A prospective study of trends in consumption of cigarettes and alcohol among adults in a rural Ugandan population cohort, 1994–2011

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Abstract

OBJECTIVES To characterise trends over time in smoking and alcohol consumption in a rural Ugandan population between 1994 and 2011.

METHODS We used self-reported data from a long-standing population cohort – the General Population Cohort. From 1989 to 1999, the study population comprised about 10 000 residents of 15 adjacent villages. From 1999, 10 more villages were added, doubling the population. Among adults (≥13 years, who comprise about half of the total study population), data on smoking were collected in 1994/1995, 2008/2009 and in 2010/2011. Data on alcohol were collected in 1996/1997, 2000/2001, 2009/2010 and 2010/2011.

RESULTS The reported prevalence of smoking among men was 17% in 1994/1995, 14% in 2008/2009 and 16% in 2010/2011; equivalent figures for women were 1.5%, 1% and 2%. In the most recent time period, for both sexes combined, prevalence of smoking increased from 1.5% in those aged <29 years, to 18% in those 50+ years ($P < 0.001$); prevalence was 14.8% in the lowest tertile of socio-economic status, decreasing to 3.7% in the highest ($P < 0.001$). For alcohol consumption, current drinking was reported by 39% in 1996/1997, 35% in 2000/2001 and 28% in 2010/2011; men were more likely to drink than women (32.9% *vs.* 23.5% in 2010/2011) and consumption increased with age ($P < 0.001$); and was associated with low socio-economic status, riskier sexual behaviour and being HIV positive ($P < 0.001$).

CONCLUSIONS In this rural Ugandan population, consumption of cigarettes and alcohol is higher among men than women, increases with age and is more frequent among those with low socio-economic status. We find no evidence of increases in either exposure over time.

keywords cigarettes, tobacco, alcohol, general population cohort, rural, Uganda

Introduction

Tobacco and alcohol consumption are a major public health challenge and are estimated to be responsible for 6 and 3.3 million deaths per year respectively [1, 2]. Both are major causes of non-communicable diseases, including cancers and cardiovascular disease and, in the case of alcohol, acute conditions such as accidents. Despite this, relatively little is known about patterns of smoking and alcohol consumption in many low income countries (although 80% of smokers worldwide live in low or middle income countries), nor are the health effects well measured. In Uganda, for example, there is some evidence from the population-based cancer registry in the capital city of Kampala that the incidence of lung cancer (strongly related to tobacco consumption with attributable fractions of greater than 90% in many populations) has increased by 1.8% per year in men (from an age-standardised incidence of 3.5/100 000/year to 4.1) between 1991 and 2010 and by 14% per year (from 0.7 to 5.1) in women [3]. This most likely reflects increases in tobacco consumption, at least in Kampala; it is unclear, however, if such an epidemiological transition is evident in the largely rural population of Uganda.

Demographic and Health Surveys have been conducted in a number of countries in sub-Saharan Africa and provide some population level data on prevalence of tobacco consumption [4]. Among men, the prevalence

varies from between 8% in Nigeria to 27% in Madagascar; among women, it ranges from 0.1% in Ghana to 6% in Namibia. Estimates of alcohol consumption are more limited.

Uganda is a low income country in East Africa with a population of around 36 million (2012 estimate); of those, 84% live in rural areas and 51% are under the age of 15 years. Like many countries in sub-Saharan Africa, it is undergoing demographic change, with population growth and improved survival into older age [5]. Relatively few data are available on prevalence and patterns of tobacco and alcohol consumption. In 2002, the census reported the prevalence of current smoking to be 8% nationwide, but no further details were available [6]. For adults, the Uganda Demographic and Health Survey [7] reported a prevalence of current cigarette smoking of 13% in men aged 15–59 and 0.6% among women aged 15–49. Previous surveys in 2006 and 2000–2001 reported prevalences of 19% and 18%, respectively, for men and 1% and 1.2% for women [4]. Only limited data are available on levels of consumption. Again, estimates of alcohol consumption are also limited.

We therefore examined prevalence of smoking and alcohol consumption, trends over time and risk factors, in a long-standing rural population cohort in south-western Uganda using data collected between the years 1994 and 2011.

Methods

The General Population Cohort was originally established in 1989, by the UK Medical Research Council and the Uganda Virus Research Institute, in Kalungu District, south-western Uganda, to examine prevalence, incidence, risk factors and trends of infection with the human immunodeficiency virus (HIV) in a rural African population [8]. More recently, research activity has broadened to include the epidemiology and genetics of other communicable and of non-communicable diseases, including cancer, cardiovascular disease and diabetes [9].

