

Prevalence and Socio-Demographic Correlates of Tobacco and Alcohol Use in Four Sub-Saharan African Countries: A Cross-Sectional Study of Middle-Aged Adults

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Abstract

Background: Substance misuse is a global public health problem. In addition to social and economic concerns; consumption of tobacco and alcohol is associated with susceptibility to cardiovascular, respiratory, and infectious diseases, and cancers, as well as risk of transitioning to substance use disorders. African data suggest regional differences in the prevalence and patterns of substance use, but there is limited data from African countries. This cross-sectional population study of middle-aged adults, aims to examine prevalence and socio-demographic correlates of substance use in four sub-Saharan African countries, in rural and urban settings.

Methods: Participants aged between 40 and 60 years were recruited from six research centres as part of the Africa Wits-INDEPTH partnership for Genomic Research study. Data on patterns of tobacco and alcohol consumption was captured by questionnaire, and alcohol consumption was further assessed using the CAGE (cut-annoyed-guilty-eye) questionnaire.

Results: Data from 10703 participants suggested that more men (68.4%) than women (33.3%) were current substance users. The prevalence of current smoking was significantly higher in men than in women (34.5% vs 2.1%, $p < 0.001$). Smokeless tobacco was used more by women than men (14.4% vs 5.3%, $p < 0.001$). Current smoking was associated with alcohol consumption, and smoking cessation in men was associated with being a former drinker, higher socioeconomic status, and if married or cohabiting. Current alcohol consumption was higher in men, compared to women (60.3% vs 29.3%), and highest in men from Soweto (70.8%) and women from Nanoro (59.8%). The overall prevalence of problematic alcohol consumption among men was 18.9%, and women 7.3%. Men were significantly more likely to consume alcohol, and to develop drinking problems. Problematic drinking was more common in men, in divorced or widowed individuals, and in current smokers.

Conclusions: Regional variation in the patterns and prevalence of substance use was observed across study sites, and in rural and urban settings. The high levels of substance use recorded in this study are of concern due to the increased risk of associated morbidities. Further longitudinal data will be valuable in determining trends in substance misuse in Africa.

Background

Global data suggest that the prevalence of substance use, namely tobacco, alcohol, and recreational drugs, is increasing especially in low and middle income countries (LMIC) (1–4). The burden of substance use contributes substantially to global disability adjusted life years, morbidity, premature mortality, and increased high risk sexual behaviour (1, 2, 4–13). Substance use has been found to be associated with increased susceptibility to cardiovascular diseases, respiratory diseases, infectious diseases such as Human Immunodeficiency Virus (HIV) and tuberculosis (TB), and cancers (1, 2, 16–25, 3, 26, 7–11, 14, 15). Along with this increased risk of morbidity; substance use, specifically alcohol and drug consumption, is associated with accidents, the perpetration of domestic and other forms of violence,

and the onset of comorbid mental disorders (1, 3, 26–33, 4, 6, 7, 17–19, 23, 24). Furthermore, there is a possibility that substance use may transition to substance dependency and potential substance use disorders (3, 6, 11, 14–15).

With regard to examining socio-demographic correlates of substance use in African countries, data, although limited from studies in Kenya, Ethiopia, South Africa (SA), and others suggests that the prevalence of substance use varies regionally and between urban and rural settings (1, 2, 19–22, 24–26, 29, 30, 34, 3, 35, 36, 4, 9, 10, 13, 15, 16, 18). Studies focused on university students and adolescents in the African region, although not nationally representative suggest higher prevalence estimates than those of the general populations in those countries (3, 9, 10, 15, 20, 25, 29, 33, 34, 36). The South African Demographic and Health Survey's 2016 estimates indicate urbanisation as a potential risk factor for increased substance use, especially amongst women (26). Although many African studies are based on specifically sampled populations, e.g. people living with HIV, homeless people, people suffering from mental disorders, or university students; a consistent finding across these studies is that males are more likely to engage in harmful substance use which is consistent with global data (3, 5, 11, 12, 15, 20, 22, 23, 25, 27, 29, 30, 36, 39). Studies have also alluded to relationships between tobacco and alcohol consumption, and an increased likelihood to recreational drug use (1, 3, 15, 18, 19, 25, 29, 36, 4–7, 9, 10, 13, 14). Other correlates of substance use include age, SES, education levels, HIV status, accessibility to substances, stress, and comorbid mental disorder(s) or trauma (1, 2, 18–24, 26, 27, 29, 3, 30, 34–36, 4, 7, 9, 10, 12, 13, 15).

Considering that approximately half of global alcohol consumption occurs in Africa, regional and environment-specific data may be useful for developing intervention strategies aimed at informing communities of the dangers of alcohol consumption (26). Smoking and smoking-attributable disease burden, is a leading global risk factor for premature mortality and disability (37). According to data published in the latest edition of The Tobacco Atlas, The World Health Organisation (WHO) estimated a 52% increase in cigarette smoking in Africa since 1980 (38). Assessing the patterns of tobacco consumption in Africa may aid in strategies to reduce tobacco consumption as a whole rather than just focusing on smoking (26, 37, 38).

This paper addresses the paucity of data of substance use in African countries. Analysing the social and demographic determinants of substance use could help identify individuals at risk for substance dependence. It examines the prevalence and socio-demographic correlates of substance use in four sub-Saharan African (SSA) countries: SA (South), Kenya (East), Ghana and Burkina Faso (West). In using a cross-sectional sample of population-based middle-aged adult research participants, we seek to assess the similarities and differences between geographic regions, and different living environments within the same regions and how they affect patterns of alcohol and tobacco consumption.

