SUBSTANCE USE AND PSYCHOSOCIAL FUNCTIONING OF ADOLESCENTS IN BENUE STATE, NIGERIA: ASSESSING THE ROLE OF AGE

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ABSTRACT

Aim: *To assess whether Substance Use (SU) is associated with Psychosocial Function (PF) among adolescent.*
Methods: *Using a self-administered validated instrument, we obtained information on demographic, SU (defined as self-reported affirmative use of one or more of any form of alcoholic drinks, cigarettes, hemps etc) and PF [using the adolescent psychosocial functioning inventory comprising of three subscales; optimism and coping strategies (OCS), behaviour and relationship problems (BRP) and general psychosocial dysfunction designed (GPD)] among 2272 apparently healthy adolescents. PF was categorized as 'elevated' if the psychosocial functioning index (PFI) score were >75th percentile, otherwise, 'not elevated' and multivariable-adjusted logistic regression was used to compute odds ratio (OR) and 95% confidence interval (CI) of SU for elevated PF risk. In addition, we applied Johnson Neyman (JN) technique to identifying the JN significance regions at which age moderated the SU-PF relationship at a statistical significance of two-sided P<0.05.*
Results: *Prevalence of SU and elevated PF was 50.7% and 79.8% respectively. Prevalence of elevated PF differed insignificantly by sex, but the proportion of adolescent with elevated PFI on SU (82.6%) was significantly higher (P<0.001) compared to those with elevated PFI but not on SU (76.9%). Multivariable-adjusted odds of decreased OCS risk given SU exposure was; OR (95%CI): 1.3791 (1.1458-1.6698), P=0.0007. Similarly, multivariable-adjusted odds of elevated PF risk in the light of SU exposure was; OR (95%CI): 1.4286 (1.1617-1.7567), P=0.0007. Furthermore, the JN significance regions for moderated regression analyses of odds of decreased OCS risk was between 10.4years [OR (95%CI): 0.5820 (0.1411-1.0228), P=0.0097] and 16.7years [OR (95%CI): 0.3025 (0.0001-0.6050), P=0.0500].*
Conclusion: *Adolescents on SU are about one and half times at risk of psychosocial dysfunction and age significantly attenuated the SU-decreased OCS risk link particularly in early adolescence.*

Keywords: *Substance use, Alcohol use, Psychosocial functioning, Adolescents, Moderated regression*

INTRODUCTION

Substances use (SU) denotes the habitual illicit use of drugs, alcohol, tobacco and narcotics (Degenhardt & Hall, 2012). It is known to cause departure from normal behavioural configuration (Vlahov et al., 2002), aggravate devaluation sensitivities (Byrne, Otto, Pang, Patrick, & Worthy, 2018) and is a growing public health concern (Toumbourou et al., 2007). In addition, it is associated with impairment of will and crime tendencies (Burke, O'Sullivan, & Vaughan, 2005). For example, illicit drug usage is attributed to about 149–271 million of the world population in 2009 and its contribution to global burden of disease estimates is substantially attributable to alcohol (Degenhardt & Hall, 2012).

SU is non-age specific in the life course but (Merline, O'Malley, Schulenberg, Bachman, & Johnston, 2004) its deleterious impact on quality of life and wellbeing appears severe in adolescence; a critical developmental stage of life that defines and shapes behavior (Alhyas et al., 2015) in addition to vulnerabilities to adventurous inclinations and juvenile peer sways (Kandel, Davies, Karus, & Yamaguchi, 1986; Rohde et al., 2007). For example, almost 31.5% of all mortality among men between 15 and 29years in high income societies and 86% of the 3.6 million SU-related deaths of 15–29year-old globally is attributable to risky alcohol use (Toumbourou et al., 2007). Similarly, about two in every three adolescent reported at least a SU by age approximately age 14 years in a lifetime and alcohol was the most common SU in adolescents (Olumide et al., 2014).