In brief, the General Population Cohort is a community-based open cohort study of residents of neighbouring villages within one-half of a subcounty, lying about 40 km from the shores of Lake Victoria. The population is scattered across the countryside in villages defined by administrative boundaries with a few concentrated in small trading centres. Agriculture is the main economic activity with rain-fed, small-holder farms. A population of approximately 10 000 people in a cluster of 15 villages was studied from 1989 to 1999. In 2000, the cohort was expanded to cover a further 10 villages, thereby doubling the population. The cohort is dynamic with new births, deaths and migration reported at each round of follow-up, and the

Table 1 Socio-demographic factors among adults aged ≥13 years in the General Population Cohort (GPC), by year of study

	1994/1995 *N* = 2903	(1996/1997 *N* = 3276	2000/2001 *N* = 6802	2008/2009 *N* = 6673	2009/2010 *N* = 7343	2010/2011 *N* = 7809
Age group						
<20	984 (33.9)	1149 (35.1)	2328 (34.2)	2158 (32.3)	2500 (34.0)	2388 (30.6)
20–29	594 (20.5)	760 (23.2)	1531 (22.5)	1309 (19.6)	1428 (19.5)	1474 (18.9)
30–39	428 (14.7)	487 (14.9)	1054 (15.5)	1105 (16.6)	1210 (16.5)	1310 (16.8)
40–49	321 (11.1)	338 (10.3)	689 (10.1)	850 (12.7)	901 (12.3)	1041 (13.3)
50–59	240 (8.3)	251 (7.7)	479 (7.0)	547 (8.2)	586 (8.0)	711 (9.1)
60+	336 (11.6)	291 (8.9)	721 (10.6)	704 (10.6)	718 (9.8)	885 (11.3)
Sex						
Male	1396 (48.1)	1581 (48.2)	3167 (46.6)	2715 (40.7)	3291 (44.8)	3417 (43.7)
Female	1507 (51.9)	1697 (51.8)	3636 (53.4)	3958 (59.3)	4052 (55.2)	4392 (56.2)
Marital status						
Married	1207 (42.4)	1363 (41.8)	2818 (41.5)	2855 (42.8)	3136 (42.7)	3408 (43.6)
Divorced/separated/widowed	478 (16.8)	508 (15.6)	1158 (17.0)	1123 (16.8)	1163 (15.8)	1489 (19.1)
Single (never married)	1161 (40.8)	1388 (42.6)	2820 (41.5)	2693 (40.4)	3044 (41.5)	2912 (37.3)
Education						
None/less than primary		1334 (40.7)		659 (9.9)	656 (8.9)	808 (10.4)
Incomplete primary		1241 (37.9)		3058 (45.9)	3242 (44.2)	3452 (44.2)
Completed primary		385 (11.8)		1351 (20.3)	1481 (20.2)	1517 (19.4)
Secondary or above		314 (9.6)		1600 (24.0)	1961 (26.7)	2032 (26.0)
HIV serostatus						
Positive	151 (5.2)	198 (6.1)	344 (5.2)	403 (6.3)	449 (6.2)	595 (7.7)

Table 2 Reported smoking and alcohol consumption among adults aged ≥13 years in the General Population Cohort (GPC), by year of study

	1994/1995	1996/1997	2000/2001	2008/2009	2009/2010	2010/2011
SMOKING						
Smoking						
Current smoker	264 (9.1)			407 (6.1)*		641 (8.2)†
Ex–smoker	125 (4.3)			195 (2.9)		194 (2.5)
Never smoked	2511 (86.6)			6065 (91.0)		6974 (89.3)
Smoking duration						
<5 years	27 (7.5)					18 (3.8)‡
5– <10 years	59 (16.5)					34 (7.1)
10– <20 years	71 (19.8)					109 (22.8)
20+ years	201 (56.2)					317 (66.3)
Average cigarettes per day						
1–2				215 (39.7)§		
3–5				205 (37.8)		
6–10				92 (17.0)		
11+				30 (5.5)		
DRINKING						
Alcohol						
Never drinks		1842 (56.2)	3773 (55.5)			5028 (64.4)
Does not drink currently		160 (4.9)	648 (9.5)			628 (8.0)
Current drinker		1276 (38.9)	2380 (35.0)			2153 (27.6)
Currently drinks alcohol and frequency of consumption						
No		2002 (61.1)	4419 (65.0)		5906 (80.5)¶	5656 (72.4)
Yes		1276 (38.9)	2380 (35.0)		1430 (19.5)	2153 (27.6)
Monthly or less					920 (12.5)	889 (11.4)
2–4 times/month					248 (3.4)	512 (6.6)
2–3 times/week					148 (2.0)	338 (4.3)
4+ times/week					114 (1.6)	414 (5.3)
Last time had a drink						
Never/not in last year						5656 (72.5)
In past month/>1 month						971 (12.5)
In the past week						536 (6.9)
Today/yesterday						639 (8.2)