Methods

Study design and participants

The participants were recruited for the primary study, the Africa Wits-INDEPTH Partnership for Genomic Research (AWI-Gen) study, which is a Collaborative Centre of the Human Heredity and Health in Africa (H3Africa) Consortium to examine genetic and environmental factors that contribute to cardiometabolic diseases in African populations (39, 40). Participants were recruited from six study sites in four SSA countries between 2013 and 2016. In SA, the sites were the MRC/Wits Agincourt Health and Demographic Surveillance System Site (HDSS) in Bushbuckridge (referred to as Agincourt), the Dikgale HDSS (now referred to as DIMAMO), and the Soweto cohort from the MRC/Wits Developmental Pathways for Health Research Unit (41–43). In Kenya, representing East Africa the study was conducted within two Nairobi slums by the African Population and Health Research Center (APHRC) HDSS in Nairobi (42). In West Africa, in Ghana, at the Navrongo HDSS Navrongo Health Research Centre, and Burkina Faso at the Nanoro HDSS Institut de Recherche en Sciences de la Santé/ Clinical Research Unit of Nanoro (45, 46).

Participants of self-reported African descent aged between 40 and 60 years were recruited through community engagement and established recruitment procedures at each of the research centres (39, 40). Exclusion criteria included: closely related individuals, pregnant women, and non-residents (39, 40). Participants were invited to complete a questionnaire requesting information on demography, family composition, marital status, education, employment, household attributes, substance use, and many other variables not applicable to this study (40). Data were captured into REDCap and underwent basic quality control (QC) (44). Further QC was completed in a PostgreSQL database after exportation.

Ethical considerations

All participants provided written informed consent prior to enrollment into the study (40). Ethics clearance for each of the study sites was approved through their relevant institutional and national ethics boards, and the AWI-Gen study as a whole was approved by the Human Research Ethics Committee (HREC) (Medical) of the University of the Witwatersrand (approval number M121029, and renewal M170880). Participant identity was protected by assigning unique study identifiers and the key linking them was securely stored at the collection site.

Measures

Substance use was firstly defined as; current substance user versus current non-user (a user was defined as a person currently consuming alcohol and/or currently consuming tobacco products (smoking, chewing, or using snuff)).

Tobacco use variables included smoking categorised as; never used, current user, or former user, based on participant responses. Age at smoking initiation and type of tobacco smoked (cigarettes, pipe, hand rolled cigarettes, and cigars - note that participants could report more than one) were also recorded. The frequency of smoking was captured as; daily (5–6 days per week), 1–4 days per week, 1–3 days per month, or less than once per month. All participants were asked if they used smokeless tobacco and if so; was it chewing tobacco, or snuff.

Alcohol use was categorised as; never consumed, current non-problematic consumer, current problematic consumer, or former consumer. Problematic alcohol use was determined according to the CAGE (cut-annoyed-guilty-eye) questionnaire (45). If the participant responded yes to at least two of the following questions: Have you ever felt that you should cut down on your drinking? Have people annoyed you by criticising your drinking? Have you ever felt bad or guilty about your drinking? Have you ever had an alcoholic drink first thing in the morning to steady your nerves, or get rid of a hangover? In the past year, did you ever have 6 or more alcoholic drinks in a single morning, afternoon, or night? Data were collected on the type of alcohol consumed (spirits, beer, homebrew, wine, or other) and the frequency of alcohol consumption (daily, 5–6 days per week, 1–4 days per week, 1–3 days per month, or less than once per month). It is important to point out that 'Other' for the type of alcohol refers to locally brewed alcohol ranging from home brewed sorghum beer in Nanoro and Navrongo, Changaa (traditional home-brewed spirit from maize, millet, or sorghum) in Nairobi, to fermented cider in Dikgale, and cider and spirits in Soweto.

Household goods were used as a proxy for SES, using a method developed by the Demographic and Health Surveys (DHS) Program (46). This method involves a principal component analysis of the SES variables (household attributes) where factor scores (factor loadings) are used to predict wealth indices (from the first principal component or factor) which in turn are categorised into quintiles (47). The partnership status of participants was categorised as; never married/co-habited, married/living with partner, or divorced/widowed. Education was reported as no formal education, primary, secondary, or tertiary education. Employment status was considered as either employed, or unemployed.

Statistical Analyses

Descriptive statistics were used to summarise the socio-demographic variables in current substance users and non-users of alcohol and/or tobacco, and the distributions were compared. Continuous variables were reported as medians and inter-quartile ranges, and categorical variables were reported as percentages. The data on the consumption of alcohol and tobacco, were analysed separately for each site according to sex, and for the combined dataset. The Kruskal-Wallis test was used to compare continuous variables between the sites. Two group comparisons for continuous and non-normally distributed variables were performed using the Mann-Whitney test and Pearson Chi-squared test, or Fishers' exact test for categorical variables to assess differences between the sexes.

To assess the correlates with alcohol use (current consumer vs non-current consumer) and abuse (problematic alcohol use vs non-problematic alcohol use), current smoking (for men either as current vs non-current smoker), smokeless tobacco use (for women), and smoking cessation (for men); multivariable logistic regression was used to calculate adjusted Odds Ratios (aORs) with 95% Confidence Intervals. We adjusted for ethnicity based on recruitment site for all logistic regressions. The analyses were performed using Stata 14.2© (49).