While quite a substantial amount of studies have explored SU in the purview of behavioural patterns; academic functioning (Jennison, 2004), marital choices (Martino, Collins, & Ellickson, 2004), job stability and satisfaction (Kandel et al., 1986; Newcomb, Galaif, & Carmona, 2001), including psychosocial functioning (PF) (Foster, Arterberry, Iacono, McGue, & Hicks, 2018; Rohde et al., 2007) etc, very limited reports have explored the relationship between SU and PF particularly among adolescent of sub-Saharan African descent. PF represents a cluster of psychosomatic, social and environmental factors (Akpa, 2018) with significant implications on health and quality of life. PF is an important index for evaluating individuals' functioning to characterize behavioral outcomes using pre-defined empirical domains in the context of environmental factors (Ro & Clark, 2009).

Earlier reports (Byrne et al., 2018; Foster et al., 2018; Kandel et al., 1986; Rohde et al., 2007) have observed the tendency of SU during transition to adulthood with significant proportion of young adults perpetually on SU and its implications on psychological wellbeing (Kandel et al., 1986; Rohde et al., 2007), but the implications of age on PF have been largely under-explored. Understanding the influence of age on PF outcomes in the light of SU is necessary to understand the etiology of SU in psychopathology of mental health outcomes among adolescents. It is vital to explore the significance of age in the SU-PF link so as to identify age regions where SU significantly impacts PF and offer novel public health intervention measures to address the burden of SU exposure on PF outcomes. Therefore, the aim of this study is to assess whether SU is associated with PF and further evaluated the influence of age (using Moderated Regression Analysis) in the relationship among adolescents in Nigeria.

METHODS

Study design and approval

The study is a subset of a cross-sectional study among children and adolescent in Benue State, Nigeria conducted from 2012 to 2015. The Institutional Review Board of the University of Ibadan, Nigeria (UI/EC/12/0235) and Ethical Committee of the Benue State Ministry of Health, Benue State Nigeria (MED/261/VOL.1/56) approved the study. In addition, authorization notes were obtained from the school authorities and all participant provided informed consent before participating in the study.

Sampling Strategies and Data collection procedures

A total of 2,553 respondents were recruited in the state-wide study on factors among adolescents in families affected and/or unaffected by HIV/AIDS. Briefly, respondents were recruited through a multi-stage sample technique and eligible for participation (after duly informed consent) if they met the following inclusion criteria; (a) between 10-19years of age (b) currently domiciling in Benue state for ≥2 years and (c) history of HIV/AIDS-related morbidity/mortality of at least a family member (parents/guardian or siblings). Details of the project and fundamental concepts have been reported elsewhere (Akpa, 2018; Akpa & Bamgboye, 2015; Akpa, Bamgboye, & Baiyewu, 2015).

Self-administered validated instrument (with the assistance of on-site trained personnel) was used to obtain information on demographic, family background, lifestyle and parent/guardian characteristics of respondents. SU was defined as self-reported affirmative use of one or more of any form of alcoholic drinks, cigarettes, hemps etc. In addition, PF was assessed using the adolescent psychosocial inventory (APFI); a 49-item (3-point Likert-like response; 0 = not at all, 1 = sometimes and 2 = very often) scale as previously reported in (Akpa, 2018; Akpa et al., 2015). Briefly, the APFI is a multidimensional psychosocial scale comprising of three subscales; optimism and coping strategies (OCS), behaviour and relationship problems (BRP) and general psychosocial dysfunction (GPD) designed to assess PF among adolescents. While each subscale has it score evaluated using the sum of scores of individual item in the particular subscale, the overall psychosocial functioning index (PFI) score was calculated as the average of the subscale scores after reversing scores for all items in the OCS subscale. Higher scores (subscale or overall) typify preeminent PF problems save the OCS where lower scores typify poorer optimism and

coping. Details of the APFI design, validation, inter-relationship of domains and reliability have been reported elsewhere (Akpa et al., 2015).

