Associations between quit attempts and health behaviors among tobacco users attending a district hospital in South Africa

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ABSTRACT

INTRODUCTION The cessation of tobacco use is associated with better health outcomes, which may facilitate the uptake of other healthy behaviors. In this study, we examined whether engaging in tobacco use cessation increases the likelihood of engaging in other healthy behaviors.

METHODS In this cross-sectional study, consecutive tobacco users attending the Outpatient Department of Dr Yusuf Dadoo District Hospital, South Africa, between February and July 2023, were administered a questionnaire that collected data on sociodemographic, clinical/health status, tobacco use, nicotine dependence, alcohol consumption, fruit/vegetable intake, physical activity, and lifetime and 12-month quit attempts. Analysis included descriptive statistics and logistic regressions.

RESULTS A total of 400 respondents completed the questionnaire. A quarter of respondents (n=104) reported making a quit attempt in the last 12 months, while 54.5% had done so in their lifetime. About 17.7 % of smokers were classified as high nicotine dependent (HND), and 17.3 % reported harmful alcohol use. Only 37.6% reported adequate physical activity, and 45.2% daily fruit/vegetable intake. In univariate analyses, among smokers, only daily fruits/vegetable intake and having a respiratory problem were significantly associated with making a quit attempt (OR=2.77; 95% CI: 1.63–4.69, p=0.001; and OR=1.07; 95% CI: 1.18–3.62, p=0.001, respectively). Among all tobacco users, tertiary education and adequate physical activity were negatively associated with HND (OR=0.23, CI: 0.08–0.69, p=0.002; and OR=0.17, CI: 0.07–0.39, p=0.001, respectively). In multivariate regression analyses, none of the health behaviors was associated with quit attempts. Only reporting good health status (compared with poor health status) and being unemployed (compared with pensioners) were independently associated with making a quit attempt in the past 12 months (adjusted odds ratio, AOR=3.0; 95% CI:1.5–5.99, p=0.002 and AOR=3.11; 95% CI: 1.1.28–7.6, p=0.013, respectively).

CONCLUSIONS Within our sample, most tobacco users did not make a quit attempt in the last 12months, highlighting a need to scale up the implementation of brief advice and motivational counselling within the clinical setting. Except for unemployment status and perceptions of being healthy, making a quit attempt appears not to be associated with uptake of other healthy behaviors. Larger and prospective studies are therefore needed to explore this relationship. Nonetheless, the study findings may find suitable expression in interventions aimed at facilitating quit attempts among tobacco users.

INTRODUCTION

The tobacco epidemic remains one of the most significant public health challenges worldwide, and South Africa is no exception[1,2]. According to the 2021 Global Adult Tobacco Survey (GATS), 29.4% of South Africans aged >15 years use tobacco products, including smoking tobacco, smokeless tobacco, or heated tobacco[2]. While there has been a downward trend in tobacco consumption reported worldwide, low- and middle-income countries continue to bear the heaviest burden[1,3]. Despite various efforts by governments and the World Health Organization (WHO) to curb this dangerous trend, tobacco use remains a pressing public health issue[1,2].

Tobacco use and other unhealthy behaviors are prevalent in South Africa[4,5]. Data from the South African Demographic and Health Survey (SADHS 2016) highlight some concerning trends[5] – 37% of men and 8% of women are tobacco users; 68% of women are overweight, with 41% obese; 31% of men are overweight, with 11% obese; 61% of men and 26% of women consume alcoholic beverages; and of those who consume alcohol, 28% of males and 5% of females engage in risky alcohol consumption[5]. Furthermore, the SADHS (2016) found that only 25% of households reported consuming at least one portion of fruit or vegetables (F&V) daily[5].

The '3-4-50' concept highlights the link between three key unhealthy behaviors, namely: tobacco use, inadequate physical activity, and poor diet[6]. These constitute major risk factors for four major chronic diseases (cardiovascular diseases, cancers, type 2 diabetes, and respiratory conditions) and ultimately account for over 50% of premature deaths worldwide[6,7]. Evidence from multiple studies suggests that unhealthy health behaviors tend to cluster together, increasing the overall risk of negative health outcomes and socioeconomic inequalities[6-8]. A Canadian study reported that smoking cessation is challenging when multiple unhealthy health behaviors co-exist, as the odds of dependence on nicotine increase by 23% with each additional unhealthy behaviour[9].

A 2022 scoping review identified a rising trend in smokeless tobacco (SLT) use among a much younger population[10]. SLT users were also most likely to engage in multiple unhealthy behaviors, such as smoking cigarettes and consuming alcohol concurrently[10-12]. This trend was confirmed by the Centers for Disease Control and Prevention (CDC) in the USA, which reported that novel forms of SLT, along with the influence of friends and family, were identified as key elements influencing the use of SLT products among the youth[11].

It is well established that all forms of tobacco products are harmful, with no safe level of exposure[1]. Therefore, promoting a quit attempt is a desirable clinical and public health priority[1,8]. It is shown that brief motivational interviews by healthcare providers increase the chances of a successful quit attempt by 30%, while quitting rates are increased by 87% with intensive counselling sessions, follow-ups, and pharmacotherapy[13]. Although most tobacco users express the desire to quit, many are unsuccessful, as the chances of quitting also decrease with higher nicotine dependence (HND) and the presence of concurrent risky health behaviours[6,8,9].