Results

Participants: Description of socio-demographic variables in current users and current non-users of tobacco and alcohol

The study included 10 703 participants aged between 40 and 60 years, of whom 5 895 were women (55.1%). Table 1 presents the characteristics of the participants according to current use or current non-use of tobacco and/or alcohol, stratified by study site, and for the combined sample. The overall median age was 50 years. In the combined dataset, age was significantly associated with substance use although age was not significant in four of the six study sites. Similarly level of education was significantly associated with substance use in the combined dataset, although the distribution of education levels differed across sites, and was only significantly associated with substance use in three of the six sites. Overall, there were more substance users among those with no formal education. SES (assessed using quintiles) showed differences in the distribution between substance users and non-users across sites. Substance use was variable across SES quintiles, and significantly associated across all study sites. There were more substance users among participants who had never married/cohabited or married/living with partner, than among those who were divorced/widowed. More employed participants were substance users than those that were unemployed. Complete data regarding substance use was not available for Soweto, as alcohol consumption was not recorded for Soweto women.

Tobacco use

The prevalence of current smoking was significantly higher in men than in women (34.5% vs 2.1%, $p < 0.001$). There were differences observed between the sites with the lowest prevalence of current smoking, Nanoro for both men and women (13.6% and 0% respectively), and the highest in Dikgale for men (63.4%) and in Soweto for women (4.9%) (Table 2). The median age of smoking initiation was 20 (17–24) years old for both sexes. Cigarettes were the most consumed type of smoking tobacco, followed by hand-rolled cigarettes and pipes. For men, Nairobi had the highest prevalence of former smokers (29.3%), and Nanoro had the lowest percentage of former smokers (11.7%). Smokeless tobacco was used more by women overall (14.4% vs 5.3%, $p < 0.001$), and chewing tobacco (7.1%) more so than snuff (5.4%) across all sites. The type and frequency of smoked tobacco was not available for Agincourt and Soweto, and smokeless tobacco data was unavailable for Soweto.

Alcohol consumption

The patterns of alcohol consumption per site, and for the combined sample (All) are presented in Table 3. In the combined sample, the percentage of lifetime abstainers (never consumed) was more than twofold higher among women than men (52.4% vs 23.8%). Overall, current consumers were more likely to be male, and men in Soweto (70.8%) and women in Nanoro (59.8%), had the highest percentage of current consumers across sites. The lowest prevalence of current alcohol consumption was observed in Nairobi (33.9% of men and 5.9% of women). Non-problematic drinkers were highest in Soweto (70.8%) for men, and in Nanoro (50.2%) for women. Navrongo had the highest rate of problematic drinking (50.1% men

and 15.3% women). Former consumers were highest in Nairobi (37.1%) for men, and Navrongo for women (24.3%). Among the sites, Nanoro had the highest prevalence of daily alcohol consumption, whilst Dikgale had the lowest. There were differences in the types of alcoholic beverages consumed at each site, despite homebrewed alcohol and beer being most popular in all sites (Table 3). Approximately 21.7% of men felt that they should cut down on alcohol consumption, and 8.6% of women felt the same. Alcohol consumption-based guilt was felt by 16.9% of men and 5.1% of women. Binge drinking (> 6 alcoholic drinks) was observed at a higher prevalence in men than in women (9.6% vs 2.5%, $p < 0.001$) (Table 3). Data on alcohol consumption was not collected for Soweto women, nor was the frequency of consumption and CAGE questionnaire responses available for Soweto men.

Multivariable logistic regression analysis of problematic drinking

In the site (proxy for ethnicity) adjusted analysis; SES, age, level of education, and employment status were not associated with problematic alcohol use when pooling the data from all sites (Fig. 1; Supplementary Table 1). Being male, and being divorced/widowed was associated with increased likelihood of alcohol abuse with respective aOR of 3.23 (95% IC [2.72–3.82]) and 1.61 (95% IC [1.12–2.32]) (Supplementary Table 1). These associations differed at the site level, and being male was the only consistent risk factor across all sites with aOR ranging from 1.91 (95% IC [1.36–2.69]) in Nanoro, to 8.15 (95% IC [1.34–49.66]) in Agincourt. Higher SES was associated with reduced odds in Nairobi, whereas in Nanoro it was associated with increased odds of having a drinking problem. When assessing the effects of tobacco consumption on problematic drinking, tobacco users showed increased likelihood of problematic alcohol consumption with aOR = 3.84 (95% IC [3.24–4.57]) for current smokers, and aOR = 2.07 (95% IC [1.70–2.52]) for smokeless tobacco users.

Analysis of current smoking in men

There were too few women smokers for meaningful analysis, so only men were included in this analysis. Multivariable logistic regression suggests that SES (4th and 5th quintiles), being married/living with partner, and tertiary education were significantly associated with a reduced likelihood of being a current smoker (Fig. 2). Having only primary school education, and alcohol consumption were associated with increased odds of being a current smoker (Fig. 2). In Nairobi (aOR = 1.04, 95% IC [0.37–2.9]) and Navrongo (aOR = 1.22, 95% IC [0.90–1.65]), being employed showed an increased likelihood of being a current smoker (Supplementary Table 2).

Correlates of smokeless tobacco use

Overall results across all sites, suggest that smokeless tobacco was more likely if the participant consumed alcohol (current non-problematic alcohol consumer aOR = 2.99 95% CI [2.41–3.70]; current problematic aOR = 4.52 [3.50–5.83]; former consumer aOR = 2.74 [2.21–3.39]) or were former smokers (aOR = 1.58, 95% IC [1.20–2.09]) (Fig. 3, Supplementary Table 3). On the other hand, current smokers were less likely to use smokeless tobacco (aOR = 0.37, 95% IC [0.26–0.51]). Men were significantly less likely to

use smokeless tobacco (aOR = 0.30, 95% IC [0.24–0.37]). Figure 3 provides a graphic summary of the results from the multivariable logistic regression performed.

