily smokers than girls [48]. The gender disparity in WPS in Bissau corresponds with research among Gambian adolescents [20]. In Ghana, the prevalence of a lifetime experience of WPS was slightly higher among boys than girls, but for more intensive smoking, the prevalence was higher among girls [17]. In Sudan and South Africa, male adolescents had a higher prevalence of WPS than females [18,19].

Gender-based social stigma appears less attached to WPS than cigarette smoking, particularly in Islamic communities [49]. Female university students in Kairo listed reasons for their smoking of cigarettes and waterpipes to be curiosity, pleasure, attractiveness, maturity, and independence [50]. In addition, less harm was the main reason for WPS rather than smoking cigarettes, together with fashion, better smell, and the associated company of friends. According to a study in the Eastern Mediterranean Region, the WPS of women is embedded in curiosity, personal determination, sensory experiences, notions of old traditions reflecting hospitality and togetherness, family cohesion, and friendship in a society with flexible laws and regulations underlining social acceptance [9].

The revival of WPS in the 1990s was characterised by youth and women replacing the elderly male as the typical WP smoker [7,51]. The subtle but effective global marketing of the new tobacco product with attractive flavours, the glamorisation of the WPS and its accessories, and the often attractively designed, at times gender-sensitive, setting contributed to this trend [52]. A recently established company in Ivory Coast, outside the traditional setting for WPS, describes WPS as follows: “Family members, close friends, and new acquaintances come together and deepen ties over a hookah in the same way it has been done for generations” [53].

#### 4.2. Influential Factors

Globally, influential factors for WPS among youth are commonly associated with their smoking of tobacco and the smoking by family members and friends [16–20,54]. In our study, uses of tobacco other than WPS and alcohol consumption were influential factors for WPS, both lifetime and < 30 days (Figures 1 and 2). We identified, in particular, the usage of smokeless tobacco as an influential factor for WPS, whose use is frequently associated with smoking tobacco [55–57]. In Bissau, peer influence was also a significant factor for a lifetime experience of WPS and WPS < 30 days. For the former, peer influence is linked to pressure to smoke cannabis within the group; however, smoking cannabis, a highly significant factor in the bivariate analysis, does not appear in the multinomial logistic regression as a significant factor for WPS < 30 days. On the other hand, for those with experience of WPS < 30 days, peer pressure to smoke cigarettes within the group was a significant factor. As found in other studies [16,19], age was not a significant factor for WPS in Bissau. The reason might be the age-mixed classes because of high numbers of over-age students [39]. A higher grade is significantly associated with the likelihood of WPS, which underlines the importance of the peer group rather than the age of the participants.

In Lebanon, adolescents' intention to smoke a WP was highly influenced by peers' and parents' permissive attitudes [58]. In our study, the adolescents who reported less parental monitoring of their activities and whereabouts at night and had fewer contacts with their friends' parents were significantly more likely to have a lifetime experience of WPS. Parental oversight and support for their children have been identified as a protective factor for the health and well-being of adolescents [36].

Many studies do not report on the financial situation of adolescents engaged in WPS. A survey from Oman among adolescents (13–15 years) revealed that those with more pocket money were likelier to have been involved in WPS than those with less money, supporting higher prices as a preventive measure [59]. In contrast, adolescents in Jordan who had engaged in WPS once or more frequently were more likely to attend a public school and had parents with lower levels of education than those attending private school and those with parents with higher levels of education [60]. In our study, variables that indicate better financial position of adolescents, i.e., attending private school versus public school and having parents who could afford to buy a car, were statistically significant for a lifetime experience of WPS in bivariate analysis. Still, we found no such association in a multinomial logistic regression analysis.

WPS was significantly associated with social media usage; adolescents who used social media were more likely to have WPS experience, both during their lifetime (OR = 1.53) and < 30 days (OR = 1.54) than those with none. In line with many studies that have identified social media as important for the marketing of WPS [11], such marketing might have had an influence. Further, access to social media indicates wealth and financial resources for the study group; less than half had access to a laptop or a computer in the last 12 months, and one-third had never used digital media [61]. Thus, our findings suggest that better-off adolescents are likelier to have WPS experience than worse-off adolescents.

A wide range of research shows that experience of sexual violence and harassment in childhood is associated with a higher prevalence of smoking tobacco and other substance abuse [62–66]. In Africa, there is a shortage of studies exploring the association between whatever form of tobacco use and experience of sexual violence [67]. A study in Eastern Ethiopia focusing on sexual violence among female university students found that the use of either hashish or shisha was statistically related to an experience of sexual violence [68]. A study from Tanzania found that males with a childhood experience of sexual violence were likelier to have smoked a waterpipe in the last 30 days than those without such an experience [69]; too few females smoked to evaluate the effect on women. In our study, adolescents with experience of WPS were significantly likelier to have a lifetime experience of sexual violence than non-WP smokers (Figures 1 and 2). Likewise, reporting first sexual relations younger than 12 years was 2.70 times more likely for those with a

lifetime experience of WPS than for non-smokers, potentially showing a propensity for risk-taking behaviour.