Studies suggest that the likelihood of attempting to quit tobacco use is associated with being female, older, having higher formal education, exposure to smoke-free environments, lower level of nicotine dependence, awareness of the dangers of tobacco, and concern about health[8,13,14]. In addition, multiple studies have shown that past or present alcohol use disorder is negatively associated with making a quit attempt and has a greater chance of relapse[15,16]. Also, smokers with HND are less likely to attempt to quit[8,17] while weight gain has been identified as both a barrier to quitting and a trigger of relapse[18].

A large number of adult patients visiting the outpatient department (OPD) at a district hospital seek care for the treatment of non-communicable diseases (NCDs) related to health[19]. Information for South African is, however, limited on the relationship between quit attempts and behavioral health, particularly, whether a quit attempt is associated with the uptake of other healthy behaviors among ambulatory hospital patients, and the extent to which nicotine dependence modulates this. Based on these findings, we hypothesized that individuals who adopt one or more healthy behavioral habits are more likely to try to quit. Therefore, this study aims to evaluate the relationship between quit attempts, nicotine dependence, and health behaviors among tobacco users.

METHODS

Study design and research setting

This cross-sectional study was conducted between February and July 2023 at the OPD of DYDH among tobacco users aged ≥18 years. DYDH is a district-level healthcare facility located in Krugersdorp, west of Gauteng, South Africa. At the time, the hospital had a capacity of 245 beds, served as a referral center for 44 fixed primary care clinics, eight mobile clinics, four satellite clinics, and three maternity and obstetric units. The OPD operates weekdays, Monday to Friday, from 8:00 a.m. to 4:00 p.m.

Study population, sampling strategy, and recruitment

According to the district health information system, there were 26632 adult patient visits to the OPD of DYDH in 2019. In addition, a study by Bokoro et al.[13], in the same setting, reported a tobacco use prevalence of 20.0% in 2020[13]. The required sample size for the study was calculated to be 336 respondents, using a 5% margin of error and a 95% confidence interval. To compensate for potential non-responses and incomplete data, the sample size was increased by 10%, resulting in a final target of 400 respondents.

On each working day, consecutive tobacco users were

invited to take part in the study. Posters in English about the research study were displayed in the OPD with permission from the hospital management. A trained research assistant fluent in English as well as several local languages (Setswana, Afrikaans, Sotho, and Zulu), notified all patients about the ongoing study, and invited them to participate after the morning health promotion talks. Those who consented were assured that they would not lose their position in the queue, as they would be returned to their original position or the next position in the front of the queue once they completed their participation. The enrolment continued until the sample size was reached. All screened patients received a sticker on their files afterwards, to avoid multiple recruitment.

Data collection

A researcher-administered questionnaire, written in English, was used to collect the data. Each questionnaire had a code to ensure anonymity. The questionnaire was developed with input from relevant literature on tobacco use, nicotine dependence, quit attempts, and health behaviors[4,5,20,21]. Ethical approval for the study was granted by the Human Research Ethics Committee (HREC-Medical) of the University of the Witwatersrand, South Africa (clearance number: M201173). Additional permission was obtained from the Chief Executive Officer of DYDH. Informed consent was obtained from all respondents.

Measures and definitions

A 12-month quit attempt was defined among tobacco users as a 'yes' to the question: 'During the past 12 months, have you tried to stop tobacco use?'[22,23]. A lifetime quit attempt was defined by any answer indicating 'once', 'twice', or 'three times or more' as opposed to 'never' in response to the question: 'Have you ever attempted to quit tobacco use?'[8].

To determine the nicotine dependence levels among smokers, the Heaviness of Smoking Index (HSI) was used. The HSI is a validated and effective measure of nicotine dependence[24]. It is derived from two items: the number of cigarettes smoked per day (CPD) and the time to first cigarette (TTFC) in the morning[24].

Health behaviors included dietary consumption of fruit and vegetables (F&V), physical activity, and consumption of alcohol. Dietary consumption of F&V was measured as proposed in the South African Social Attitudes Survey (SASAS) of 2014[5], by asking respondents how often they consumed fruits and/or vegetables per day or week[5]. Adequate F&V intake was defined as the WHO guidelines of a minimum of five servings of F&V daily[25].

Physical activity was measured using the Global Physical Activity Questionnaire (GPAQ), a tool developed by the WHO to monitor physical activity levels across different countries[6,21]. The GPAQ gathers data on physical activity across three domains: vigorous and moderate activity at work, transport-related activity, and vigorous and moderate activity during leisure time. Additionally, it records information on sedentary behavior, specifically the duration of time spent sitting[21].

To assess alcohol consumption, the Alcohol Use Disorders Identification Test-Concise (AUDIT-C) tool was utilized. This is a brief but effective screening tool for identifying individuals who engage in harmful drinking or may have an active alcohol use disorder[26]. The AUDIT-C comprises the first three questions from the full Alcohol Use Disorders Identification Test (AUDIT). Harmful drinking refers to a pattern or quantity of alcohol consumption that increases the likelihood of adverse health outcomes and is recognized by the WHO as a distinct disorder[26].

Covariates

Current tobacco users were defined as individuals who responded 'daily' or 'less than daily' to the question: 'Do you currently use any tobacco products on a daily basis, less than daily, or not at all?'[22]. For tobacco use patterns, the GATS questionnaire was used to collect data on tobacco use patterns[20]. The GATS questionnaire is an internationally valid and reliable tool used to obtain information on tobacco use and quit attempts for both smokers and SLT users[20].