Furthermore, 2,272 respondents were included in this current study after excluding respondents because of missing information; (a) to establish history of HIV/AIDS-related morbidity/mortality of at least a family member (parents/guardian or siblings), (b) on items relating to PF and/or (c) imprecise responses on PF-related items.

Statistical Analyses

Respondents' characteristics were summarized using descriptive statistics; mean ± standard deviation (SD) for continuous variables but frequencies and percentages were computed for categorical variables. Also, OCS was categorized as 'decreased' if OCS score was ≤75th percentile, otherwise 'not decreased'. Similarly, BRP, GPD and PFI scores were categorized as 'elevated' if score were >75th percentile, otherwise, 'not elevated' and χ^2 test was used to assess the relationships between categorical variables.

Furthermore, using the categorized scores for OCS, GPD and PFI as outcome variables (excluding BRP due to distorted results), multivariable-adjusted logistic regression was used to compute odds ratio (OR) and 95% confidence interval (CI) of decreased OCS (using 'not decreased' category as reference) elevated GPD and PFI (using 'not elevated' category as reference) by SU status adjusting for respondents' characteristics found to be significantly related to OCS, GPD and PFI in the χ^2 tests.

In addition, using Johnson Neyman (JN) technique as described in (Kowalski, Schneiderman, & Willis, 1994), OR and 95% CI of decreased OCS, elevated GPD and PFI by status of SU to assess the potential impact of age (identifying the JN significance regions) on the relationship between SU and PFI was computed. All statistical analyses were computed at a statistical significance of two-tailed $P < 0.05$ using Statistical Package for Social Science (SPSS) version 20.

RESULTS

Characteristics of Respondents

Characteristics of respondents are present in Table 1. A majority of respondents were males 1124 (53.9%) and mean age of respondents was 14.67±2.06years. Most respondents were between ages 13-17 years 1697 (74.7%), from urban settings 1073 (47.2%), and monogamous relationship 1473 (64.8%) with about 71.0% of respondents' parents living together. While a higher percentage of respondents' mother were self-employed 1370 (60.3%), less than 50% of respondents' fathers were self-employed 952 (41.9%). Also, 1152 (50.7%), 1627 (71.6%), 1825 (80.3%), 1912 (84.2%) and 1812 (79.8%) of respondents reported SU, decreased OCS, elevated BRP, GPD and PFI respectively.

Table 1. Participants' Demographic and Psychosocial Characteristics

Factor		Frequency (N=2272)	Percentage
Sex			
	Male	1224	53.9
	Female	1048	46.1
Age, Mean±SD		**14.67±2.06**	
	10-12years	361	15.9
	13-17years	1697	74.7
	18-19years	214	9.4
Place of residence			
	Rural	1060	46.7
	Urban	1073	47.2
Family Type			
	Monogamy	1473	64.8
	Polygamy	722	31.8
Family Status			
	Parents are together	1612	71.0
	Parents live apart	602	26.5
Mother's Occupation			
	Self employed	1370	60.3
	Other forms of employment	836	36.8
Father's occupation			
	Self employed	952	41.9
	Other forms of employment	1260	55.5
Alcohol/Substance use			
	Yes	1152	50.7
	No	1111	48.9
Optimism and coping strategies			
	Decreased	1627	71.6
	Not decreased	631	27.8
Behaviour and Relationship Problems			
	Elevated	1825	80.3
	Not elevated	428	18.8
General Psychosocial dysfunction			
	Elevated	1912	84.2
	Not elevated	345	15.2
Psychosocial functioning Index			
	Elevated	1812	79.8
	Not elevated	458	20.2

Furthermore, SU prevalence in our population is independent of sex, place of residence, family type and family status (Table 2). Also, we found place of residence, family type, family status, mother's occupation and father's occupation of respondents were associated with elevated PF. Respondents from families with parent living apart are more likely to report decreased OCS (37.7%), elevated GPD (84.4%) and elevated PF (38.9%) simultaneously. Similarly, respondents on SU are more likely to report decreased OCS (31.2%), elevated GPD (86.7) and elevated PF (82.6%) but not elevated BRP (82.3%). In addition, prevalence of SU differed insignificantly across socio-demographic phenotypes except age group of respondents.