Multivariable logistic regression analysis of smoking cessation in men

Results suggest that the adjusted odds ratio (aOR) for smoking cessation increased with higher SES (4th and 5th Quintiles), being married/living with partner, and having stopped drinking (Fig. 4). Current alcohol consumption was correlated with a lower likelihood of smoking cessation (Fig. 4; Supplementary Table 4).

Discussion

In this study we reveal complex regional patterns of tobacco and alcohol consumption in six communities across four SSA countries. In the total cohort, almost half (49%) of all participants, men and women, either consumed tobacco products or alcohol, or both. Men were more likely to be current smokers than women (34.5% vs 2.1%), in line with global studies (16, 17, 21, 37), but more women (14.4%) used smokeless tobacco (snuff and chewing tobacco) than men (5.3%), with some regional variation. Overall, being a current smoker was associated with alcohol consumption, lower education levels and was less common among married individuals or those living with partners. Alcohol consumption was also more common among men, but had higher prevalence than smoking in both sexes (60.8% of men and 29.3% of women). Problematic alcohol use was associated with being male, widowed or divorced and using tobacco products (smoking and smokeless use).

Results for each of the sites showed a much higher prevalence of smoking in the AWI-Gen cohort compared to the age-adjusted prevalence for men in their respective countries in 2015 (Nanoro 13.6% vs Burkina Faso 12.5%, Navrongo 42.0% vs Ghana 5.8%, Nairobi 23.5% vs Kenya 14.9%, and Agincourt 27.2%, Dikgale 63.4%, and Soweto 52.8% vs South Africa 21.9%) (37). Patterns of tobacco use were highly sex-specific, with smoking tobacco most common among men and women preferring snuff or chewing tobacco, supporting previous findings in SA, Ethiopia, the Gambia, Kenya and Angola (2, 4, 12, 13, 18, 20–22). In the combined sample, more than half of the men ever smoked, and 34.5% were current smokers. A similarly high prevalence of current smoking was previously reported in men from other African countries (2, 4, 12, 13, 18, 20–22). Age was neither strongly correlated with current smoking nor smokeless tobacco consumption in our study. Adults in the highest wealth categories and those who had attained higher education levels were less likely to use tobacco products, in concordance with previous studies in Africa (2, 4, 12, 13, 18, 20–22). Alcohol consumption was strongly associated with tobacco use. Furthermore, former smokers appeared to be more likely to consume some form of smokeless tobacco, which suggests that there may be a substitution process at play, whereby people who stop smoking start to use smokeless tobacco products. Smoking cessation was significantly associated with the highest SES quintiles, being married/living with a partner, and ceasing to consume alcohol. Within the

AWI-Gen study, smoking was less common among adults with tertiary education and if they did smoke, they were more likely to stop smoking than those with lower levels of education.

Overall current alcohol consumption (both problematic and non-problematic) was present in 40.5% of the AWI-Gen cohort. The lower prevalence of alcohol consumption among women, as well as the decreased likelihood to engage in harmful alcohol consumption has been attributed to social and cultural stigmas surrounding women who consume alcohol. This finding is supported by several studies in different African contexts (1, 3, 4, 6, 11, 15, 18, 19, 23–25, 27, 29, 30, 36, 38). Lifetime alcohol abstainers were more prevalent in East and South (Kenya and South Africa) Africa, compared to West Africa (Burkina Faso and Ghana). This difference was found to be more defined among women, with women in Nairobi (Kenya), Agincourt, Dikgale, and Soweto (South Africa) more likely to abstain from alcohol than participants in Navrongo (Ghana) and Nanoro (Burkina Faso). The frequency of daily alcohol consumption was highest among men in Nanoro (27.2%) and 10.3% of women in Nanoro were daily consumers. This trend of high daily alcohol consumption in both sexes was also observed during the national WHO-STEPs survey in 2013 in Nanoro where 26.2% of men and 16.7% of women were identified as daily alcohol consumers (46).

Differences in alcohol use were observed between the West African sites, Nanoro and Navrongo, despite having similar rates of alcohol consumption. Navrongo reported a much higher prevalence of problematic alcohol consumption (31.2%) than Nanoro (12.5%). In Navrongo, spirits were also more popular than in Nanoro. Binge drinking was found to be highest among men in Dikgale and Agincourt, corroborating previous data suggesting that SA has one of the highest rates of alcohol consumption per capita in the world (1, 31). Binge drinking was the main feature of problematic alcohol consumption together with the feeling of needing to “cut down”. It also appears that social pressure through criticism (“people criticising you”) was most prevalent in Navrongo, followed by Dikgale. In Agincourt however, there was little criticism toward drinkers, leading to less feelings of guilt by alcohol consumers. In this study of older adults, between 40 to 60 years, age was not significantly associated with problematic alcohol consumption. In other studies, age was significantly associated with problematic drinking, but these studies covered a much wider age range (10, 18, 24, 27). Across the combined dataset, problematic drinking was not significantly correlated with SES, but SES associations were complex and varied at site level. A recent cross-sectional study examining correlates of alcohol use in the slums in Kenya suggested that alcohol use was associated with higher income (13). In our study, alcohol consumption was highly correlated with tobacco use, likely reflecting addictive behavior, rather than a preference for one substance above the other. This correlation has been observed in many cross-sectional studies that were also not designed to reveal the likely sequence of substance use behaviours (2, 4, 5, 7–12, 14, 15, 18, 22, 23, 27, 30, 32, 33, 36, 38). Current (problematic and non-problematic) and former drinkers were more likely to use tobacco products than those that had never consumed alcohol.

