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Tobacco consumption and non-communicable diseases in Ghana; Identifying accentuating factors and further evidence from 2014 Ghana demographic and health survey

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ABSTRACT

Background: Non-communicable diseases such as hypertension, diabetes, strokes, cancers and chronic kidney conditions have caused disabilities and negatively impacted on economic development. While greater efforts of controlling these non-communicable diseases are clinically motivated, the non-clinical factors such as behavioural lifestyle and the associated accentuating factors have not been given due attention. It has been established elsewhere that, tobacco use which is a risk factor for non-communicable diseases occurrence is influenced by individual's residential status, educational status, occupational status, income level and access to media projections. This study therefore sought to identify associations between accentuating factors and tobacco use and its implications for the occurrence of non-communicable diseases prevalent in Ghana.

Methods: This was a mixed method study involving in part, use of secondary data from the Ghana Demographic and Health Survey 2014 with a sample of 4,122 respondents and primary qualitative interviews of 32 respondents respectively, from 4 Regions of Ghana. Descriptive statistics, probit regression and content thematic analysis were used for data analysis for both the quantitative and qualitative arms respectively.

Results: The study found that, there was statistically significant association between educational status and tobacco use *[X^2 (5, 4,123)=164.5619; $p = 0.000$]*, income levels and tobacco use *[X^2 (7, 4,123)=68.5615; $p = 0.001$)*, occupational status and tobacco use [X^2 (8, 4,123)=195.6919; $p = 0.000$], residential status and tobacco *[X^2 (3, 4,134) = 82.7824; $p = 0.000$)]* and finally, access to mass media and tobacco use *[X^2 (2, 4,134)= 1.2352, $p = 0.009$]*. Again, the regression result shows that, the accentuating factors determine about 51% (50.579) of the tobacco use by individuals in the relation [$R^2 = 0.305$, F(17, 4,077) = 50.579, $p = 0.000$]. Moreover, 62.4 percent of females were less likely to smoke

Abbreviations: GDHS, Ghana Demographic and Health Survey; NCDs, non-communicable diseases; PLWNCDs, peoples living with non-communicable diseases; FCTC, framework convention on tobacco control; TTI, theory of triadic influence.

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than males. Within the educational levels, secondary school completion category influence smoking by 82.8 percent. Also, assessing the relations between wealth quintiles and smoking, the study found that, the middle class income earners category influence smoking by 53.4 percent. Lastly, in the residential status, living in rural area contributed 41 percent to tobacco use. The implication is that, urban dwellers are more likely to use tobacco than rural dwellers.

Conclusion: The study concludes that, educational status, residential status, occupational status, wealth quintiles and access to media accentuates tobacco use within a population with implications for the occurrence and control of non-communicable diseases. The study calls for a strengthening of the WHO Framework Convention on Tobacco Control in Ghana.

Introduction

Achieving good health in developing countries is a major challenge [1–3]. Low resource countries continue to scuffle with double burden of non-communicable diseases (diabetes, hypertension, strokes, cancers, chronic kidney conditions) and communicable diseases (Turberclosis, HIV AIDS, and among others) [4]. Systematic review on evidence for acquiring non-communicable diseases (NCDs) clearly implicates behavioural lifestyle, biological and genetic risk factors [2,5,6]. One such behavioural lifestyle is tobacco use which continues to remain an important risk factors for NCDs. This study aims to fill a gap in theory and practice. Theoretically, not much studies have been conducted in investigating these accentuating factors in relation to tobacco use with consequential effects on NCDs occurrence [2,5,6,10]. Also, most studies have reported tobacco as a major risk factor to NCDs occurrence. However, the practical orientation of what is remotely pushing people into tobacco use which has been termed 'accentuating factors' in this study has not been investigated.

The accentuating factors of differences in social factors (educational level, residential status), economic factors (income status, occupational status), and political factors (access to media, government regulations) have been mentioned as among the key factors influencing tobacco use and the later having implications for NCDs such as cancers, heart disorders and other respiratory disorders [7–10].

A previous study has projected that, by 2030, there will be approximately 26 million new cancer cases and 17 million cancer deaths per year [8]. The authors also reported that, low-and middle-income countries accounted for about 51% of all cancers worldwide in 1975; 55% in 2007 and is projected to reach 61% by 2050. Another study also projected that, by 2030 there will be 70% increase in new cancer cases due to population growth and aging [9]. The impact of tobacco use has been noted across geographical spectrum. For instance in Brazil, smoking is responsible for considerable number of deaths emerging out of cardiovascular diseases and neoplasms [10].

Social, economic and political factors have been mentioned as major influence on tobacco use [11]. Studies have found that, differences in the educational level of a population may influence the degree of tobacco use and hence manisfestation of NCDs [12]. Owusu-Dabo et al. [7] reported that, heavy smoking was predominant among men and women with low educational status. Similarly, a study in India noted that, tobacco use and hypertension were prevalent among lower educational groups [13].