Table 2. Proportion with problematic psychosocial functioning per participants' characteristics

Factor		Proportion with decreased OCS	P	Proportion with elevated BRP	P	Proportion with elevated GPD	p	Proportion with elevated PFI	p	Prevalence of substance use	p
Sex											
	Male	29.6	0.065	81.6	0.505	82.8	0.006	78.4	0.067	51.0	0.936
	Female	26.1		80.5		86.9		81.5		50.8	
Age, Mean±SD											
	10-12years	39.4	<0.001	73.8	0.001	84.9	0.238	82.3	0.151	44.6	0.032
	13-17years	25.4		82.1		84.2		78.9		52.2	
	18-19years	28.6		84.4		88.6		83.2		51.4	
Place of residence											
	Rural	37.0	<0.001	81.0	0.789	89.2	<0.001	85.4	<0.001	50.0	0.463
	Urban	18.4		81.4		80.6		74.6		51.6	
Family Type											
	Monogamy	24.6	<0.001	81.9	0.147	83.6	0.051	77.8	0.001	49.6	0.330
	Polygamy	34.2		79.3		86.8		83.6		51.8	
Family Status											
	Parents are together	24.2	<0.001	82.8	0.036	78.2	0.001	19.2	<0.001	50.2	0.408
	Parents live apart	37.7		77.2		84.4		38.9		52.2	
Mother's Occupation											
	Self employed	33.8	<0.001	81.0	0.879	87.9	<0.001	84.4	<0.001	53.3	0.008
	Other forms of employment	17.4		81.3		79.6		72.4		47.5	
Father's occupation											
	Self employed	38.9	<0.001	82.1	0.305	90.5	<0.001	88.0	<0.001	55.5	<0.001
	Other forms of employment	19.2		80.4		80.5		73.6		47.6	
Substance use											
	Yes	31.2	0.001	82.3	0.127	86.7	0.008	82.6	0.001		
	No	24.7		79.7		82.6		76.9			

***OCS**- Optimism and Coping Strategies; **BRP**- Behaviour and Relationship Problems; **GPD**- General Psychosocial Dysfunction; **PFI**- Psychosocial Functioning Index*

Substance Use and risk of Psychosocial Dysfunction

Respondents on SU are about one and half times at higher risk of decreased OCS [OR (95%CI): 1.3791 (1.1458-1.6698), *P*-value=0.0007], elevated GPD [OR (95%CI): 1.3682(1.0860-1.7237), *P*-value=0.0078] and elevated PF [OR (95%CI): 1.4286 (1.1617-1.7567), *P*-value=0.0007] after adjusting for age, sex, place of residence, family type and family status (Tables 3).

Moderated effect of age on the relationship between SU OCS, GPD and PFI

From our data (Figure 1), prevalence of elevated PF appears not worth mentioning in early adolescence, but increases with age until age 15 years where it appears prominent (with seriously worrisome prevalence among respondents on SU) and decreases in late adolescence. The relationship between age and OCS or GPD or PF is summarized in Tables 3, 4 and 5 respectively. Age of respondents was inversely related with OCS [OR (95%CI): 0.9173 (0.8563-0.9827), *P*-value=0.0140] but not with GPD [OR (95%CI): 1.0075 (0.9298-1.0918), *P*-value=0.8552] and PFI [OR (95%CI): 0.9890 (0.9203-1.0629), *P*-value=0.7633].