To our knowledge, this is one of the larger cross-sectional African population study of multi-site comparisons of the prevalence of both tobacco and alcohol consumption with related sociodemographic correlates. Patterns of tobacco and alcohol consumption show sex specific, regional (East, West, South

Africa), as well as within region differences. These differences may be due to the differences in socioeconomic transition, but may also be affected by different national policies related to the regulation and taxation of tobacco and alcohol products, in turn affecting accessibility to those substances (37, 48). In addition, there are differences across religions and cultural beliefs which are known to influence patterns of tobacco and/or alcohol consumption (1, 3, 4, 6, 11, 15, 18, 19, 23–25, 27, 29, 30, 36, 38).

Limitations

This cross-sectional study was not designed to infer causality. We cannot infer the temporal sequence of substance use from these data. We assessed data only for persons aged between 40 and 60 years which is not representative of the general population. The data generated from a single community cannot be generalised to be representative of an entire country, they only represent specific regions. Under-reporting of substance use may have occurred due to cultural differences within regions, as women would be less likely to report substance use as it may be stigmatising. The study also did not assess the motivations behind substance use and possible abuse, and because the CAGE questionnaire asks sensitive questions, participants may not have answered the questions honestly and objectively, possibly leading to under-reporting of problematic drinking.

Conclusion

This study reports the prevalence and socio-demographic correlates of alcohol and tobacco consumption in four SSA countries (Burkina Faso, Ghana, Kenya, and South Africa). Sex, SES, and education had varying effects on tobacco and alcohol consumption both regionally and by study site. Our results showed the prevalence of substance use, the sex-differences in the type of tobacco products consumed, and the patterns of alcohol consumption per site and as a whole. The high prevalence of alcohol consumption and problematic alcohol use is of concern and policies should be strengthened on a macro level in order to combat this high prevalence of substance use in SSA (37, 48). Individual behavioural changes may be more difficult to achieve without addressing them from a broader perspective, such as product-specific taxation, proactive monitoring and regulation, and limiting access to substances. Our results provide insight and understanding into trends of tobacco and alcohol consumption in African communities in rural and urban settings, which is vital for the development of policies and interventions which may assist in reducing the burden of disease and mortality associated with substance use in Africa.

List Of Abbreviations

aOR, adjusted odds ratio

AWI-Gen, Africa Wits-INDEPTH Partnership for Genomic Research Study

HDSS, Health and Demographic Surveillance System

HIV, Human Immunodeficiency Virus

LMIC, low and middle income countries

Q1-Q5, first to fifth quintile for socioeconomic status

QC, quality control

SES, socioeconomic status

SA, South Africa

SSA, sub-Saharan Africa

TB, Tuberculosis

Declarations

Declarations

None

Ethics approval and consent to participate

Ethics approval was obtained from the University of the Witwatersrand (Wits) Human Research Ethics Committee (HREC) for AWI-Gen which included approval for the Wits sites at DPHRU (Soweto) and Agincourt (M121029, Renewal M170880). Each of the research centres outside of Wits applied for ethics approval in accordance with their national regulations. Dikgale (DIMAMO) (University of Limpopo, Medunsa Research and Ethics Committee (MREC) MREC/HS/195/2014:CR), APHRC (The Ethics and Scientific Review Committee AMREF P114/2014), Nanoro (The Institutional Ethics Committee of Centre Muraz 015-2014/CE-CM), and Navrongo (Ghana Health Service Ethical Review Committee GHS-ERC 05/05/14). All participants were required to sign an informed consent document stating their willingness to share and have stored both their anonymised collected data and biospecimens. A withdrawal clause was included which makes provision for participants to withdraw from the study. It also specifies that any anonymised data already within the public sphere cannot be withdrawn.

Consent for publication

All authors agree to publication.

Availability of data and materials

All data generated or analysed during this study are included in this published article [and its supplementary information files]. The datasets generated and/or analysed during the current study are not yet publicly available but are available from the study principal investigator on reasonable request.

The majority of the AWI-Gen phenotype data variables will be deposited into the European Genome-Phenome Archive.

Competing interests

The authors declare that they have no competing interests.

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Author contributions

RPB analysed the data, interpreted the results, and co-drafted the manuscript. He was also part of the Nanoro research team as study-coordinator during data collection. CCS performed the literature review and co-drafted the manuscript. She contributed to the original development of the AWI-Gen questionnaire. CD interpreted the results and gave input regarding data from Navrongo. SN provided an expert interpretation and background of substance use in South Africa. SM helped draft and lay out the manuscript as senior author along with MR who is the principal investigator for AWI-Gen. Her input and experience ensured data, analysis and interpretation were accurate. All co-authors read and approved the final manuscript.

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Tables

Due to technical limitations, table 1 to 3 xls are only available as a download in the Supplemental Files section.