Sociodemographic characteristics data collected included age, gender (male, female), marital status (single, married, or divorced/widowed/separated), employment status (employed including professionals, artisan and self-employed; and unemployed including students), education level (no formal education, primary education, secondary education, tertiary), and ethnicity in terms of self-identification as Black African, White, Colored (of mixed ancestry), (Black, White, Colored, Indians), and Indian/Asian.

Study respondents were also asked to rate how they perceived their general health status (good, average, poor, or I don't know)[5,8]. Respondents were also asked to specify the reason for their clinical visit. Smokers were categorized into nicotine dependence levels based on their scores from the HSI questions[24]. Respondents were considered adequately physically active if they engaged in at least 150 minutes of moderate-intensity exercise or 75 minutes of vigorous-intensity activity per week[21]. The AUDIT-C tool was used to assess alcohol drinking behavior, where a score of ≥8 indicated harmful behavior.

Potential confounders were identified prior to analysis based on existing literature. Sociodemographic variables (age, sex, marital status, employment status, education level, and ethnicity) were included due to their known associations with tobacco use behaviors and quit attempts. Perceived general health status was included as it may influence motivation to attempt to quit, while the reason for the clinical visit was included to account for differences in underlying health status. Tobacco use patterns were treated as primary exposure variables. All identified factors were adjusted for in a multiple-stepwise logistic regression analysis.

Data analysis

A statistician provided support with data management and analysis. The data were entered into REDCap and later analyzed using STATA 18. Descriptive statistics, including frequencies and percentages for the categorical variable, and means and standard deviations for the continuous variables, were calculated. Measures of central tendency and cross tabulation were also performed in terms of age, sex, marital status, employment status, education level, ethnicity, self-reported health status, clinical diagnoses, mean number of cigarettes, snuff used, and proportions of tobacco users engaged in each health behavior. The 12-month quit attempt and lifetime attempt variables were analyzed as binary (yes, no).

To analyze the associations between respondents' demographic and clinical profiles, levels of nicotine dependence, health-related behaviors, and attempts to quit smoking, appropriate statistical tests were applied: chi-squared tests, t-tests, ANOVA, and logistic regression were used for testing categorical and numerical variables, as appropriate. Statistical significance was set at $p<0.05$. Multivariate logistic regression analyses were performed to examine factors associated with making a quit attempt. The 12-month and lifetime quit attempt (yes, no) was specified as the dependent variable. Independent variables entered into the multivariable models included sociodemographic characteristics, adequate fruit and vegetable intake, adequate physical activity and harmful alcohol use. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were estimated.

RESULTS

Respondent characteristics

A total of 400 Respondents completed the questionnaires. Supplementary file Table 1 summarizes the baseline sociodemographic data, self-reported health status, and clinical conditions of the respondents. Most respondents were Black (65%), male (51.2%), single (46.5%), employed (43%), and had a secondary education (71.2%). The mean age of the respondents was 48.3 years. Less than half of the respondents (45.2%) described their general health status as good. The most common reason for a clinical encounter was a cardiovascular disease (CVD) (49%). The mean duration of reported health conditions among respondents was 6.9 years.

Tobacco use patterns

About 80.5% (n=322) were cigarette smokers (268 were exclusive cigarette smokers), and 19.5% (n=78) were SLT users. Most of the cigarette users smoked daily (91.9%), and preferred the manufactured type of cigarette (63%). The mean number of packs per year of smoking was 14.5. Hookah pipe only was reported by 6.8% (n=27), e-cigarette only use was noted by 2 participants, combined cigarette and other product use by 4.8% (n=19), and combined e-cigarette and other product use by 1.5% (n=6).

Most cigarette smokers had low nicotine dependence (LND) (60.9%), while 21.25% had moderate dependence, and 17.7% high nicotine dependence (HND).

Among SLT users, the majority (71.7%, n = 56) used snuff daily. The median duration of snuff use was 10 years (IQR: 3–20). On average, SLT users used three snuff dips per day (Supplementary file Table 2).

Only three respondents (0.75%) met the WHO guidelines for adequate consumption of F&V, of a minimum of five servings daily. More than half of the respondents (55%) consumed less than one serving of F&V daily. Compared to others, respondents with a tertiary education were more likely to eat at least one serving of F&V each day (OR=2.04; 95% CI: 1.19–3.47, p=0.009) (Supplementary file Table 3).

Regarding physical activity, most respondents (83%) reported engaging in either vigorous or moderate physical activity. Of these, only 37.6% met the WHO guidelines for a total of 150 minutes of weekly physical activity. On average, respondents worked for eight hours a day, with half spending three hours sitting or reclining. In the univariate analysis,

Table 1. Twelve-month and lifetime quit attempts among tobacco users at DYDH, South Africa, February–July 2023 (N=400)

Items	Categories	Cigarette smokers n (%)	Smokeless tobacco n (%)	Other products n (%)	Total n (%)
Ever tried to quit	No	103 (35.89)	50 (64.1)	29 (82.86)	182 (45.5)
	Yes	184 (64.11)	28 (35.9)	6 (17.14)	218 (54.5)
During the past 12 months, have you tried to stop using tobacco?	No	203 (70.73)	65 (83.33)	31 (88.57)	299 (74.75)
	Yes	84 (29.27)	13 (16.67)	4 (11.43)	101 (25.25)
How many times have you tried in the past 12 months?	Once	53 63.1)	7 (53.85)	2 (50.0)	62 (61.39)
	2–10	30 (35.71)	6 (46.15)	2 (50.0)	38 (37.62)
	Not specified	1 (1.19)	0	0	1 (0.99)