Studies have also shown the influence of a person's economic status on health outcomes. These economic influences include occupational status and income levels. In the study of Ferman and Gardener [14], and Owusu-Dabo et al. [7], the researchers found that, prolonged periods of unemployment are also associated with unhealthy lifestyle such as excessive smoking which is associated with health problems such as the occurrence of heart related diseases, mental disorders, cancers, among others. Previous studies in the USA grounded on the cost-of-illness approach disclosed that use of tobacco products and exposure to second-hand smoke were associated with excess health-care use, expenditure and lost of productivity [15,16].

Again, government regulations and compliance on tobacco use may determine tobacco exposure, availability, affordability and the categories of people accessing these products [17–19]. For instance, Ghana established a multidisciplinary stakeholder team for formulating tobacco control policies in 1993 [20,21] Despite the enforcement of advertising ban, observation of 'World No Tobacco Day', enforcement of ban on smoking in public places, tobacco use still exist in some communities and NCDs such as hypertension, strokes, respiratory disorders and cancers are among the top 10 causes of hospital admissions and deaths [22–26].

In many African countries, including Ghana, global interventions on NCDs reduction have concentrated on curative measures [3,27–29]]. In the meantime, tobacco use accentuating factors are almost neglected [8,9,10]. Health conditions emerging out of tobacco use continue to surge globally. The need to reduce the prevalence of these conditions is necessary espe-

cially through the identification of accentuating factors responsible for tobacco use. We therefore identified some factors that influence tobacco use and its implications to NCDs occurence using the GDHS 2014 data and some qualitative interviews to guide policy interventions for tobacco control.

Theoretical perspective

Theory of triadic influence

The theory of triadic influence (TTI), an integrative theory for health associated behaviors developed by Flay, Snyder and Petraitis in 1994, underpins the current study. This theory is one of the most consolidative theories that highlights behavior as being the result of three strands of causes of behavior (*intrapersonal*, *interpersonal*, and *sociocultural-environmental)* flowing through levels of causation (ultimate → distal → proximal). Factors in each of the three strands interrelates. All the 3 strands inform decisions on intended behavior. The basic political economy variables of (residential status, educational status, occupational status, wealth quintiles and access to media projections) emerging out of th tridiac of social, economic and political strands accentuate tobacco use within the population. Flay et al. in their 1994 report indicated that, the TTI was used to conduct a screening study on vaccination. This suggest that, this model is equally suitable for studies concentrating on identifying the accentuating factors of tobacco use. TTI is therefore a suitable theory in formulating appropriate policies to reduce the effects of accentuating factors on tobacco use which has implications for non-communicable diseases control in Ghana.

Methods

Study setting

The study was conducted in Ghana between 2018 and 2020. A national survey data collected by the Ghana Statistical Service was used. This was supplemented with field work in four (4) regions in Ghana (Ashanti, Brong Ahafo, Nothern and Greater Accra). In each Region, two communities (urban and rural) were chosen.

Study design

The study adopted mixed methods to address the objective. The qualitative arm was primarily the first hand information obtained from the in-depth interviews, while the quantitative arms employed data from the Ghana Demographic and Health Survey (GDHS), 2014.

Qualitative study

A total of 32 qualitative interviews were conducted. This involved 15 in-depth interviews (IDIs) from patients living with an NCD, 11 key informant interviews (KIIs) involving 6 primary health care professionals, and 5 health care policy makers and 6 focus groups discussions (FGDs) among community members who were not necessarily NCD patients.

Quantitative study

The quantitative arm used the sixth round of the GDHS, published in 2014. The GDHS is a series of population and health surveys conducted in Ghana every five years. Currently, the 2014 GDHS is still the most recent survey. The GDHS is a nationally representative survey of 9396 women and 4388 men from 11,835 interviewed households. The primary purpose of the GDHS is to generate reliable information on fertility, family planning, infant and child mortality, maternal and child health, nutrition, non-communicable diseases and their risk factors, among others. For instance, the GDHS collects data to inform policy based on the tobacco regulations itemized in Articles 61 to 68 of the Public Health Act of 2012, (Act 851). The Act, in Article 64, clearly prohibits the sale of tobacco without adequate labeling of its hazards. Again, legal provision for incorporating tobacco education on hazards of smoking into school health programmes is given in Article 66 (4) of Act 851 which also affirms Ghana's commitment to the WHO Framework Convention on Tobacco Control (2003). All the six (6) rounds of GDHS collected data on male and female smoking habits (kinds of tobacco used, socioeconomic status, frequency of tobacco use, geographical region and tobacco use, and many other variables such as age, residential status, educational status, among others. The GDHS is therefore the largest health data collected every 5 years in Ghana. At the time this research started in 2018, the most current GDHS was the 2014 data, Currently, the 2021 GDHS is in the process.

Sampling

The sample for the qualitative studies involved in-depth interviews from 15 NCDs patients, 11 key informant interviews (health care professionals and health care policy makers) and 6 focus groups discussions (FGDs) conducted with males and females in separate groups.