In short, the adolescents in our study who engaged in WPS < 30 days were likelier than others to live a turbulent life with a lack of parental supervision; experience discharge from school, usage of smokeless tobacco, and daily smoking of cigarettes; and be victims of sexual violence. They are also likely to be somewhat better off economically than those with a lifetime experience and no experience of WPS.

#### 4.3. Preventive Measures

For public health benefits, regulating WPS with effective interventions and formulating relevant policies should be priorities [7,70]. Globally, there is an urgent need to revise outdated, vague legislation that is unable to control the rapidly expanding tobacco industry [71].

Guinea-Bissau consented to the WHO Framework for Tobacco Control (FCTC) in 2008 [72]; however, implementation is severely lacking [23,24]. For legal action, the FCTC should guide the government in setting preventive policies and actions that have not yet been adopted [73]. Further, Guinea-Bissau should consider following an increasing group of African countries that have recently adopted WPS bans [74–81]. The common argument that higher taxation increases smuggling appears exaggerated [82]; thus, higher taxes on WPS are also likely to reduce its use and associated health hazards [83]. The greatest policy challenge is to prevent occasional WP smokers from moving into more frequent usage or becoming regular cigarette smokers. Easy access, lack of legal action, and the attractive aspects of WPS are likely to contribute to frequent usage among adolescents with a lifetime experience of WPS.

The frequent conception that WPS is less dangerous and addictive than cigarette smoking may encourage the practice [10]. Our study did not inquire about the adolescents' knowledge about the dangers of WPS; however, such knowledge is likely inadequate, considering the lack of awareness campaigns and preventive policies and laws [23–25]. While research is lacking to guide interventions to combat WPS, approaches that educate and empower adolescents are recommended [71]. School-based interventions in Lebanon increased knowledge but not behaviour; it was suggested to merge behaviour change theory and approaches that are sensitive to social context, which supports WPS, for a lasting behaviour change [84]. The influential factors for WPS identified in this study mostly overlap with risky health behaviours identified for narcotics use in the same sample of adolescents [85]. A focus on WPS, a recent introduction in the country, for educational campaigns might be more effective than a focus on more stigmatising behaviour, such as substance abuse.

#### 4.4. Strengths and Weaknesses

The strength of this study rests on the methodology. First, the survey is the first of its kind in the capital, applying a survey questionnaire developed over the years by scientists as part of the international collaborative network of Planet Youth [86]; similar questions have been used in other recurrent international surveys on the health of young people used for preventive activities [87,88]. Second, the participants were randomly selected from a class-based register, as described elsewhere [38]. Third, within the two groups of students with a lifetime WPS experience and during the preceding 30 days, the study identified several influential factors for smoking that these students share with peers in other settings (Figures 1 and 2).

Our research has limitations. First, the study participants are school-attending adolescents residing in the capital city. They might be more exposed to advertisements and easy access to WPS compared to rural peers and those out of school. Thus, prevalence rates in our study group might be higher than those in other groups and settings in Guinea-Bissau. However, while shisha bars are found in some towns and villages outside Bissau, there is no reliable information on access to WPS in rural areas. Second, the study is cross-sectional

and unable to evaluate change over time. Third, the extent of missing values varied across the different variables; however, this was addressed by recoding to increase the number of participants per studied variable, and was also considered by the statistical software in the multinomial logistic regression analysis. Finally, the data collection was in June 2017, and the results may not accurately reflect the current situation.

Additional research on WPS in Guinea-Bissau, both quantitative and qualitative, is needed. There is a need to follow up on the eventual prevalence rates of WPS among adolescents in the capital and rural areas, including school-attending and out-of-school adolescents. Potential research questions should be gender-sensitive and include, e.g., settings that provide access to WPS, cost of usage, who pays, what type of substance is used, the emerging cultural significance of WPS, the motives for its usage, and knowledge of the associated risks with WPS.

## 5. Conclusions

The prevalence rates for a lifetime experience of WPS and in the preceding 30 days among school-attending adolescents in Bissau, Guinea-Bissau, are high compared to those in other countries, considering its recent introduction in the country. In short, 15.0% of the participants had used a WP at least 1–2 times in the preceding 30 days, and about one-fifth reported intensive usage of 40 times or more often. Of particular interest is the lack of gender difference in its usage, in contrast to the higher prevalence of males smoking cigarettes. The overlapping of determinants for several risky health behaviours, including smoking cigarettes, drinking alcohol, and using cannabis, suggests that focusing on less stigmatising behaviours such as WPS might be a way to go forward for substance-abuse-preventive actions. Better implementation of the FCTC and an outright ban of WPS, as reported in many neighbouring countries, appears to be an option facilitated by the fact that WPS is a recent phenomenon in the country without attached traditions.

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**Institutional Review Board Statement:** The study was conducted in accordance with the Declaration of Helsinki and approved by the Ministry of Education in Guinea-Bissau (No/Ref 250/MEES/GM/2017). The date of approval was 6 June 2017.

**Informed Consent Statement:** Due to the students' mature age as children (aged 14–19) and the study's setting, pre-parental approval was not sought; the adolescents decided on their participation in the survey without any personal identifiers.

**Data Availability Statement:** The data presented in this study are available on reasonable request from the corresponding author.

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