Figures

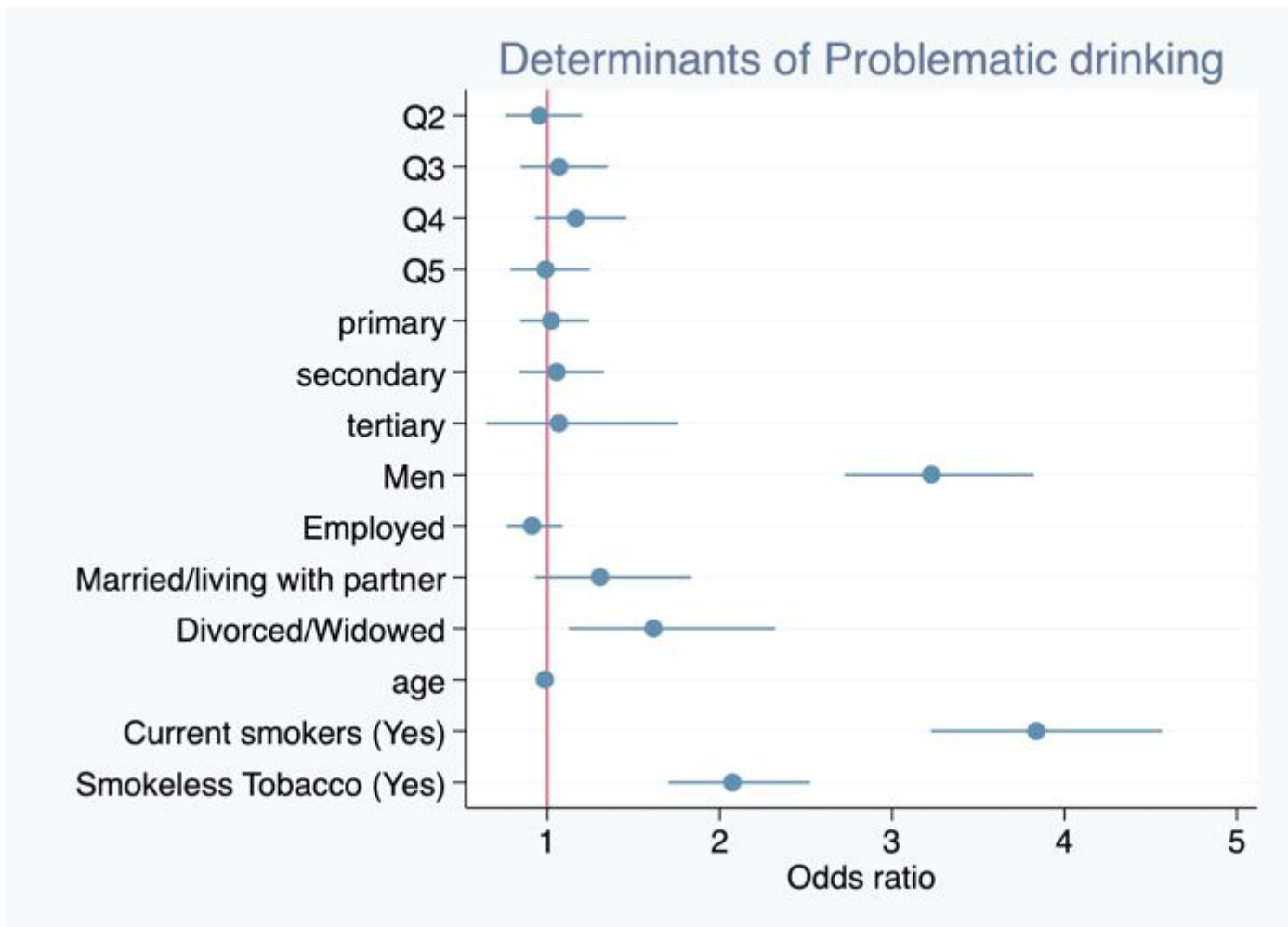


Figure 1

Forest plot depicting the aORs for the determinants of problematic alcohol consumption in men and women for the combined dataset (Legend) Figure 1 shows the Forest plot of multivariable logistic regression coefficients (95% Confidence Intervals) for the association of problematic drinking with socio-economic status (SES quintiles) (Reference=Q1), highest education level (Reference=No formal education), sex (Reference=Women), employment status (Reference=Not employed), marital status (Reference=Single), age, smoking status (Reference=current non-smokers), smokeless tobacco use (Reference=smokeless tobacco non-user). The model adjusted for site as a proxy for ethnicity based on location of research centre (N=8 486).