Table 2. Factors associated with the quit attempts of cigarette smokers (N=287) and smokeless tobacco (snuff) users (N=98), for 12-month and lifetime quit attempts of tobacco users attending DYDH, South Africa, February–July 2023 (N=400)

Variables	Cigarette smokers			Smokeless tobacco (snuff)			Overall			Overall		
	Quit attempt	Univariate logistic regression		12-month quit attempt	Univariate logistic regression		12-month quit attempt	Univariate logistic regression		Lifetime quit attempt	Univariate logistic regression	
	n (%)	OR (95% CI)	p	n (%)	OR (95% CI)	p	n (%)	OR (95% CI)	p	n (%)	OR (95% CI)	p
Age (years) mean (SD)	48 (15.2)	0.99 (0.98–1.01)	0.827	57.5 (11.6)	1.1 (0.99–1.11)	0.087	48.3 (14.6)	1.0 (0.99–1.02)	0.358	49.3 (14.2)	1.01 (1.01–1.03)	**0.003**
Gender												
Male ®	53 (28.19)	1	–	2 (25.0)	1	-	56 (27.32)	1	-	121 (59.02)	1	-
Female	31 (31.31)	1.16 (0.68 –1.97)	0.581	11 (15.71)	0.56 (0.09–3.14)	0.509	45 (23.08)	0.8 (0.51-1.26)	0.330	97 (49.74)	0.69 (0.46–1.02)	0.063
Employment												
Pensioner ®	18 (23.68)	1	-	4 (18.18)			22 (22.45)	1	-	53 (54.08)	1	-
Employed	34 (27.42)	1.22 (0.63–2.35)	0.559	4 (13.79)			40 (23.26)	1.05 (0.58–1.89)	0.880	91 (52.91)	0.95 (0.58–1.57)	0.852
Unemployed	32 (36.78)	1.87 (0.94–3.72)	0.072	5 (18.52)			39 (30.0)	1.48 (0.81-2.71)	0.204	74 (56.92)	1.12 (0.66–1.91)	0.669
Race												
Other ®	33 (24.44)	1	-	0			33 (23.57)	1	-	98 (70.0)	1	-
Blacks	51 (33.55)	1.56 (0.93–2.61)	0.092	13 (17.11)			68 (26.15)	1.15 (0.72–1.85)	0.571	120 (46.15)	0.37 (0.24–0.57)	**<0.001**
Marital status												
Single ®	36 (29.03)	1	-	5 (16.67)	1	–	45 (24.19)	1	-	86 (46.24)	1	**-**
Married	31 (26.96)	0.9 (0.51 – 1.59)	0.721	3 (8.57)	0.47 (0.11–2.15)	0.33	34 (22.52)	0.91 (0.55-1.51)	0.718	88 (58.28)	1.62 (1.05-2.50)	**0.028**
Other	17 (35.42)	1.34 (0.67–2.71)	0.417	5 (38.46)	3.13 (0.72–13.64)	0.13	22 (34.92)	1.68 (0.91–3.11)	0.099	44 (69.84)	2.69 (1.46–4.96)	**0.001**
Education level												
Primary ®	38 (30.89)	1	-	9 (17.31)	1	-	47 (26.26)	1	-	103 (57.54)	1	-
Secondary	29 (26.61)	0.81 (0.45–1.43)	0.472	3 (15.79)	0.89 (0.22–3.73)	0.88	35 (25.0)	0.94 (0.56–1.55)	0.799	77 (55.0)	0.90 (0.56–1.41)	0.65
Tertiary	17 (30.91)	1.01 (0.51–1.99)	0.998	1 (14.29)	0.79 (0.09–7.45)	0.84	19 (23.46)	0.86 (0.47-1.59)	0.631	38 (46.91)	0.65 (0.38-1.11)	0.112
CVD												
No ®	47 (35.07)	1	-	7 (23.33)	1	-	47 (24.74)	1	-	105 (55.26)	1	-
Yes	37 (24.18)	0.59 (0.35–0.99)	**0.044**	6 (12.5)	0.47 (0.14–1.56)	0.218	54 (25.71)	1.05 (0.67–1.66)	0.822	113 (53.81)	0.94 (0.63–1.39)	0.771