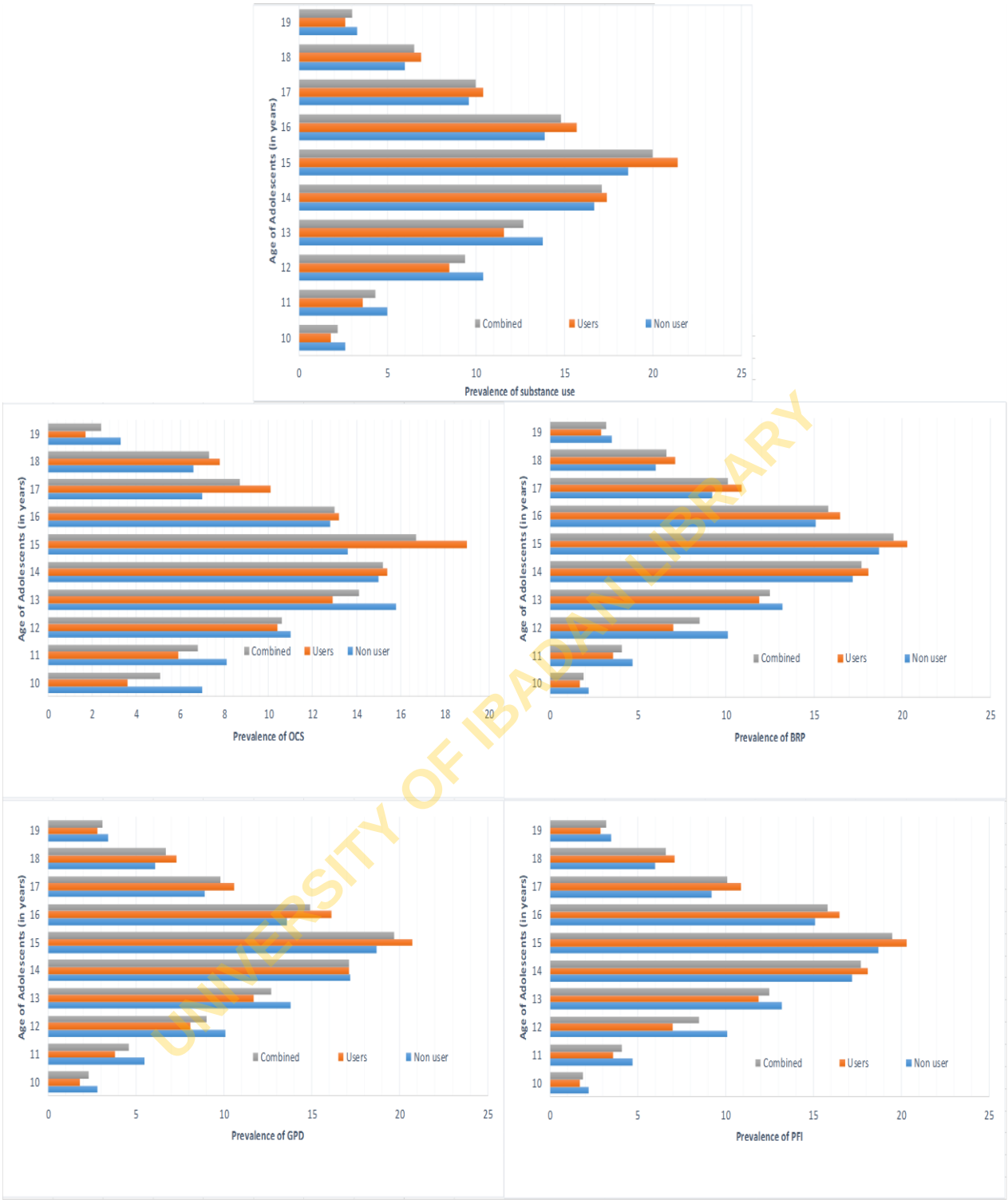

Figure 1. Comparing Psychosocial functioning between users and non-users of alcohol across Age of participants

SU was inversely related with decreased OCS from 10years old [OR (95%CI): 0.6019 (0.1219-1.0820), *P*-value=0.0140] until about 16.7years old [OR (95%CI): 0.3205 (0.0001-0.6050), *P*-value=0.0500]. Similarly, SU was inversely related with odds of elevated GPD from approximately 13.7years old [OR (95%CI): 0.2654 (0.000-0.5039), *P*-value=0.0500] until 17.6years [OR (95%CI):

0.6281 (0.0269-1.2294), *P*-value=0.0007]. In addition, the SU-elevated PF risk association was largely attenuated from approximately 11.9year old [OR (95%CI): 0.3750 (0.000-0.7500), *P*-value=0.0500] to 18.2years old [OR (95%CI): 0.4576 (0.0000-0.9151), *P*-value=0.0500]. Age exerted on significant interaction in the relationship between SU and PF at <11.9years and >18.2years (Table 3).