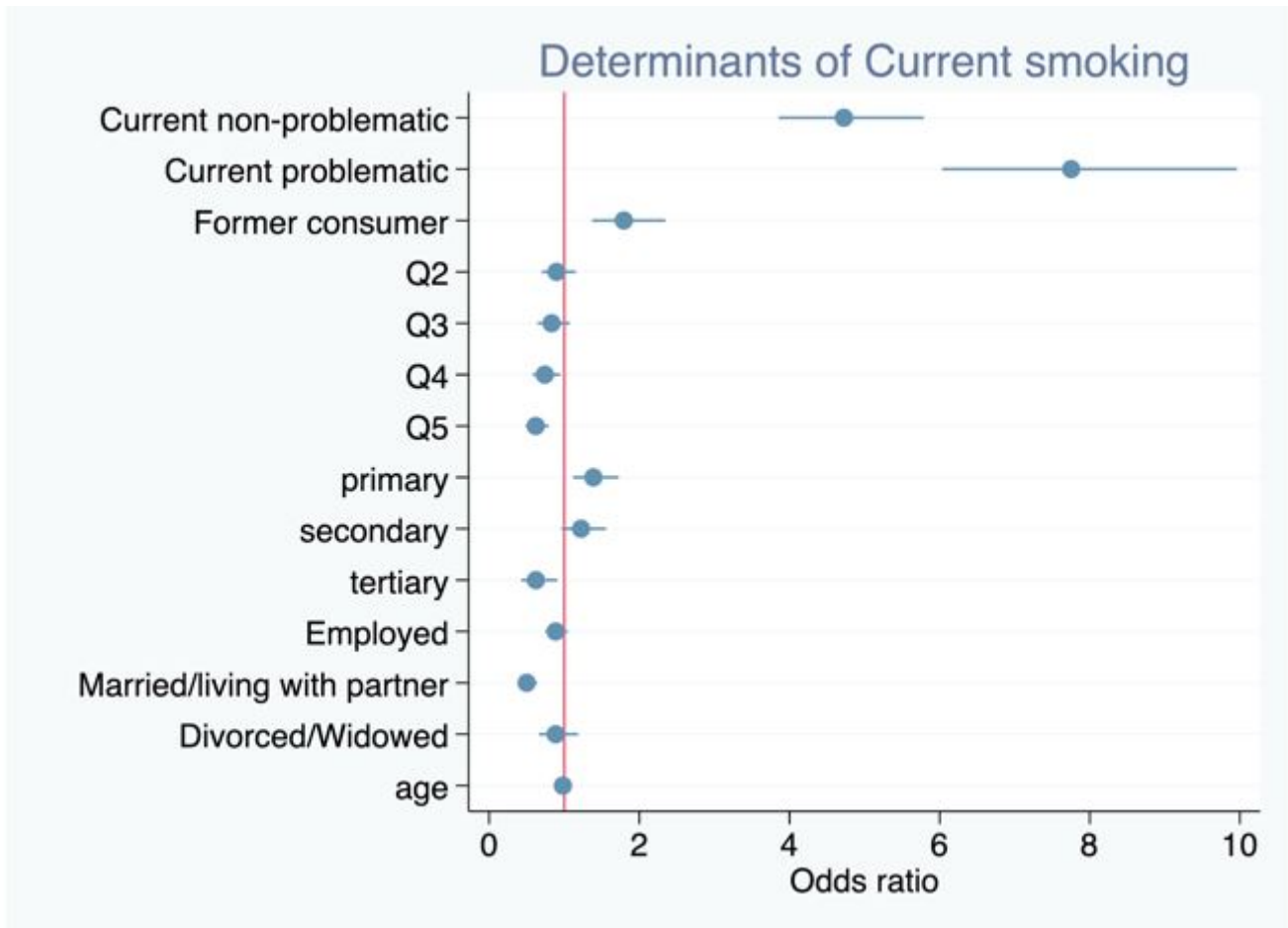


Figure 2

Forest plot showing the correlates of current tobacco smoking for men only (Legend) Figure 2 is the Forest plot of regression coefficients (95% Confidence Intervals) for the association of current smoking in men with socio-economic status (SES quintiles) (Reference=Q1), highest level of education (Reference=No formal education), employment (Reference=Not employed), marital status (Reference=Single), age, alcohol consumption (Reference=never consumed). Model adjusted for site as a proxy for ethnicity. Estimates for men only (N=4 734).