*In 2008/2009, participants were asked whether they currently or had ever smoked regularly, but not about current/past non-regular smoking.
†In 2010/2011, participants were asked whether they ever smoked daily, not about past non-daily smoking.
‡Information on duration in participants who are current daily smokers.
§Average consumption in participants who report currently or ever smoking regularly.
¶In 2009/2010, participants were only asked about drinking in the past 12 months, not if they had ever consumed alcohol.

population under survey includes approximately 22 000 people, fewer than half of whom are ≥13 years of age. Data are collected through an annual census, questionnaire and serological survey. Details of sexual behaviour, medical, socio-demographic and geographic factors are recorded. Blood specimens are obtained at each annual survey. Serum is tested for HIV-1, and the remainder is stored at −80 °C in freezers in Entebbe. For much of that time, seroprevalence of HIV has remained relatively stable in this population, with about 8% of participants infected; in recent years, prevalence has risen slightly, with the roll out of antiretroviral therapy. For a more detailed history of the cohort, see Asiki *et al.* [9] and Kaleebu *et al.* [10].

By way of background to the cohort, Table 1 shows socio-demographic variables and HIV serostatus in the cohort population. It is a relatively young adult population, similar to many developing countries, with the proportion of people in each age group, declining with age. In each time period, there are more female participants than males and about 40% of people report being single and never married. The proportion of people with at least primary school education has increased markedly over time, reflecting the growth of free primary education in

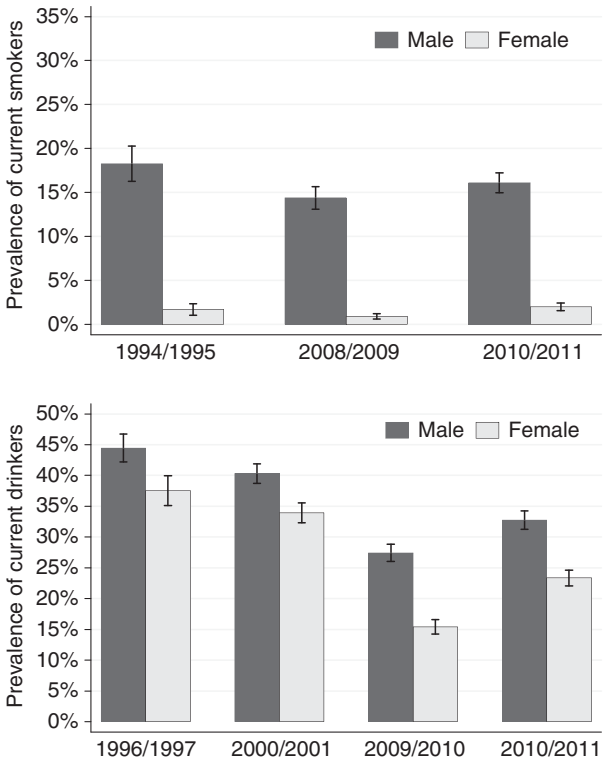

Figure 1 Prevalence (95% CI) of current smokers (top) and current drinkers (bottom) in the GPC, by sex and year, age-standardised to the population in 2010/2011.

Uganda. HIV prevalence has increased over time from 5.2% in 1994/1995 to 7.7% in 2010/2011.

Self-reported data on smoking were collected in survey rounds in 1994/1995, 2008/2009 and 2010/2011. Self-reported data on alcohol consumption were collected in 1996/1997, 2000/2001, 2009/2010 and 2010/2011. Some data from 1996/1997 to 2009/2010 have been published in other contexts, but patterns and trends of consumption over time have not [11, 12]. The specific questions asked are shown in the Table S1, but it is notable that the questions asked in each round varied slightly (for example, in some rounds, participants were asked about history of any smoking, whereas in other rounds, they were asked about daily smoking), making direct comparisons over time more difficult. In Round 2010/2011, a modified version of WHO STEPS was used (http://www.who.int/chp/steps/en/).