The NCDs patients were selected by simple random sampling technique using the NCDs patients' hospital attendance list. The key informants were purposely recruited using their knowledge and authority in NCDs issues. These respondents were health care professionals such as Doctors, Nurses, Pharmacists, NCDs focal persons and Directors at the Ministry of Health, Ghana. The FGD respondents were purposefuly selected using age status, gender, socioeconomic status, residental status, occupational status, and among others.

Concerning quantitative sampling, of the 13,784 respondents in the 2014 GDHS [30], our study filtered the data using age limit of 30 years and above, socioeconomic status, tobacco use status and non-communicable diseases status to obtain 4122 respondents.

Ethical considerations

The quantitative part of the study used the GDHS 2014 data. The Institute of Statistical, Social and Economic Research (ISSER) at the University of Ghana released the raw data of GDHS after written permission was sought. The study was approved by the Research and Development Unit of Komfo Anokye Teaching Hospital, Kumasi. The study followed all the ethical principles from selection of samples within the population, interview process, data management and data analysis. Respondents were also assured of confidentiality of information given. They were also informed of the right to exit the interview process at any time without any penalty. Respondents were told that, they may not get any direct benefits from participating in the study but their information given would inform policy to shape tobacco use in Ghana. All respondents consented to participate in the study voluntarily and were given consent forms to sign and date.

Data collection

The main tool used for the qualitative interviews were interview guides based on the objectives of the study. The sectioning of the in-depth interview guides were categorized under bio-data, respondents impression about residential status, educational status, wealth status, occupational status, access to media projections and their implications for tobacco use. With the persmission of the repondents, their voices were recorded.

The quantitative data were collected directly from the raw data of the 2014 GDHS. The entire questionnaire of the GDHS was consulted and compared to the actual raw data collected. The key variables of interest relating to smoking, social, economic and political issues were then picked and recoded.

Selection of study variables

The selection of both qualitative and quantitative variables were informed by the study objectives, the study design, the study approach, the composition of the study population and the expected variable descriptors (dependant or independent) as shown on Tables 1 and 2. An additional consideration was also given in the selection of the quantitative variables in relation to the effect size.

Table 1
Qualitative data extraction.

Global Themes	Organizng Themes	Basic Themes	Definition of Terms	No. of Respondents	Sample Quotations of Repondents
Accentuating factors influencing tobacco use and the implictions for NCDs control	Age and tobacco	Views of respondents	Age defined as standard cohorts	Number of respondents responding to this organizing theme in the transcript.	Best respondents feedback matching this organizing theme.
	Gender and tobacco use	Views of respondents	Gender defined as male / female	Number of respondents responding to this organizing theme in the transcript.	Best respondents feedback matching this organizing theme.
	Educational status and tobacco use	Views of respondents	Educational status categorised as primary, secondary and tertiary	Number of respondents responding to this organizing theme in the transcript.	Best respondents feedback matching this organizing theme.
	Residential status and tobacco use	Views of respondents	Residential status defined as rural / urban	Number of respondents responding to this organizing theme in the transcript.	Best respondents feedback matching this organizing theme.
	Occupational status and tobacco use	Views of respondents	Occupational status defined as professionals, clerical, sales, skilled and unskilled	Number of respondents responding to this organizing theme in the transcript.	Best respondents feedback matching this organizing theme.
	Waealth quintiles and tobacco use	Views of respondents	Wealth quintiles defined as poorer, middle poor, richer, and richest	Number of respondents responding to this organizing theme in the transcript.	Best respondents feedback matching this organizing theme.

NOTE: Cateogrised field data into themes, response pattern and means of selecting best sample quotes.

Table 2
Quantitative data extraction.

Objective	Variables	Classification	Initial Action	Final Action
Accentuating factors influencing tobacco use and the implictions for NCDs contol	Age	*> 30 years, < 100 years	Selected from GDHS.	Recoded into: *30–45 years *46-60 years *61^{+} years
	Gender	*Male *Female	selected from GDHS.	Recorded as: Female =1, other wise =0
	Educational status	*none *primary *secondary *Tertiary	selected all from GDHS	Recoded exactly as in GDHS
	Residential status	*Rural *Urban	selected all from GDHS	Recorded into Rural =1, other wise = 0.
	Occupational status	* Professional *Non-Professional *Sales *Services *Agricultural-SE *Agricultural-E *Skilled *Unskilled	selected all from GDHS	Recoded exactly as in GDHS
	Wealth Quintiles	* Poorer *Middle Poor *Richer *Richest	selected all from GDHS	recoded exactly as in GDHS
	Access to media	GDHS caputured access to media as 'ownership of the gadget"	Access to media information was selected	Recoded into: *No access to media information at all. *At least access to media information once a week. *More than one access to media information once a week

Data extraction

In extracting both quantitative and qualitative data, due coniderations were also given to the study objectives, the study design, the study approach and the composition of the study population.

Qualitative data extraction

The thematic extraction used the format of Jennifer Attride-Stirling, 2001 as shown on Table 1.