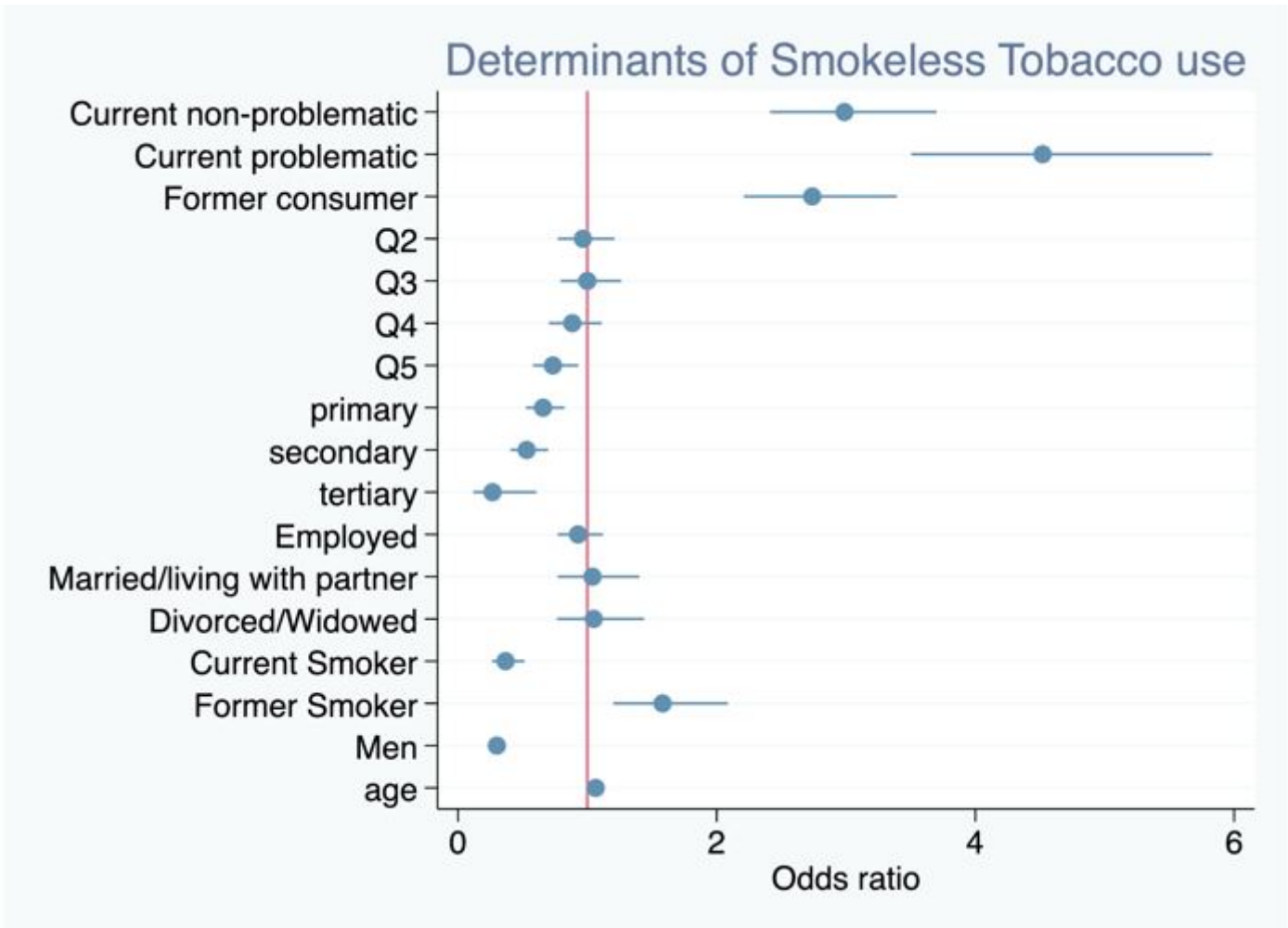


Figure 3

Forest plot indicating the site aORs for the correlates of smokeless tobacco consumption (Legend) Figure 3 depicts the Forest plot of regression coefficients (95% Confidence Intervals) for the association of smokeless tobacco use with socio-economic status (SES quintiles) (Reference=Q1), highest level of education (Reference=No formal education), employment (Reference=Not employed), marital status (Reference=Single), age, sex (Reference=Women), alcohol consumption (Reference=never consumed), smoking status (Reference=Never smoked). Model adjusted for site as a proxy for ethnicity. (N=8 485).

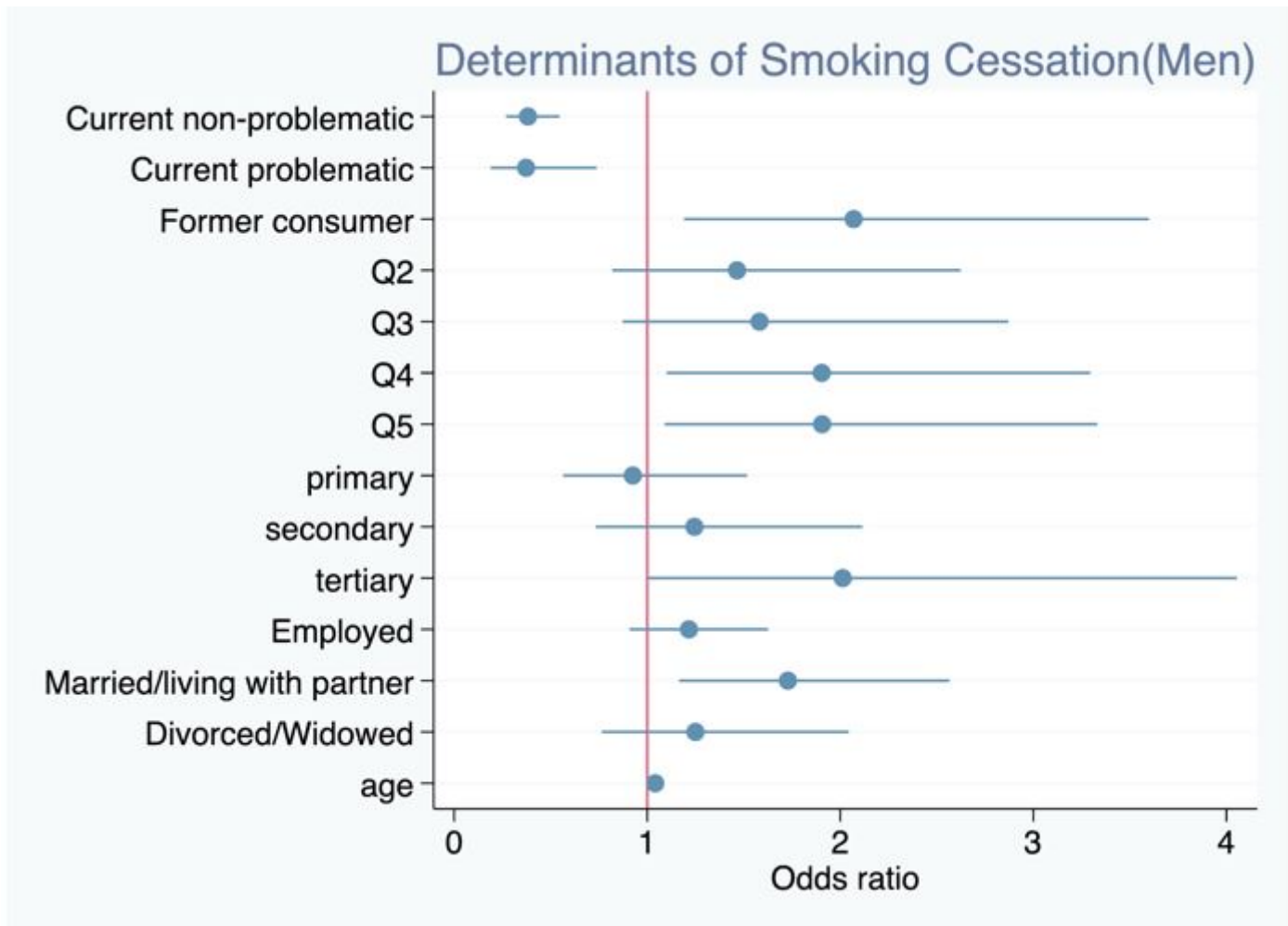


Figure 4

Forest plot showing the correlates of smoking cessation in men Forest plots of regression coefficients (95% Confidence Intervals) for the association of smoking cessation in men with socio-economic status (SES quintiles) (Reference=Q1), highest level of education (Reference=No formal education), employment (Reference=Not employed), marital status (Reference=Single), age, alcohol consumption (Reference=never consumed), smoking status (Reference=Never smoked). Model adjusted for site as a proxy for ethnicity. Estimates for men only (N=2 102).

Supplementary Files

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