Table 3. Factors associated with OCS, GPD and PFI interaction effect and the Johnson-Neyman Significance Regions for Moderated Regression Analyses

Model Predictors	Odds of OCS				Odds of GPD				Odds of PFI			
	OR	**95% CI**		***P***	**OR**	**95% CI**		***P***	**OR**	**95% CI**		***P***
Substance use[$]	**1.3791**	**1.1458**	**1.6698**	**0.0007**	**1.3682**	**1.0860**	**1.7237**	**0.0078**	**1.4286**	**1.1617**	**1.7567**	**0.0007**
Moderated regression												
Age	0.9173	0.8563	0.9827	0.0140	1.0075	0.9298	1.0918	0.8552	0.9890	0.9203	1.0629	0.7633
Alcohol use	2.8457	0.6861	11.8035	0.1496	0.4995	0.0816	3.0593	0.4529	1.2437	0.2390	6.4734	0.7956
Interaction *(Substance × Age)*	0.9566	0.8679	1.0544	0.3716	1.0721	0.9477	1.2128	0.2687	1.0132	0.9066	1.1324	0.8175
Sex *(Male)*	1.1698	0.9523	1.4369	0.1351	0.7101	0.5521	0.9135	0.0077	0.7838	0.6259	0.9816	0.0339
Residence *(Rural)*	2.4831	2.0150	3.0603	<0.001	2.0620	1.5925	2.6701	<0.001	2.0867	1.6576	2.6272	<0.001
Family type *(Polygamy)*	1.4551	1.1749	1.8024	0.0006	1.2662	0.9584	1.6728	0.0967	1.3362	1.0403	1.7160	0.0232
Parents live apart	1.5252	1.2214	1.9043	0.0002	1.0825	0.8095	1.4477	0.5929	1.2095	0.9279	1.5763	0.1595
					Johnson-Neyman Significance Regions							
Age in years	Effect	L	U	*P*	Effect	L	U	*P*	Effect	L	U	*P*
10	0.6019	0.1219	1.0820	0.0140	0.0018	-0.6125	0.6161	0.9954	0.3490	-0.2187	0.9167	0.2282
10.45	0.5820	0.1411	1.0228	0.0097	0.0331	-0.5309	0.5971	0.9084	0.3549	-0.1671	0.8770	0.1827
10.9	0.5620	0.1594	0.9645	0.0062	0.0644	-0.4503	0.5792	0.8062	0.3608	-0.1165	0.8381	0.1384
11.35	0.5420	0.1765	0.9075	0.0037	0.0958	-0.3711	0.5626	0.6877	0.3667	-0.0669	0.8003	0.0974
11.8	0.5220	0.1919	0.8522	0.0019	0.1271	-0.2938	0.5479	0.5540	0.3726	-0.0189	0.7641	0.0622
11.9829	ǂ				ǂ				**0.3750**	**0.0000**	**0.7500**	**0.0500**
12.25	0.5021	0.2051	0.7991	0.0009	0.1584	-0.2191	0.5358	0.4108	0.3785	0.0269	0.7300	0.0348
12.7	0.4821	0.2151	0.7491	0.0004	0.1897	-0.1479	0.5273	0.2707	0.3844	0.0699	0.6988	0.0166
13.15	0.4621	0.2209	0.7034	0.0002	0.2210	-0.0816	0.5237	0.1523	0.3903	0.1089	0.6717	0.0066
13.6	0.4422	0.2209	0.6634	0.0001	0.2523	-0.0223	0.5269	0.0717	0.3962	0.1422	0.6501	0.0022
13.7883					**0.2654**	**0.0000**	**0.5309**	**0.0500**				
14.05	0.4222	0.2136	0.6308	0.0001	0.2837	0.0280	0.5393	0.0297	0.4021	0.1680	0.6362	0.0008
14.5	0.4022	0.1974	0.6070	0.0001	0.3150	0.0670	0.5630	0.0128	0.4080	0.1841	0.6319	0.0004
14.95	0.3822	0.1720	0.5925	0.0004	0.3463	0.0937	0.5988	0.0072	0.4139	0.1892	0.6385	0.0003
15.4	0.3623	0.1380	0.5865	0.0015	0.3776	0.1089	0.6464	0.0059	0.4197	0.1835	0.6560	0.0005
15.85	0.3423	0.0969	0.5877	0.0063	0.4089	0.1143	0.7036	0.0065	0.4256	0.1684	0.6829	0.0012
16.3	0.3223	0.0503	0.5944	0.0202	0.4402	0.1122	0.7682	0.0085	0.4315	0.1459	0.7171	0.0031