Continued

Table 2. Continued

Variables	Cigarette smokers			Smokeless tobacco (snuff)			Overall			Overall		
	Quit attempt	Univariate logistic regression		12-month quit attempt	Univariate logistic regression		12-month quit attempt	Univariate logistic regression		Lifetime quit attempt	Univariate logistic regression	
	n (%)	OR (95% CI)	p	n (%)	OR (95% CI)	p	n (%)	OR (95% CI)	p	n (%)	OR (95% CI)	p
Daily fruit and vegetable consumption												
No ®	30 (19.61)	1	–	5 (11.61)	1	-	50 (22.83)	1	-	121 (55.25)	1	-
Yes	54 (40.3)	2.77 (1.63-4.69)	**<0.001**	8 (22.86)	2.25 (0.66–7.63)	0.193	51 (28.18)	1.33 (0.84–2.1)	0.221	97 (53.59)	0.94 (0.63–1.39)	0.740
Health status												
Poor ®	36 (27.07)	1	-	6 (20.69)	1	-	43 (23.76)	1	-	102 (56.35)	1	-
Moderate	25 (26.32)	0.96 (0.53–1.75)	0.899	2 (5.88)	0.24 (0.04-1.29)	0.097	29 (20.42)	0.82 (0.48-1.40)	0.475	70 (49.3)	0.75 (0.48–1.17)	0.207
Good	23 (38.98)	1.72 (0.9–3.29)	0.100	5 (33.33)	1.92 (0.47–7.77)	0.362	29 (37.66)	1.94 (1.09–3.44)	0.024	46 (59.74)	1.14 (0.67–1.97)	0.615
Physical activity												
Not physically active ®	15 (26.79)	1	-	2 (22.22)	1	-	17 (25.0)	1	–	40 (58.82)	1	-
Active (not adequate)	44 (31.88)	1.28 (0.64 –2.55)	0.485	7 (14.0)	0.57 (0.1-3.32)	0.532	55 (26.77)	1.09 (0.59–2.03)	0.798	113 (54.59)	0.84 (0.48–1.47)	0.542
Active (adequate)	25 (26.88)	1.1 (0.48–2.12)	0.990	4 (21.05)	0.93 (0.14–6.37	0.944	29 (23.2)	0.91 (0.46-1.81)	0.779	65 (52.0)	0.76 (0.42–1.37)	0.364
Alcohol use												
Not harmful ®	40 (22.99)	1	-				40 (31.01)	1	-	75 (58.14)	1	-
Harmful	14 (37.5)	2.01 (0.97–4.18)	0.061				61 (22.51)	0.65 (0.41–1.03)	0.068	143 (52.77)	0.81 (0.53-1.23)	0.314
Nicotine dependence												
Low ®	51 (29.14)	1	-									
Moderate	21 (34.43)	1.28 (0.69–2.37)	0.441									
High	12 (23.53	0.75 (0.36–1.54)	0.432									
Pack-years	15.6 (16)	1.01 (1.00–1.03)	0.106									
Respiratory												
No ®	76 (22.75)	1	-				76 (22.75)	1	-	181 (54.19)	1	-
Yes	25 (37.88)	2.1 (1.2–3.6)	**0.011**				25 (37.88)	1.07 (1.18–3.62)	**0.001**	37 (56.06)	1.08 (0.63–1.84)	0.781

CVD: cardiovascular disease. Significant at p<0.05 in bold. ® Reference categories.

Table 3. Univariate logistic regression analysis of health behavior of tobacco users attending DYDH, South Africa, February–July 2023 (N=400)

Variables	Daily fruit and vegetable consumption		Harmful alcohol use		Adequate physical activity		HND	
	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Age (years) (mean, SD)	0.99 (0.98–1.01)	0.365	0.97 (0.95–0.99)	**0.012**	0.9 (0.9–0.97)	**<0.001**	1.02 (1.0–1.03)	**0.001**
Gender								
Male ®	1	–	1	–	1	-	1	-
Female	0.95 (0.64–1.41)	0.804	0.36 (0.18–0.72)	**0.004**	0.49 (0.31–0.76)	**0.001**	0.95 (0.59–1.52)	0.836
Marital status								
Single ®	1	-	1	-	1	-	1	-
Married	1.28 (0.83–1.97)	0.263	0.46 (0.22–0.94)	**0.033**	0.71 (0.45–1.12)	0.140	4.37 (2.1–8.98)	**<0.001**
Other	0.85 (0.48-1.53)	0.592	0.33 (0.10–1.17)	0.087	0.23 (0.11-0.52)	**<0.001**	2.29 (0.88–5.96)	0.091
Employment								
Pensioner ®	1	-	1	-	1	-	1	-
Employed	1.2 (0.73–1.99)	0.471	1.97 (0.64–6.09)	0.238	11.8 (5.4–25.8)	**<0.001**	0.29 (0.14–0.59)	**0.001**
Unemployed	1.36 (0.80-2.32)	0.251	4.45 (1.45–13.7)	**0.009**	3.2 (1.4–7.4)	**0.006**	0.39 (0.18–0.82)	**0.013**
Race								
Other ®	1	-	1	-	1	-	1	-
Blacks	1.06 (0.7–1.61)	0.776	2.5 (1.11–5.60)	**0.026**	1.67 (1.06–2.67)	**0.028**	0.2 (0.1–0.39)	**<0.001**
Education level								
Primary ®	1	-	1	-	1	-	1	-
Secondary	1.54 (0.98–2.41)	0.058	0.79 (0.39–1.60)	0.515	1.14 (0.69–1.85)	0.606	0.91 (0.48–1.71)	0.322
Tertiary	2.04 (1.19-3.47)	**0.009**	0.65 (0.28–1.53)	0.327	1.92 (1.11-3.32)	**0.02**	0.23 (0.08-0.69)	**0.002**
CVD								
No ®	1	-	1	-	1	-	1	-
Yes	0.72 (0.49–1.07)	0.107	1.57 (0.83–2.98)	0.168	0.84 (0.56–1.28)	0.434	0.86 (0.47–1.56)	0.633
Daily fruit and vegetable consumption								
No ®			1	-	1	-	1	-
Yes			1.05 (0.56–1.97)	0.871	1.07 (0.79–1.64)	0.755	1.52 (0.84–2.78)	**0.168**