Quantitative data extraction

In extracting the quantitative data, the main questionnaire of the 2014 GDHS was consulted. Questions pertaining to the accentuating factors affecting individual's tobacco use were noted and coded. These include incidence of tobacco use, frequency of tobacco use and general use of tobacco in any form. Again, issues relating to the various NCDs were also noted and coded. All responses that fell into this category were selected for the study as shown in Table 2.

Data analysis

Qualitative analysis

First, thematic analysis was employed to ascertain the accentuating factors for tobacco use and its implications for NCDs occurrence. The thematic analysis used the format of Jennifer Attride-Stirling, 2001. All the transcripts were coded and coding frame was developed to ascertain respondents response pattern in the interviews. The various global themes in the study were identified to develop the thematic framework. These global themes were broken down into organizing themes using the objectives of the study. We also looked at the basic or emerging themes relating to the coded transcripts (text) from the respondents and related them to the organizing themes. Where appropriate, sample quotations from the voices of the respondents were quoted to support the basic theme.

Quantitative analysis

Secondly, descriptive statistics was used to ascertain the frequencies and corresponding percentages of the accentuating factors in relation to tobacco use. Thirdly, Chi-square (χ^2) was employed to examine the influence of the accentuating factors (education, residential status, occupational status, wealth quintiles and access to media) on tobacco use. Our final model sort to understand the relationships between the independent variables and the dependent variable. We therefore employed probit regression to examine both the influence and marginal effects of a unit change in any identified accentuating variable on tobacco use.

All the response variables were specified. For instance, Age was catgorized as: if the person is within 30-60 years = 1, otherwise =0; Gender was female =1, otherwise 0; residental status was rural =1, otherwise =0. We modelled our regression based on the ideas of McClool et al. [31] and Hanck et al. [32]. In the Probit regression, we used the cumulative standard normal distribution function $\Phi(\cdot)$ $\Phi(\cdot)$ to model the regression function regarding dependent binary variables.

We assumed E(Y|X) = P(Y = 1|X) = $\Phi(\beta 0+\beta 1X)$.....Eq. (1). $\beta 0+\beta 1X$ in Eq. (1) then played the role of a quantile z. Noting that, $\Phi(z) = P(Z \leq z)$, Z∼N (0,1) such that, the Probit coefficient $\beta 1$ in Eq. (1) was the change in z associated with a one unit change in X. Although, the effect on z of a change in *X* is linear, the link between z and the dependent variable Y is nonlinear since Φ is a nonlinear function of *X*. The selected data from the GDHS already captured with capi software, exported to SPSS version 25 were recoded to suit the objectives of our study. The data was then imported into STATA version 14.0 (Stata Corp LP, College Station, Texas, USA) for statistical analysis and results presentation.

Results

Sociodemographic characteristics of study participants

As shown on Table 3, of the 4122 study particpants, 68.1% were females, 68.7% were married and 17.6% were divorced or separated. The study capured more females than males. This had effect on the educational status variable where more females were captured than males. However, male / female comparative analysis (percentage) of all educational status variables depict that, more males completed all levels of education than females. Again, 94.7% of the participants were employed.

From Table 4, out of the proportion that use tobacco, about 52.5% of respondents live in the urban areas. The findings showed that, residential status (urban) has statistically significant association with tobacco use in the relation χ^2 *(3, 4134) = 82.7824, p = 0.000*.

Again, the study found strong links between occupational status as an accentuating factor to tobacco use in the relation X^2 *(8, 4123)=195.6919, p =* 0.000. Moreover, the study also established a statistically significant relations between access to media and tobacco use in the relation X^2 *(2, 4134) = 1.2352, p = 0.009*.

Assessing the effects of accentuating factors on tobacco use

In the analysis in Table 5, the regression using coeff & $p>z$ shows that, the accentuating factors determines about 50.579 (51%) of the tobacco use by individuals in the relation *[R^2 =0.505, F(17, 4077) = 50.579, p = 0.000].* Age (30–45years), gender (males), education (secondary school completion), residential status (urban dwellers), occupational status (agriculture SE and unskilled) categories were implicated in the effects of accentuating factors in tobacco use within the population.

Table 3
Sociodemographic characteristics.

	Sociodemographic Characteristics	
Variables	Frequency	Percentage(%)
Age		
30–45 years	1563	37.9
46–60 years	2559	62.1
Gender		
Male	1319	31.9
Female	2803	68.1
Marital Status		
Never married	495	12
Married	2832	68.7
Divorced/Separated	725	17.6
Widowed	70	1.7
Educational Status		
Male		
None	224	17
Completed Primary	409	31
Completed Secondary	580	43.9
Completed Tertiary	106	8.0
Female		
None	841	30
Completed Primary	757	27
Completed Secondary	1093	38.9
Completed Tertiary	112	3.9
Employment Status		
Unemployed	217	5.3
Employed (formal & Informal)	3905	94.7

NOTE: Data is presented in absolute figures with their corresponding percentages.
n = 4122, Males = 1319; Females = 2803.

Table 4
Accentuating factors and tobacco use.