Data were double-entered and verified in Access. Stata 12 (Stata Corporation, College Station, TX, USA) was used for analyses. Socio-demographic characteristics and reported smoking and alcohol consumption were tabulated by survey round. In addition, the prevalence of current smoking and current drinking in each round was age-standardised to the population in 2010/2011.

Consistency of reporting between rounds of ever and current smoking, or ever and current drinking was assessed using Kappa statistic, with the Landis and Koch interpretation for the strength of agreement [13].

Logistic regression was used to estimate odds ratios (OR) and 95% confidence intervals (CI) for associations with current smoking in and with current drinking in each of the relevant time periods. Age and sex were included in all models as *a priori* confounders. Because there were few covariates in common across the rounds, no attempt was made to build a final multivariable model.

Ethical approval for this study was granted by the Uganda Virus Research Institute Science and Ethics Committee and was approved by the Uganda National Council for Science and Technology.

Results

Table 2 reports smoking and alcohol consumption over time. Population characteristics – including smoking prevalence and reported alcohol consumption – remained relatively stable between 1994 and 2011. The prevalence of smoking among men was reported to be 17% in 1994/95, 14% in 2008/2009 and 16% in 2010/2011; the equivalent figures for women were 1.5%, 1% and 2%, respectively (Figure 1). Data from 1994/1995 to 2010/2011 indicate that more than half of smokers had been smoking for more than 20 years; data from 2008/2009 indicate that nearly 80% of smokers consume fewer than five cigarettes per day. The prevalence of ex-smokers was reported to be 4.3% in 1994/1995, 2.9% in 2008/2009 and 2.5% in 2010/2011. In relation to alcohol consumption, in all time periods, between 28 and 39% of people reported being a current drinker (Figure 1); 56–64% of people report never drinking (Table 2).

Table 3 shows factors associated with current smoking among GPC participants for 1994/1995 and 2010/2011. Although not all factors were considered in both rounds, there is consistency in results over time. Men are more likely to smoke than women (in 1994/1995, adjusted odds ratio [aOR] = 16.1; 95% confidence interval [CI] 10.3–24.9; in 2010/11, aOR = 12.5; 95% CI 9.8–15.8) and prevalence of smoking increases with age. Level of education and other markers of socio-economic status (SES), such as number of rooms in the house, are inversely associated with smoking in both time periods. In addition, the prevalence of smoking increases with increasing self-reported alcohol consumption (P-trend < 0.001 in 2010/11) and is higher among

Table 3 Factors associated with current smoking among participants in the GPC in 1994/1995 and 2010/2011