Continued

Table 3. Continued

Variables	Daily fruit and vegetable consumption		Harmful alcohol use		Adequate physical activity		HND	
	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Health status								
Poor ®	1	-	1	-	1	-	1	-
Moderate	1.15 (0.74–1.78)	0.544	0.71 (0.33–1.51)	0.365	0.62 (0.39–0.99)	**0.046**	1.32 (0.66–2.63)	0.431
Good	1.22 (0.72–2.08)	0.464	1.69 (0.77–3.75)	0.191	0.22 (0.11–0.46)	**<0.001**	1.75 (0.81–3.79)	0.155
Physical activity								
Not physically active ®	1	-	1	-			1	-
Active (not adequate)	0.95 (0.55–1.66)	0.869	0.97 (0.38–2.48)	0.954			0.28 (0.13–0.56)	**0.001**
Active (adequate)	1.03 (0.57–1.87)	0.914	1.13 (0.44–2.94)	0.792			0.17 (0.07–0.39)	**<0.001**
Alcohol use								
Not harmful ®					1	-	1	-
Harmful					1.16 (0.61–2.21)	0.65	0.9 (0.37–2.2)	0.831
Pack-years					0.97 (0.95–0.99)	**0.002**	1.06 (1.04–1.08)	**<0.001**

HND: high nicotine dependence. CVD: cardiovascular disease. Significant at p<0.05 in bold. ® Reference categories.

Table 4. Multivariate adjusted logistic regression analysis with 12-month and lifetime quit attempts as outcome among tobacco users attending DYDH, South Africa, February–July 2023 (N=400)

Variables	Categories	12-month quit attempts			Lifetime quit attempts		
		AOR	95% CI	p	AOR	95% CI	p
Age (years)		1.02	1.00–1.06	0.056	1.02	1.0–1.05	0.07
Gender	Male ®	1	-	-	1	-	-
	Female	0.68	0.41–1.13	0.138	0.62	0.39–0.98	**0.04**
Marital status	Single ®	1	-	-	1	-	-
	Married	1.26	0.63–2.48	0.513	1.65	0.90–3.02	0.108
	Other	2.02	0.87–4.70	0.102	2.07	0.92–4.69	0.078
Education level	Primary ®	1	-	-	1	-	-
	Secondary	1.43	0.78–2.60	0.246	1.04	0.61–1.78	0.865
	Tertiary	1.09	0.53–2.23	0.816	0.79	0.41–1.50	0.462
Hypertension	No ®	1	-	-	1	-	-
	Yes	0.83	0.36–1.91	0.668	1.15	0.56–3.37	0.697
Diabetes	No ®	1	-	-	1	-	-
	Yes	0.91	0.41–1.91	0.668	0.72	0.37–1.42	0.346
VTE	No ®	1	-	-	1	-	-
	Yes	0.42	0.13–1.39	0.155	0.54	0.22–1.32	0.177
Harmful alcohol use	No ®	1	-	-	1	-	-
	Yes	1.3	0.45–3.72	0.627	0.69	0.24–1.99	0.497
Health status	Poor ®	1	-	-	1	-	-
	Moderate	1.03	0.57–1.88	0.911	0.84	0.5–1.42	0.522
	Good	3.0	1.5–5.99	**0.002**	1.46	0.76–2.8	0.251
Daily fruit and vegetable consumption	No ®	1	–	-	1	-	-
	Yes	1.43	0.82–2.50	0.207	1.08	0.65–1.82	0.761
Physical activity	Not physically active ®	1	-	-	1	-	-
	Active (not adequate)	1.19	0.58–2.45	0.635	0.95	0.50–1.8	0.881
	Active (adequate)	1.28	0.54–3.0	0.573	1.46	0.45–1.98	0.884
Ethnicity	Other ®	1	-	-	1	-	-
	Black	1.36	0.74–2.50	0.98	0.34	0.20–0.58	**<0.001**
Employment status	Pensioners ®	1	-	-	1	-	-
	Employed	2.16	0.87-5.39	0.099	2.76	1.23–6.23	0.014
	Unemployed	3.11	1.28–7.6	**0.013**	2.96	1.32–6.65	0.008
Mental health problem	No ®	1	-	-	1	-	-
	Yes	1.03	0.87–5.39	0.099	0.54	0.21-1.45	0.223
Respiratory condition	No ®	1	-	-	1	-	-
	Yes	1.94	0.77–4.91	0.966	1.16	0.46–2.92	0.745
Retroviral disease	No ®	1	-	-	1	-	-
	Yes	3.89	1.56–4.91	0.162	6.25	1.93–20.2	**0.002**
CVD	No ®	1	-	-	1	-	-
	Yes	0.84	0.33–9.72	0.724	0.50	0.21–1.16	0.107
Musculoskeletal disease	No ®	1	-	-	1	-	-
	Yes	0.67	0.30–1.50	0.327	0.46	0.22–0.95	**0.037**

AOR: adjusted odds ratio. VTE: venothromboembolic. CVD: cardiovascular disease. Significant at p<0.05 in bold. ® Reference categories.

females, pensioners, and those with a mean pack-years of smoking higher than 14.5 were negatively associated with engaging in adequate physical activity (p=0.001, 0.001, and 0.002, respectively). Respondents who described their general health as good were less likely to engage in adequate physical activity (OR=0.22; 95% CI: 0.11–0.46, p=0.001). Tertiary education, being Black, and not being a pensioner were all significantly associated with engaging in adequate levels of physical activity (p=0.02, p=0.028, p=0.001, and p=0.006).

The overall prevalence of alcohol use among the study respondents was 67.7% (n=271), with 70% of Blacks, 55% of males, and 45% of females reporting alcohol use. Harmful drinking was reported by 17.3% of respondents. Being Black or unemployed was significantly associated with harmful alcohol drinking (p=0.03 and p=0.01, respectively). Harmful drinking was negatively associated with being a female or married (p=0.00 and p=0.03, respectively).