Accentuating Variables	Tobacco Use			
	No(%)	Yes(%)	χ^2	P-Value
Residential Status			(3) 82.7842	0.000
Urban	62(29.5)	2061(52.5)		
Rural	148(70.5)	1863(47.5)		
Occupational Status			(8) 195.6919	0.000
Not working at all	4(1.9)	213(5.4)		
Professionals	3 (1.4)	362(9.3)		
Clerical	0(0.0)	46(1.2)		
Sales	6(2.9)	1235(31.6)		
Agriculture (SE)	156(74.3)	1195(30.5)		
Agriculture (E)	2(1.0)	23(0.6)		
Service	3(1.4)	100(2.6)		
Skilled	23,911.0)	553(14.1)		
Unskilled	23(6.2)	186(4.8)		
Access to Media			(2) 1.2352	0.009
Not at all	24(11.4)	424(10.8)		
Atleast once a week	49(23)	1052(26.8)		
More than once a week	137(65.2)	2448(62.4)		
Total (*N* = 4122 each)				

Note: Data is presented in absolute figures with their corresponding percentages.
$n = 4122$; Pearson chi2, $p < 0.05$.

Table 5
Effects of accentuating factors on tobacco use.

Accentuating Variables	Coeff.	Std.Err	z	$p>z$	95% Conf. Interval	
Age						
30–45 years	0.631	0.011	−1.25	**0.000****	0.042	0.541
46–60 years	−0.042	0.009	−4.39	**0.000****	0.023	0.061
Gender						
Female	−0.624	0.406	−8.91	**0.000****	2.827	4221
Residential Status						
Rural	0.410	0.223	1.84	0.066	0.026	0.847
Educational Status						
Completing Primary	0.279	0.214	1.3	0.193	−0.141	0.699
Completing Secondary	0.828	0.200	**5.12**	**0.000****	0.634	1.421
Completing Tertiary	0.651	0.578	1.13	0.259	−0.481	1.784
Wealth Quintiles						
Poorer	0.327	0.204	**1.61**	0.010	−0.074	0.728
Middle	0.534	0.272	**1.96**	0.050	0.001	1.067
Richer	0.036	0.379	**3.00**	0.003**	0.393	1.879
Richest	0.029	0.488	2.66	0.008	0.341	2.257
Occupational Status						
Professional	0.212	0.859	**257**	**0.001****	0.528	3.896
Sales	0.057	0.687	1.54	0.124	−0.290	2.405
Agricultural-SE	0.808	0.577	0.36	0.718	−0.922	1.339
Agricultural-E	−0.326	0.984	−0.26	0.795	−2.186	1.674
Services	0.024	0.827	1.24	0.216	−0.596	2.645
Skilled	0.570	0.591	0.63	0.031	−0.788	1.529
Unskilled	0.728	0.629	0.68	0.496	−0.804	1.661
cons	5.813	0.776	7.48	0.000	4.290	7.335

NOTE: Probit regression; Number of obs. =4077; LR chi2 (17) = 50.597; Pseudo R2=0.505; Prob> chi2 =. 0.000; likelihood = −574.46. ***, **, * indicates significance at 10%, 5% and 1% respectively.

Qualitative data presentation

Table 6
Respondents impressions on how accentuating factors influence tobacco use.

Organizing Themes	Emerging Themes (Sub-Themes)
6.1 Residential status	6.1.1 Urban dwellers smoke more
	6.1.2 In urban areas, people found in slums smoke more
	6.1.3 S-hand smoking is high in urban slums
6.2 Occupational status	6.2.1 All occupational professions smoke
	6.2.2 Non-professional sub-category smokes most
	6.2.3 Non-professional sub-category have double burden of smoking and alcohol consumption
6.3 Government compliance / regulation	6.3.1 Occupational stress may plunge People into smoking
	6.3.2 Legislation on smoking bans in public places is not effective in urban slums

NOTE: Generation of organizing and emerging themes from study participants.

Residential status and tobacco use

The qualitative results revealed that, urban dwellers are much involved in smoking than the rural dwellers. Within the cities, living in slums influence smoking and these people have double burden of active smoking and second-hand smoking. A health care policy maker said this:

> "The fact that, there is a tobacco policy is an achievement. Some countries do not even have a policy. The legislation on tobacco regulation in public places is working especially in the cities except probably slums where some people may not conform. But then, the population level and the impact on people's health are where we have challenges. Even though there is a law on ban of smoking in public places, this is not adhered to in some places…."**{NCDs Programme Co-ordinator_GHS_Ghana}**

Occupational status and tobacco use

The qualitative results potrayed that, tobacco use is not tagged to a particular occupational category. The outcome of their responses seem to suggest that, smoking is high among the non-professionals in the occupational category. The study also found that, these non-professionals also consume alcohol. Therefore the evidence garthered suggest that, individuals found in the non-professional category may be influenced into smoking more epecially when their jobs are stress related. A diabetic patient mentioned this:

> "Both categories of people (professionals and non-professionals) smoke. More serious are those non-professionals who consume alcohol and smoke especially, the marijuana" **{Diabetic patient_Male_Kumasi}.**

Similarly, a respondent from the FGDs said this:

> 'We all know that when one in involved in certain categories of work, smaoking becomes synonymous. These are mostly manual jobs which require a lot of stress. Most people in this job category smoke to overcome stress and over-shadow themselves from the consitutents of the job they are doing"….{**R5 Female member of FGD_Sunyani, Gana}**

Thematic network of accentuating factors and tobacco use

The thematic networks in Fig. 1 higlights the various links from all the accentuating variables and showcase the pathways of tobacco consumption. Some of the links show direct relation to tobacco use while others are indirectly linked to tobacco use with considerable implications for NCDs control (Table 6).