16.747	**0.3025**	**0.0001**	**0.6050**	**0.0500**	ǂ				ǂ			
16.75	0.3023	-0.0004	0.6050	0.0503	0.4716	0.1048	0.8383	0.0117	0.4374	0.1181	0.7567	0.0073
17.2	0.2824	-0.0539	0.6186	0.0998	0.5029	0.0935	0.9122	0.0161	0.4433	0.0864	0.8002	0.0149
17.65	0.2624	-0.1096	0.6344	0.1668	0.5342	0.0794	0.9890	0.0213	0.4492	0.0520	0.8464	0.0266
18.1	0.2424	-0.1668	0.6517	0.2457	0.5655	0.0633	1.0677	0.0273	0.4551	0.0156	0.8946	0.0424
18.2867	ǂ				ǂ				**0.4576**	**0.0000**	**0.9151**	**0.0500**
18.55	0.2225	-0.2253	0.6702	0.3302	0.5968	0.0457	1.1480	0.0338	0.4610	-0.0223	0.9443	0.0616
19	0.2025	-0.2846	0.6896	0.4152	0.6281	0.0269	1.2294	0.0406	0.4669	-0.0614	0.9952	0.0832
The J-N Cut-off Age	**16.747 years**				**13.788 years**				**18.287 years**	**and**	**11.983 years**	
% with age below cut-off	**81.03%**				**29.29%**				**97.29%**		**6.65%**	
% with age above Cut-off	**18.97%**				**70.71%**				**2.71%**		**93.35%**	

§- *Results of a bivariate logistics regression analysis;* ***OCS-*** *Optimism and Coping Strategies;* ***OR-*** *Odds Ratio;* ***CI-*** *Confidence Interval,* ǂ-empty cells.

DISCUSSION

This report is the first to the best of our knowledge to assess the association between SU and PF among adolescents in addition to factoring the moderated effect of age. First, we found adolescent on SU are about one half times at risk of psychosocial dysfunction. Second, age significantly moderated the association between SU and decreased OCS in early adolescence (≤16years old). Third, though age was not independently associated with GPD and PFI, the JN significant regions revealed a profound inverse relationship towards late adolescence (≥14 years old) and between approximate ages of 12-18 years respectively.

Earlier reports (Manyike et al., 2016; Ogunsola & Fatusi, 2016; Olagunju et al., 2017; Olumide et al., 2014) has suggested certain predictors of SU but none have explored the relationship and path-physiology of SU on PF outcomes particularly in adolescent of sub-Saharan Africa descent. Our report hints adolescent on SU are at risk of psychological dysfunction alluding to the need for effective public health intervention strategies to avert the dire consequence of SU among adolescent prior to onset of adulthood. SU impairs PF given its reported association with compromised neuro-psychological performance.