Quit attempts

In the past 12 months, 25% of respondents had attempted to quit tobacco, while 54.5% reported having tried to quit at some point in their lives (Table 1).

Among various health behaviors, consuming at least one serving of F&V daily was the only factor significantly linked to a quit attempt in the previous 12 months (OR=2.77; 95% CI: 1.63–4.69, p=0.001). Smokers diagnosed with cardiovascular disease were less likely to attempt quitting (OR=0.59; 95% CI: 0.35–0.99, p=0.044). Across all tobacco users, those who rated their general health as good and those with a respiratory illness were more inclined to try quitting (OR=1.94; 95% CI: 1.09–3.44, p=0.024; and OR=1.07; 95% CI: 1.18–3.62, p=0.001, respectively). Marital status showed a significant association, with individuals who were married or in other non-single arrangements being more likely to have made a quit attempt (OR=1.62; 95% CI: 1.05–2.50, p=0.028; and OR=2.69; 95% CI: 1.46–4.96, p=0.001, respectively), as detailed in Tables 2 and 3.

Multivariate regression analysis (Table 4) revealed that individuals who reported good overall health and were unemployed, were more likely to quit smoking within the past year (AOR=3.0; 95% CI: 1.5–5.99, p=0.002; and AOR=3.11; 95% CI: 1.28–7.6, p=0.013, respectively). In relation to lifetime quit attempts, non-pensioners regardless of employment status were significantly more likely to have attempted to quit tobacco use (AOR=2.96; 95% CI: 1.23–6.23, p=0.014; and AOR = 2.96; 95% CI: 1.32–6.65, p=0.008, respectively). Individuals living with HIV were six times more likely (AOR=6.25; 95% CI: 1.93–20.2, p=0.002). Unlike Black or females who were less likely to quit (AOR=0.34; 95% CI: 1.20–1.58, p=0.001; and AOR=0.62; 95% CI: 0.39–0.98, p=0.04, respectively).

DISCUSSION

This study found a low quit rate with poor uptake of healthy behaviors among tobacco users. The findings reveal that most tobacco users were cigarette smokers, with the majority reporting low nicotine dependence. One quarter of respondents had attempted to quit in the past 12 months and almost half of them attempted to quit at least once in their lifetime. The engagement in other healthy behaviors was minimal, with only three respondents consuming ≥5 servings of F&V daily, a third achieved adequate physical activity, and as well abstaining from alcohol. Furthermore, being unemployed, eating at least one portion of F&V daily, having a respiratory problem, living with HIV, and perceiving their general health as good, were all associated with making a quit attempt in the past 12 months among smokers. In contrast, smokers with CVD and respondents who self-identified as female or Black individuals were less likely to attempt quitting. These findings hold significance at clinical, public health level and has the potential to improve outcomes of chronic diseases care, considering that tobacco use (in particular smoking) is a traversal risk factor among most NCDs.

Only a quarter of tobacco users attempted to quit in the past year, a worrying finding in a population with high chronic disease burden as nearly half reporting CVD. This is much lower than previously reported in other studies conducted in South Africa – SASAS data in 2017 (60%)[23], in DYDH in 2019 (74%)[13], the GATS South Africa in 2021 (40.5%)[2], and the United States CDC in 2022 (53%)[27]. The low quit attempt rate observed in this study may partly be explained by the impact of the COVID-19 pandemic, particularly the temporary ban on cigarette sales in South Africa during 2020[28,29]. Restrictions during the pandemic also limited patient–clinician interactions and reduced brief cessation advice, a key driver of quit attempts[30]. While the ban initially forced some smokers to reduce or temporarily stop smoking, evidence shows that many relapsed once the ban was lifted and many purchased cigarettes through informal channels[28,29]. Consequently, when data were collected in 2023, the residual effects of these factors likely contributed to the observed low quit attempt rate in the past 12 months[28,29]. Notwithstanding the above, this trend was not observed in the USA, where the CDC reported that 53.3% of adult smokers made a quit attempt in 2022, compared with the pre-COVID-19 rate of 55.1% in 2018[27].

Although cigarette smoking was the predominant form of tobacco use among respondents, the finding that approximately one-fifth reported using smokeless tobacco (SLT) is consistent with previous South African reports, particularly among Black females[12,31]. Despite representing a minority in this study, only fewer SLT users reported having made a quit attempt, either in their lifetime or within the past 12 months. This is clinically concerning, given that SLT use is associated with an increased risk of adverse health outcomes, including various cancers[10,11], and that those who continue to use SLT may constitute a large number at population level. Notably, persistent SLT

use occurs despite high awareness of its health risks, with approximatively four out of five South African SLT users reporting knowledge of associated harms (GATS survey 2021)[2]. This pattern may reflect the addictive potential of SLT products and may partly explain the low prevalence of quit attempts among these users. These study findings therefore underscore the necessity of prioritizing SLT users for tobacco use cessation treatments just as much as cigarette smokers[10,11].

Black South Africans were less likely to attempt to quit smoking than other ethnic groups, a finding consistent with previous reports[23,32]. This finding may be explained by similar significant socio-economic disparities between the ethnic groups in South Africa, such that Black South Africans are predominantly in the lower socio-economic class and experience higher levels of psychosocial distress that in turn result in unhealthy coping mechanisms, including continued cigarette smoking[3,8]. This highlights the need to implement interventions that address the social determinants of ill health.