Discussion

The study noted the wide difference in the GDHS 2014 data in terms of total number of males and females captured per 9396 women as against 4388 men. This seems to obscure true reflection of some variables at a glance. For instance,

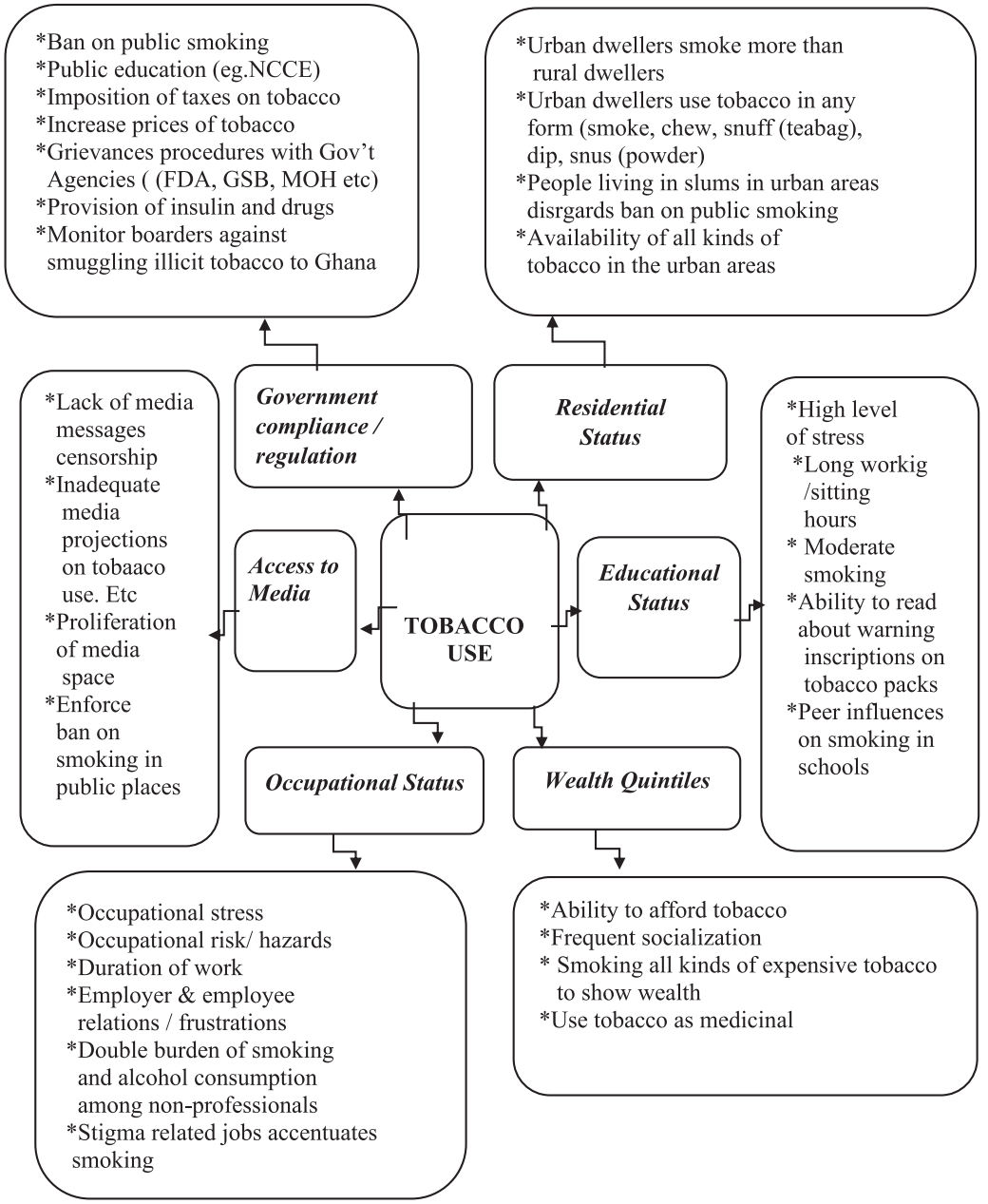

Fig. 1. Thematic network showing how accentuating factors influence tobacco use.
Note: In-depth and Key informant responses combined to form the thematic network.