	1994/1995		2010/2011	
	n current smoker/ total *N* (%)	Age- and sex-adjusted OR (95% CI)	*n* current smoker/ total *N* (%)	Age- and sex-adjusted OR (95% CI)
SOCIODEMOGRAPHIC				
Age group		$P < 0.001$		$P < 0.001$
<29	70/1575 (4.4%)	0.24 (0.16, 0.36)	58/3862 (1.5%)	0.11 (0.08, 0.15)
30–39	55/428 (12.9%)	1	122/1310 (9.3%)	1
40–49	58/321 (18.1%)	1.63 (1.05, 2.53)	174/1041 (16.7%)	1.93 (1.48, 2.52)
50+	81/576 (14.1%)	0.97 (0.65, 1.43)	287/1596 (18.0%)	2.20 (1.73, 2.81)
Sex		$P < 0.001$		$P < 0.001$
Male	241/1396 (17.3%)	16.1 (10.3, 24.9)	552/3417 (16.1%)	12.46 (9.84, 15.76)
Female	23/1504 (1.5%)	1	89/4392 (2.0%)	1
Marital status		$P < 0.001$		$P < 0.001$
Married	118/1206 (9.8%)	1	345/3408 (10.1%)	1
Divorced/separated/ widowed	82/478 (17.1%)	3.25 (2.26, 4.68)	242/1489 (16.2%)	3.09 (2.47, 3.85)
Single (never married)	194/869 (5.2%)	0.84 (0.53, 1.35)	54/2912 (1.8%)	0.65 (0.42, 1.02)
Education				$P < 0.001$
None/less than primary			141/808 (17.4%)	5.21 (3.73, 7.28)
Incomplete primary			318/3452 (9.2%)	2.51 (1.91, 3.30)
Completed primary			102/1517 (6.7%)	1.64 (1.18, 2.27)
Secondary or above			80/2032 (3.9%)	1
Tribe		$P < 0.001$		$P < 0.001$
Muganda	60/1062 (5.6%)	1	335/5745 (5.8%)	1
Rwandese	30/252 (11.9%)	1.98 (1.20, 3.26)	151/1135 (13.3%)	2.22 (1.76, 2.80)
Other	26/107 (24.3%)	5.74 (3.16, 10.4)	134/763 (17.6%)	3.40 (2.63, 4.39)
Religion		$P = 0.005$		$P = 0.006$
Catholic	104/931 (11.2%)	1	367/4489 (8.2%)	1
Protestant	16/244 (6.6%)	0.52 (0.29, 0.93)	131/1294 (10.1%)	1.40 (1.10, 1.78)
Muslim	27/439 (6.1%)	0.53 (0.33, 0.85)	123/1863 (6.6%)	0.89 (0.71, 1.13)
Rooms in house		$P < 0.001$		$P < 0.001$
≤ 2	112/634 (17.7%)	4.51 (3.05, 6.68)	219/1900 (11.5%)	3.36 (2.54, 4.43)
3	49/572 (8.6%)	1.71 (1.10, 2.66)	96/919 (10.4%)	2.92 (2.11, 4.05)
4	53/742 (7.1%)	1.37 (0.89, 2.10)	215/2546 (8.4%)	2.16 (1.65, 2.82)
5+	47/941 (5.0%)	1	99/2351 (4.2%)	1
SES tertile				$P < 0.001$
Low			270/1820 (14.8%)	4.59 (3.51, 6.00)
Middle			176/2566 (6.9%)	2.07 (1.57, 2.73)
High			93/2522 (3.7%)	1
BEHAVIOURAL				
Alcohol				$P < 0.001$
Never drinks			153/5028 (3.0%)	1
Does not drink currently			77/628 (12.3%)	2.35 (1.70, 3.24)
Current drinker			411/2153 (19.1%)	3.00 (2.41, 3.72)
Frequency of drinking in past year				$P < 0.001$
No drinking			230/5656 (4.1%)	1
Monthly or less			63/889 (7.1%)	1.42 (1.04, 1.94)
2–4 times/month			84/512 (16.4%)	1.85 (1.38, 2.49)
2–3 times/week			110/338 (32.5%)	3.15 (2.34, 4.22)
4+ times/week			154/414 (37.2%)	3.78 (2.90, 4.96)

Table 3 (*Continued*)

	1994/1995		2010/2011	
	n current smoker/ total *N* (%)	Age- and sex-adjusted OR (95% CI)	*n* current smoker/ total *N* (%)	Age- and sex-adjusted OR (95% CI)
Sexual partners in the past 12 m				$P = 0.009$
None			204/3552 (5.7%)	1
1			315/3581 (8.8%)	0.72 (0.58, 0.91)
2			71/443 (16.0%)	0.70 (0.50, 0.98)
3+			49/227 (21.6%)	1.09 (0.72, 1.63)
Casual partner in past 12 m				$P = 0.002$
No			537/7168 (7.5%)	1
Yes			104/640 (16.2%)	1.52 (1.17, 1.97)
HIV serostatus		$P < 0.001$		$P < 0.001$
Negative	232/2726 (8.5%)	1	548/7145 (9.2%)	1
Positive	29/150 (19.3%)	3.17 (1.88, 5.34)	86/595 (16.2%)	1.74 (1.31, 2.32)

those who are HIV positive (in 1994/1995, aOR = 3.2; 95% CI 1.9–5.3; in 2010/2011, aOR = 1.7; 95% CI 1.3–2.3).

Table 4 shows factors associated with current drinking for 1996/1997, 2000/2001 and 2010/2011. Patterns of alcohol use were broadly similar to those of cigarette consumption, with risks being higher among men compared to women, in older people and among those of low SES ($P < 0.001$ for each). In all Rounds, Protestants reported less alcohol use than Catholics; Muslims reported substantially less (aOR = 0.03; 95% CI 0.02–0.04 in 2010/2011). In addition, alcohol was associated with riskier sexual behaviour and being HIV seropositive (aOR = 1.6; 95% CI 1.3–1.9 in 2010/2011). These findings were evident in all of the rounds examined.