The level of tobacco dependence is known to influence both quit attempts and success[8,17]. Most respondents had low nicotine dependence (LND), aligning with a prior South African study showing that individuals with LND were more likely to intend to quit[8]. Smokers with LND are generally more amenable to non-pharmacological interventions such as counselling and behavioral therapy[7-9] Clinicians, particularly in primary care, should therefore be trained in tobacco dependence treatments, including brief advice and motivational counselling, which are effective in promoting quit attempts and cessation[9,13]. Tertiary education was linked to LND, which agrees with previous South African studies[9,13]. A recent publication by the Society for Research into Nicotine and Tobacco suggested that tertiary education significantly reduces tobacco use in low- and middle-income countries[3]. This may indicated that socioeconomic disparities may translate into differing tobacco cessation interventions in different socioeconomic groups and the nuances may be important for effective lowering of tobacco consumption[3].

Regarding F&V consumption, the majority of respondents did not meet WHO recommended intake. Only a very small proportion of participants met the WHO guideline, reflecting extremely low levels of adequate F&V consumption in this population. This finding is consistent with evidence from a recent national household survey in South Africa, which reported that only 0.6% of individuals achieved adequate F&V intake[25]. Collectively, these findings highlight that insufficient consumption of F&V remains a persistent public health concern in South Africa, reflecting the global trends[7,18]. Diet poor in F&V carries significant health implications for the prevention and management of NCD, particularly in a population already exposed to other unhealthy risky behaviors such as tobacco use. These findings highlight the necessity for combined interventions addressing diet and tobacco simultaneously. cessation[7-9].

Regarding physical activity, individuals with tertiary education, Black respondents, non-pensioners, and those engaging in harmful drinking were found to be more physically active. A recent meta-analysis published in 2023 found that physical activity interventions were beneficial only in the short-term, as they helped reduce cravings and withdrawal symptoms in individuals with HND[7,33]. This effect, however, did not seem to contribute to long-term smoking cessation. Furthermore, another study found that smokers who were highly physically active were more likely to consume more F&V, have lower nicotine dependence, and were more likely to have successfully quit smoking compared to less physically active smokers[34]. Although not established in our study, many researchers support the integration of physical activity as a strategy for tobacco cessation and relapse prevention[19,34].

Conjoint use of tobacco and alcohol is prevalent in South Africa[13,35]. In this study, being Black or unemployed was associated with higher likelihood of excessive alcohol consumption. These findings are consistent with other studies conducted in South Africa[13,15,35] and may be attributed to the fact that Black South Africans are disproportionately unemployed, and while those employed are likely of other ethnic groups and may have alternative methods to relieve stress, anxiety, and depression related to work, the unemployed who tend to be Black[3,4] may not. This inability to cope with stressors and negative emotions may promote continued smoking and act as a barrier to quit attempts[3,4]. Moreover, several studies have found that smokers with alcohol use disorders tend to have HND and experience difficulties in making a quit attempt[16,19]. Hence, it is strongly recommended that tobacco users consider stopping or substantially reducing alcohol consumption before or during a quit attempt[16,19].

Strengths and limitations

This is a novel study in South Africa to examine the association between quit attempts and concurrent engagement in other healthy behaviors among tobacco users in a clinical setting. This study provides valuable insight into the association between quit attempts and other health behaviors, as well as the potential role of nicotine dependence.

However, several limitations should be considered. Due to the cross-sectional design, causal inferences cannot be made. Additionally, the reliance on self-reported data for key variables may have introduced information bias and potential misclassification of both exposures and outcomes, which could have affected the estimated associations. Although multivariate analyses were conducted to adjust for relevant confounders, residual confounding from unmeasured or inadequately measured variables cannot be excluded. Finally, as the study was conducted among tobacco users attending a hospital-based clinical setting in South

Africa, the findings may not be generalizable to the broader population of tobacco users or to non-clinical settings. Despite these limitations, the results provide important insight into the relationship between quit attempts and other health behaviors, including the role of nicotine dependence, among tobacco users in a South African hospital-based setting.

CONCLUSIONS

With only one-quarter of respondents reporting a quit attempt in the past 12 months and nearly one-fifth demonstrating HND, these findings point to considerable gaps in access to tobacco cessation support in South Africa. While a causal relationship cannot be inferred from this cross-sectional study, these results suggest that improved access to evidence-based cessation support, including pharmacotherapy, is needed within the public health system. The observed co-occurrence of tobacco use with unhealthy diet, alcohol use, and physical inactivity also highlights the potential value of integrated approaches to behavior change. These findings suggest that making a quit attempt while concurrently adopting other healthy behaviors is a complex behavioral process. Future studies with larger sample sizes are required to better understand the influence of socio-economic factors, levels of nicotine dependence, co-existing health risks, and individuals' perceptions of their health status.

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The authors have each completed and submitted an ICMJE form for disclosure of potential conflicts of interest. The authors declare that they have no competing interests, financial or otherwise, related to the current work. O.B. Omole, reports that in the last 36 months, had a leadership or fiduciary role as a Council member of the College of Family Physicians of South Africa and was on the Clinical Governance committee of the Gauteng Department of Health, South Africa.

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

AUTHORS' CONTRIBUTIONS
All authors: conceptualization and design, development of the proposal, data analysis, and drafting of the manuscript. NM: the data collection. All authors read and approved the final version of the manuscript.

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