relating to educational levels (*see* Table 3*)* in absolute terms, more females completed than males. However, we found that, using male and female comparative analysis (percentage) of all educational levels, more males completed all levels of education than females. This result is consistent with the study outcome of Sasu [33] who reported that, the completion rate for educational levels in Ghana is higher among male students than among female students. Smillarly, a study measuring gender equality in education from trends in 43 countries reported of patterns of gender gaps in enrollment and attainment of males against females [34]. However, our study result is contrary to the emerging reports from most western countries where females have surpassed *males* in *educational* enrollment and attainment [35,36]. Linking our theoretical perspectives of theory of triadic influence, educational levels promote intrapersonal and interpersonal relations. People interact and socially influence the behavior of others such that, good and bad habits are transferred from one person to the other [37–39]. For instance, available literature reveals how along the educational levels, individuals pick on the habit of tobacco consumption. Though the study of Haddad & Malak [40] was conducted among university students unlike the current study

which cut across all educational levels, they found that, the prevalence of smoking was 28.6% (50.2% among males and 6.5% among females). Their study found that, friends, not family, were the main source of the first smoking, and this most often occurred after 15 years of age confirming the intrapersonal and interpersonal behavior influence, informing decisions as well as intended behavior such as tobacco consumption.

From our results, we found that, females were less likely to consume tobacco than males (*see* Table 5). This is consistent with the report of Demographic and Health Surveys in 22 sub-Saharan African countries which found that, current tobacco use had significantly decreased; the decrease was steeper among female participants [41]. This is also consitent with the study outcome of Haddad and Malak [40] where the prevlalence of smoking was found to be 50.2% among males and 6.5% among females. The current study therefore reports that, being a female reduces the chances of using tobacco by 62.4% and holding all other confounders constant, females are expected to record lower rates of acquiring NCDs emerging out of smoking. Linking the prevalence of tobacco use to prevalence of NCDs such as cardiovascular disease (CVD) is very complicated due to the sex/gender differences in the burden of cardiovascular disease [42]. This complication is reported by the study outcome of Mosca, Barrett-Connor and Wenger [43] who noted that, CVD mortality among female sex exceeded that of male sex. However, when the same data was adjusted for differences in age distribution, CVD mortality rate was considerably higher in male sex than female sex.

The study found that, the general educational status was statistically significant to tobacco use ($p<0.05$) and this is consistent with other studies outcomes [44,12,9]. The analysis of our data seem to portray that, uneducated people were more likely to use tobacco than educated people and this is contrary to our qualitative outcomes. In relation to the regression (Table 5), assessing the various educational levels and tobacco use depicted, 27.9 percent at primary level, increased to 82.8 percent at the secondary school level and reduced to 65.1 percent at the tertiary level. For instance, educational levels with the category of 'completion of secondary' implies that 82.8% of individuals who smoke, acquired this habit during their secondary school. It also came out in the qualitative interviews that, secondary school leavers and individuals who are unemployed are prone to tobacco use. This is consistent with the studies by Owusu-Dabo et al. [7] and Cutler and Lleras-Muney [12] who reported that, heavy smoking and high alcohol consumption was predominant among people with low educational status.

Our study found that, educational level category 'secondary school sompletion' which is part of the general youth cohort (>15years <45years) accounted for a significant proportion of tobacco users [(Coeff.0.828 (82.8%), Std.Err. 0.200, *t*-test 5.12]. This is contrary to the CDC report, (2022) which found that, the age category 45–64years (14.9%) were the highest tobacco users, followed by the age cohort 25–44years (14.1%). Another study conducted by the Office of Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion of the center for Disease Control in 2019 also found that, nearly 9 out of 10 adults who smoke cigarettes daily first try smoking by age 18, and 99% first try smoking by age 26. The study further reported that, 80.2% of high school students and 74.6% of middle school students who used tobacco products in the past 30 days reported using a flavored tobacco product during that time. These findngs are consistent with our research outcome which demonstates that, the youths are highly implicated in tobacco use. The sustained use of tobacco has the likelihood of increasing the prevalence of NCDs within the population.

Again, residential status (urban) was found to be statistically significant to tobacco ($p<0.05$) use with implications to the occurrence of NCDs as illustrated on (Table 4) and accounted for 59% of tobacco use (rural coeff = 0.410) as illustrated on Table 5. This means that, as individual moves away from rural to urban, the person becomes more predisposed to tobacco use by 59% and has higher chances of acquiring an NCD. Similar studies by Sobngwi et al. [45], and WHO [2] noted that, urban living and NCDs occurrence were positively associated. During the qualitative interviews, it was also revealed by the people living with non-communicable diseases (PLWNCDs) and the health care professionals that, living in urban areas influence smoking more than rural dwelling. Again, the qualitative responses suggest that, within the urban dwelling, living in slums has much influence on smoking and second-hand smoking. This finding is consistent with study outcomes in Bangladesh which revealed that, about 42.3% of *the young men aged 15–24years, living* in *urban slums* were *tobacco smokers* [46]. The outcome of residential status linking tobacco use is related to our theoretical perspetives which posit the influences of socio-cultural-environment on levels of causation of a phenomena or behavior. The residential environment where a person stays may have behavioural influence. For instance, evidence has shown that, individuals especially young adults are influenced by the behavior of their peers whom they interact with in their vicinity. This is true reflection of the 3 stands causing behavior (intrapersonal, interpersonal, and sociocultural-environmental) as put forth by the theory of triadic influence. Our study results of residential status influencing behavior (tobacco use) is consistent with the study outcome of Shohaimi et al. [47], who reported of strong independent effects of residential area status on cigarette smoking habit.