For example, a recent longitudinal study reported early exposure to drinking predicted poorer psychomotor speed, cognitive inhibition and other alcohol-related neuro-cognitive vulnerabilities (Nguyen-Louie et al., 2017). Thus, promoting psychosocial complications (such as emotional volatility, poor interpersonal relations, sleep disturbances etc) implicated in impaired psycho-neurological wellbeing (Coenen et al., 2016; Hartley et al., 2014).

In addition, SU can impair PF in adolescent via disturbances in cognitive, social, emotional and behavioural wellbeing to promote strange psychiatric tendencies. In tandem with our observation, impairment of physical, cognitive, social and behavioural development has been observed among adolescents on SU (Rose & Grant, 2010). Similarly, adolescent on SU are more likely at risk of increased tendencies of poor social functioning, psychological distress, physical health, HIV and criminality; public violence, psychosis, homicide and suicide, (Burke et al., 2005; Spooner, Mattick, & Noffs, 2000; Vlahov et al., 2002).

Furthermore, our finding that age exerted significant moderation on the SU-decreased OCS link in early adolescent is in tandem with certain reports. First, a longitudinal study on age at drinking onset in adolescent and neuro-cognitive performance using a comprehensive battery test (Nguyen-Louie et al., 2017) after a mean follow-up of 6.8years suggested initiation of early alcohol use at younger ages gags neuro-cognitive performance and is a risk factor for neuropsychological dysfunction. Second, the adolescent stage is a critical period of growth in the life-course. Adolescents are still evolving and exposures to SU at this stage could likely distort their growth pattern (particularly mental wellbeing) and potential impair them in adulthood. Recently, a report provided strong evidence on the implications early patterns of drinking in adolescence and adult outcomes. These authors asserted early initiation of alcohol consumption in adolescence are likely to extend into adulthood and initiate other SU with adverse outcomes in adulthood (Silins et al., 2018).

Despite the non-observance of a relationship between age and PF in our study (due to lack of statistical power), the JN band of significance revealed age largely modified the SU-PF association in adolescent averagely from 11-18 years in adolescent. The JN significance regions uncovered unique peculiarities explainable to significant theoretical implications that were unaccounted for. For example, aside age, we also noticed that residence and family type interacted with the SU-PF relationship. In tandem with this observation, the absence of a father figure has been highlighted as a predictor to cigarette use among adolescents (Olumide et al., 2014). Similarly, adolescents from divorced homes are likely to have a poor self-reported quality of life (Akpa & Bamgboye, 2015). Our findings indicates perhaps the potential window of opportunity to tackle the effect(s) of SU (and prevent long-term consequences in adulthood) in early adolescence, suggesting the necessity for organized, all-inclusive and thorough longer-term intervention measures that includes prevention, treatment and recovery services to mitigate the potential deleterious consequences of SU on adolescent PF and wellbeing.

Our study has both strengths and limitations. Most evidence-based instruments for assessing PF are predominantly for clinical use, time-consuming and in most cases disease-specific. In our study, we applied a validated, adolescent-specific and community-based instrument for evaluating PF to provide concise and comparable data on PF in the context of SU among adolescent. Also, the JN approach endowed our study with an exact "region of significance" to compute the precision of the point estimate of the conditional effect of age on the SU-PF relationship. Also, it is difficult to infer causal relationship between SU and PF given our study design is cross-sectional. A certain degree of misclassifications of PFI is likely in spite of the use of a validated APFI instrument. However, it is unlikely these limitations significantly alter our findings because they are more or less randomly distributed. Probable confounders are typically extant in most epidemiological reports but their influences were moderated by adjusting for them. Also, our respondents were chiefly from African descent. Longitudinal studies from multi-ethnic settings are considered essential to clearly elucidate the etiology of the SU – PF relationship.

In conclusion, our data suggest higher SU exposure is associated with increased psychosocial dysfunction among adolescents with severe implications in early adolescence.

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CONFLICTS OF INTEREST

All authors declare no conflict of interest

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