People who report being a current smoker, or having ever smoked, in an earlier time period should report ever smoking in subsequent rounds. Of those who reported current smoking in 1994/1995, 80% reported ever smoking in 2008/2009 and 90% reported ever smoking in 2010/2011. Of those who reported current smoking in 2008/2009, 84% reported ever smoking in 2010/2011. Agreement based on Kappa statistics is moderate and increases as the interval between rounds get smaller. However, 10–20% of participants who reported being a smoker in an earlier round said they had never smoked in a subsequent round. Of those who reported ever smoking in 1994/1995, 74% reported ever smoking in 2008/2009, and 86% reported ever smoking in 2010/2011. Of those who reported ever smoking in 2008/2009, 82% reported ever smoking in 2010/2011. The Kappa statistic showed moderate to substantial agreement. As current smoking status can change between rounds, we cannot use this to assess response validity; however, it appears that 60–70% of smokers remain consistent smokers across rounds, and >90% of non-smokers remain consistent non-smokers.

A similar level of agreement between responses in different time periods was seen with the questions about drinking. Around 60–70% of current drinkers remained consistent drinkers across time periods, and around 85% of non-drinkers remained consistent non-drinkers. Agreement based on the Kappa statistic was moderate to substantial and remained fairly constant between time periods (Table S2).

Discussion

In summary, in this rural Ugandan population, cigarette consumption is higher among men than women, increases with age and is more frequent among those with low socio-economic status. We find no evidence of substantial increases over time, and nearly 80% of smokers consume fewer than five cigarettes a day. The findings are in line with those of other studies from Uganda and elsewhere in the region and more widely in sub-Saharan Africa [1, 4, 7], with the exception of the Global Youth Tobacco Survey [14]. This survey indicated a prevalence of tobacco use among girls aged 13–15 years in Uganda of 4%, substantially higher than was found here – the reasons for this are unclear, although may reflect the fact that the sample was from urban centres. Furthermore, the prevalence of people reported as being ex-smokers declined over time, despite recent national antismoking campaigns.

Table 4 Factors associated with current drinking among participants in the GPC in 1996/1997, 2000/2001 and in 2010/2011