Equally, our study results found strong links between occupational status as an accentuating factor to tobacco use ($p < 0.05$) as demonstrated on Table 4 and this is relevant to onset of NCDs. The qualitative outcomes admitted that, though all categories of professionals may smoke, individuals in the non-professional category are implicated most. This puts the non-professional category in the double burden of smoking and alcohol consumption. This is consistent with many study outcomes of Cancer Treatment Centres of America which report of double burden of excessive smoking and alcohol intake combining to elevate cancer risk. The qualitative studies also revealed that, some occupations that people do, also influence the adoption of some risk factors for NCDs such as smoking and alcohol consumption. This may happen where smoking tobacco is used to release stress and to conceal other occupation related issues, leading to addiction and resulting in NCDs occurrence. These finding are consistent with the outcomes of other studies reporting on negative effects of tobacco use [7,9,14,15].

In addition, our study was comparable with other studies that found statistically significant association between wealth quintiles and tobacco use [7,17,48]. Again, it was found that, all the categories of income levels had statistically significant association with tobacco use ($p<0.05$). As individuals moved from poorest to middle rich, the chances of them using tobacco increases from 32% to 53% but the urge to continue using tobacco reduces as people become richer and richest by 36% an 29% respectively as shown on Table 5. From the Table 6, the qualitative perspective, PLWNCDs also associated rich people to moderate smoking. A country-level research outcome revealed that *smoking is more prevalent among groups living in lower wealth or income households* [46].

Issues of occupational category and wealth quintiles associating with tobacco use has always been very complex in outocmes. For instance, occupational gradients in smoking may simply reflect the education and income associated with the occupation. Contary, occupation may also reflect other illimitable factors that promote smoking, such as work stress where smoking is used as a coping mechanism, easy access to tobacco, permissible social norms that may facilitate tobacco use in the workplace among others. Our study result was also in conformity with the study outcome of Fujishiro et al. [49], who reports that, among men, those in management/professional occupations were more likely to be never smokers than other occupational groups.

In relation to media issues, our study also found statistically significant association between access to media projections and tobacco use in the relation *[X^2 (2, 4134)= 1.2352, $p = 0.009$]* as shown in Table 5. Our finding is consistent with a study in Samoan, where the reearchers identified that, adolescents who lived in homes where there were clear non-smoking expectations were less likely to view smoking in media in characteristically positive terms [50]. The implication is that, such adolescents are less likely to use tobacco in any form.

The qualitative outcomes in Table 6 showed that, in recent times, there is virtually no projections on tobacco use in the media. Most of the respondents feel the government mounted policies on tobacco use through the Framework Convention on Tobacco Control (FCTC), the Public Health Act, 2012 (Act no. 851 of 2012), legislations on tobacco and the activities of the Food and Drug Authority are good and making positive impact within the population especially in rural areas.

Limitation

Though this study used the most recent and improved demographic health survey (2014), it is limited since this version is 1 out of the 6 rounds of demographic surveys in Ghana.

Conclusion

Our study revealed that, accentuating variables (residential status, educational level, income levels, occupational status;-non-professionals and wealth quintiles) have accounted for tobacco use within the population with implications for the occurrence of NCDs. Our study has also established that, among these accentuating variables of tobacco consumption, the strongest influence on smoking falls on the educational status category 'secondary school completion', followed by non-professionals with the sub-categories of agriculture-self-employed and unskilled labor. We therefore call for a strenghtennng of the WHO Framework Convention on Tobacco Control in Ghana.

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Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon request.

Authors' contributions

BJK led the background development, field work and analysis of the paper. NJ developed the methodology, was involved in analysis and proof reading of the paper. SA was involved in conceptualizing and grounding the theoretical framework of the paper with EOD structuring, assessing the analysis and proof reading the paper. All authors were involved in discussions, conclusion and recommendations put forward by the paper. All authors therefore read and approved the final manuscript.

Ethics approval and consent to participate

The study was approved by the Research and Development Unit of Komfo Anokye Teaching Hospital where the qualitative respondents were selected. The quantitative data (GDHS 2014) was released by the Institute of Statisitcal, Social and Economic Research (ISSER) of University of Ghana. Again, all participants were provided with written informed consent to participate. The study followed all the ethical considerations in relation to respondents selection, interview process, confidentiality and data analysis protocols.

Consent for publication

All Authors' have fully consented for this paper to be published

Declaration of Competing Interest

We have no conflicting Interest. We therefore declare no interest contrary to our quest for the publication of this manuscript.

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