	1996/1997		2000/2001		2010/2011	
	n current drinker/total *N* (%)	Age- and sex-adjusted OR (95% CI)	*n* current drinker/total *N* (%)	Age- and sex-adjusted OR (95% CI)	*n* current drinker/ total *N* (%)	Age- and sex-adjusted OR (95% CI)
SOCIODEMOGRAPHIC						
Age group		$P < 0.001$		$P < 0.001$		$P < 0.001$
<29	503/1909 (26.3%)	1	797/3859 (20.7%)	1	456/3862 (11.8%)	1
30–39	258/487 (53.0%)	3.27 (2.66–4.03)	542/1051 (51.6%)	4.19 (3.63–4.84)	527/1310 (40.2%)	5.55 (4.78–6.45)
40–49	201/338 (59.5%)	4.23 (3.32–5.38)	378/688 (54.9%)	4.80 (4.05–5.69)	467/1041 (44.9%)	6.54 (5.58–7.67)
50+	313/542 (57.7%)	3.86 (3.16–4.72)	663/1200 (55.3%)	4.83 (4.20–5.55)	703/1596 (44.0%)	6.37 (5.53–7.34)
Sex		$P < 0.001$		$P < 0.001$		$P < 0.001$
Male	677/1581 (42.8%)	1	1226/3166 (38.7%)	1	1123/3417 (32.9%)	1
Female	599/1697 (35.3%)	0.67 (0.58–0.78)	1154/3633 (31.8%)	0.68 (0.61–0.76)	1030/4392 (23.5%)	0.51 (0.46–0.57)
Marital status		$P < 0.001$		$P < 0.001$		$P < 0.001$
Married	734/1363 (53.9%)	1	1359/2813 (48.3%)	1	1299/3408 (38.1%)	1
Divorced/ separated/widowed	279/508 (54.9%)	1.08 (0.87–1.35)	590/1157 (51.0%)	1.01 (0.87–1.17)	605/1489 (40.6%)	1.12 (0.98–1.29)
Single (never married)	256/1388 (18.4%)	0.21 (0.17–0.26)	427/2820 (15.1%)	0.27 (0.23–0.31)	249/2912 (8.6%)	0.25 (0.20–0.30)
Education		$P < 0.001$				$P = 0.57$
None/less than primary	308/1334 (23.1%)	1			291/808 (36.0%)	1
Incomplete primary	660/1241 (53.2%)	3.14 (2.62–3.75)			958/3452 (27.8%)	1.02 (0.85–1.21)
Completed primary	164/385 (42.6%)	2.28 (1.77–2.94)			402/1517 (26.5%)	0.96 (0.79–1.18)
Secondary or above	141/314 (44.9%)	2.16 (1.64–2.83)			502/2032 (24.7%)	1.08 (0.89–1.32)
Tribe		$P < 0.001$		$P < 0.001$		$P < 0.001$
Muganda	530/1313 (40.4%)	1	1051/2817 (37.3%)	1	1413/5745 (24.6%)	1
Rwandese	182/342 (53.2%)	1.66 (1.30–2.13)	345/634 (54.4%)	1.96 (1.63–2.35)	398/1135 (35.1%)	1.48 (1.27–1.71)
Other	100/168 (59.5%)	2.11 (1.51–2.97)	208/404 (51.5%)	1.63 (1.31–2.02)	285/763 (37.4%)	1.68 (1.42–2.00)
Religion		$P < 0.001$		$P < 0.001$		$P < 0.001$
Catholic	749/1197 (62.6%)	1	1489/2709 (55.0%)	1	1699/4489 (37.8%)	1
Protestant	151/305 (49.5%)	0.60 (0.46–0.78)	314/724 (43.4%)	0.62 (0.52–0.74)	350/1294 (27.0%)	0.54 (0.47–0.63)
Muslim	20/526 (3.8%)	0.02 (0.01–0.03)	36/1055 (3.4%)	0.02 (0.02–0.03)	46/1863 (2.5%)	0.03 (0.02–0.04)
Rooms in house		$P < 0.001$				$P < 0.001$
≤ 2	355/758 (46.8%)	2.06 (1.67–2.54)			656/1900 (34.5%)	1.87 (1.61–2.18)
3	257/603 (42.6%)	1.62 (1.30–2.03)			246/919 (26.8%)	1.22 (1.01–1.48)
4	347/893 (38.9%)	1.36 (1.11–1.67)			702/2546 (27.6%)	1.26 (1.10–1.45)
5+	293/954 (30.7%)	1			518/2351 (22.0%)	1
SES tertile						$P < 0.001$
Low					606/1820 (33.3%)	1.61 (1.39–1.87)
Middle					696/2566 (27.1%)	1.35 (1.17–1.55)
High					542/2522 (21.5%)	1

Table 4 (*Continued*)

	1996/1997		2000/2001		2010/2011	
	n current drinker/total *N* (%)	Age- and sex-adjusted OR (95% CI)	*n* current drinker/total *N* (%)	Age- and sex-adjusted OR (95% CI)	*n* current drinker/ total *N* (%)	Age- and sex-adjusted OR (95% CI)
Ownership of household items		$P < 0.001$		$P < 0.001$		
1–2	314/615 (51.1%)	4.20 (2.58–6.83)	464/936 (49.6%)	2.75 (2.05–3.69)		
3–4	571/1463 (39.0%)	2.73 (1.71–4.38)	1074/2992 (35.9%)	1.80 (1.38–2.37)		
5	344/1000 (34.4%)	2.33 (1.45–3.75)	729/2382 (30.6%)	1.45 (1.10–1.91)		
≥6	24/132 (18.2%)	1	81/375 (21.6%)	1		
BEHAVIOURAL						
Partners in the past 12 months		$P < 0.001$		$P < 0.001$		$P < 0.001$
None	298/1383 (21.5%)	1	628/2958 (21.2%)	1	552/3551 (15.5%)	1
1	818/1603 (51.0%)	3.60 (3.01–4.30)	1419/3190 (44.5%)	2.88 (2.53–3.27)	1260/3581 (35.2%)	2.51 (2.20–2.86)
2	102/179 (57.0%)	4.47 (3.17–6.30)	215/410 (52.4%)	3.68 (2.91–4.66)	216/443 (48.8%)	3.85 (3.04–4.87)
3+	58/111 (52.3%)	3.75 (2.47–5.70)	114/235 (48.5%)	3.65 (2.72–4.89)	123/227 (54.2%)	4.96 (3.65–6.74)
Casual partner in past 12 months		$P < 0.001$		$P < 0.001$		$P < 0.001$
No	1178/3068 (38.4%)	1	2140/6275 (34.1%)	1	1848/7167 (25.8%)	1
Yes	98/208 (47.1%)	1.78 (1.31–2.40)	239/521 (45.9%)	2.19 (1.80–2.67)	305/640 (47.7%)	2.63 (2.18–3.16)
Condom use at last sex		$P < 0.001$		$P = 0.50$		
No	1182/3061 (38.6%)	1	2030/4373 (46.4%)	1		
Yes	94/215 (43.7%)	1.73 (1.29–2.33)	190/468 (40.6%)	0.93 (0.76–1.15)		
HIV serostatus		$P < 0.001$		$P < 0.001$		$P < 0.001$
Negative	1147/3064 (37.4%)	1	2146/6308 (34.0%)	1	1877/7144 (26.3%)	1
Positive	123/198 (62.1%)	2.76 (2.01–3.79)	188/343 (54.8%)	2.04 (1.61–2.58)	254/596 (42.6%)	1.58 (1.31–1.91)

The methods used for measuring smoking in the General Population Cohort did not include questions about use of snuff, or chewing tobacco, both of which are relatively common in the study area [15, 16]. Total tobacco consumption is likely, therefore, to be higher than the results suggest. We have no data on the type of cigarette consumed (commercial brands or home-made), the relative use of pipes *vs.* cigarettes, or on whether tobacco was grown locally or purchased from elsewhere. However, data from a study of agricultural practice in the cohort area indicate that more than 30% of households examined grow some tobacco – apparently largely for personal consumption or local sale (D. Agol, R. Newton, D. Bukenya, G. Asiki, F. Ssembajja, G. Tumwekwase, J. Seeley, submitted).

In the General Population Cohort, the study population is enumerated and recruited through annual house-to-house rounds of census, through which participants for the medical surveys are selected. Overall, more than 95% of households approached for census participate and this has remained consistent over time [9]. To be eligible for the census and survey, each participant must have spent or be planning to spend at least 3 months in a household within the area. At the time of survey, the proportion of those eligible at census that are recruited has varied from 61% to 89% over time, but is usually greater than 70%. Of those included in the census, but absent from the survey, young men predominate and, in fact, they may well be working elsewhere. Many return to the area in subsequent rounds. Recent unpublished findings indicate that of those actually present at the time of survey, more than 90% are recruited. It is unclear how this impacts on the findings presented here, but has at least been consistent over time, suggesting that examination of temporal trends is valid.

The lack of evidence of increases in the prevalence of smoking in this study is no reason for complacency regarding prevention. The negative health effects of tobacco are both established and massive. The evidence showing that it is easier to prevent uptake of smoking than to persuade smokers to stop is overwhelming. The time for intervention against tobacco in sub-Saharan Africa must surely be now.

Similarly, reported prevalence and patterns of alcohol consumption changed little over time. The exception to this was in Round 21 (2009/2010) when the reported prevalence of current drinking was substantially lower than in other rounds. The low prevalence of heavy consumption and high prevalence of those reporting never drinking alcohol suggest that there may be more reporting bias in data from this round than others – perhaps this is due to the particular questions used. Use of locally grown agricultural products to brew and distil alcohol is common in the study area, and there are several bars serving commercial brands of beer and spirits in local trading centres.

There are few data on the health consequences of tobacco and alcohol from Uganda. There is no routine death certification or disease notification, with the exception of a population-based cancer registry serving Kyadondo Country – in effect, the capital city of Kampala. As the majority of the Ugandan population (>80%) is not urban, caution is required before extrapolating the findings from a major urban centre to the largely rural population. However, there is evidence of increases in the incidence of lung cancer in the last two decades particularly among women; this presumably reflects increases in tobacco consumption in Kampala, which are not evident in data presented here [3]. Similarly, liver cancer, which is known to be caused by alcohol, is relatively common in Uganda. However, as other important causes – notably Hepatitis Viruses B & C and Aflatoxins – have also been shown to be common in Uganda, the relative contribution of alcohol to liver cancer incidence is unknown [17, 18]. In summary, therefore, in rural Uganda, we find no evidence of increases in either cigarette or alcohol consumption over time. The impact of epidemiological transition, as measured by smoking and alcohol consumption, is not evident in the self-reported data from this population group.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Table S1. Questions about smoking and alcohol consumption that were asked in medical survey.

Table S2. Comparison of answers to questions about smoking and alcohol across years.

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