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## Overestimation of alcohol consumption norms as a driver of alcohol consumption: a whole-population network study of men across eight villages in rural, southwestern Uganda

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### Abstract

**Background and aims:** Little is known about how perceived norms about alcohol consumption may influence high alcohol consumption rates in Uganda. This study estimated the accuracy of perceived norms about men's alcohol consumption and estimated the association between perceived norms and personal consumption.

**Design:** Cross-sectional, whole-population, sociocentric social network study.

**Setting:** Eight rural villages in Rwampara District in southwestern Uganda in 2016–2018.

**Participants:** A total of 719 men aged 18 years and older (representing 91% of permanent resident men).

**Measurements:** Self-reported frequent ( 4 days per week) and heavy alcohol consumption (six or more drinks on one occasion, three or more occasions of intoxication, or spending an excessive

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amount on alcohol). Participants also reported whether they thought most other men in their village engaged in frequent and heavy alcohol consumption (perceived norms). Using the network study design, we calculated alcohol consumption behavior within villages and social networks. Perceived norms were compared with aggregated self-reports. Multivariable Poisson regression models were used to estimate the association between perceived norms and individual behavior.

**Findings:** Throughout villages, frequent and heavy alcohol consumption ranged from 7 to 37%. However, 527 (74%) participants perceived, contrary to fact, that most other men in their villages frequently consumed alcohol, and 576 (81%) perceived that most others heavily consumed alcohol. Overestimation of alcohol consumption by others was pervasive among sociodemographic subgroups and was present irrespective of the actual consumption behavior at the village level and within social networks. Men who misperceived these alcohol consumption behaviors as being common were more likely to engage in frequent (adjusted relative risk [aRR] = 3.98; 95% confidence interval [CI] = 1.69–9.34) and heavy (aRR = 4.75; 95% CI, 2.33–9.69) alcohol consumption themselves.

**Conclusions:** Most men in eight rural Ugandan villages incorrectly thought that frequent and heavy alcohol consumption were common among men in their villages. These misperceived norms had a strong positive association with individual drinking behavior.

### Keywords

social norms; social networks; descriptive norms; perceived norms; binge drinking; alcohol consumption; sub-Saharan Africa; Uganda; alcohol use; misperception

## INTRODUCTION

During the last several decades, the commercial availability of alcohol has expanded across sub-Saharan Africa. Increases in alcohol marketing, alcohol industry influence, and alcohol consumption have accompanied this expansion.[1–3] Updates to national alcohol regulatory frameworks, however, have lagged.[4] Meanwhile, the availability of treatment and support for people with alcohol use disorders remains limited.[5] Moreover, stigma attached to alcohol use and mental disorders is pervasive and undermines treatment seeking.[6–8]

Uganda has one of the highest per capita rates of alcohol consumption among men in sub-Saharan Africa.[9] While fewer than 8% of women report heavy drinking in Uganda, one in three men report heavy episodic drinking and 1 in 10 are classified as having alcohol use disorder.[9, 10] Despite these high rates, Uganda has few alcohol use disorder treatment programs and most are particularly inaccessible in rural areas.[11] Identifying novel entry points to reduce harmful levels of alcohol consumption among men in this context is critical for reducing personal alcohol-related harms associated with consumption[12] as well as reducing negative consequences for others, such as HIV transmission[13] and intimate partner violence.[14] Perceived norms about alcohol consumption in this context may be an understudied key factor in determining alcohol consumption behaviors among men in Uganda.

## Conceptual Framework

People often incorrectly perceive the extent to which health behaviors among peers are normative, i.e. which health behaviors or health risk behaviors are widely prevalent among their peers.[15–18] College students in the United States and Europe represent the canonical example of this phenomenon: studies have consistently found that college students believe heavy alcohol consumption is more common among their peers than is actually true.[17] Moreover, individuals' perceptions concerning typical alcohol consumption behavior are strongly associated with their own alcohol consumption behavior.[19–24] This body of research has focused primarily on studying alcohol consumption among young adults within educational or other institutional settings in high-income countries.

Emerging literature from sub-Saharan Africa has provided parallel evidence consistent with these findings. First, people overestimate the prevalence of high-risk or harmful behaviors, and underestimate the prevalence of protective behaviors, in relation to HIV[25–29] and other health conditions of interest.[30] These studies also show evidence of associations between norm perceptions and individual behavior. Second, field experiments investigating expressions of dissent, conflict resolution, corruption, and violence against women find associations between changes in perceived norms and changes in individual attitudes and behaviors.[31–34] However, the extent to which alcohol consumption norms are misperceived and the role of this misperception in driving individual alcohol consumption have not been studied within a general population sample in sub-Saharan Africa.

Additionally, no studies have assessed the extent to which exposure to alcohol consumption by others, either during childhood or adulthood, may confound estimates of the association between perceived norms about alcohol consumption and individual alcohol consumption. However, exposure to others' alcohol consumption is associated with both perceived norms [35, 36] and individual alcohol consumption.[37–39] Failure to properly adjust for exposure to alcohol consumption by others may bias (away from the null) estimates of the association between perceived norms and individual consumption.

The relevance of this body of research for prevention of alcohol-related harms is clear: if men in Uganda overestimate alcohol consumption norms among their peers, and this misperception is a significant driver of their own heavy alcohol consumption, then the “social norms approach” might be used to correct misperceived alcohol consumption norms and, ultimately, change behavior.[40] In contrast to interventions that aim to educate people about the harmful biological effects of alcohol consumption or to persuade people about the risks of heavy consumption, ‘social norms’ interventions provide information about how peers actually consume less alcohol than is commonly believed.[40–43] This intervention approach has primarily been used to reduce high-risk alcohol consumption among college students,[17, 18, 44–46] but has also gained traction in other contexts.[47–57]

For this study, we analysed data about perceived alcohol consumption norms and personal reports of alcohol consumption from individuals and peers in an ongoing whole-population, sociocentric social network study of adults in rural Uganda.[58] The study design uniquely allowed us to collect and compare measures of exposure with perceived norms and estimate their associations with personal consumption. This study focused only on alcohol

consumption behavior among men because self-report of potentially harmful levels of alcohol use is rare among women in this setting in Uganda. We hypothesized that most men would not report frequent or heavy alcohol consumption, that men across the whole population perceive that most other men in their villages engage in frequent and heavy consumption of alcohol, and that individual alcohol consumption behavior would be associated with one's perception of alcohol consumption norms (after adjusting for exposure and other factors).

## METHODS

### Study Population and Procedure

We conducted a cross-sectional, whole-population study among all adult residents aged 18 years and older in 8 villages in one administrative parish in Rwampara District, a rural region in southwestern Uganda. This parish, located approximately 20 kilometers from the local commercial hub of Mbarara Town, was selected due to its tractable population and geographic size, the lack of non-profit and intervention presence in the parish, and its similarity to other rural areas in Uganda where most Ugandans reside.[59] Additionally, this region is similar to other low-resource rural contexts in sub-Saharan Africa in that most households engage in an agriculture-based economy or small-scale trading/enterprise, household food and water insecurity are common, and access to electricity and piped water is rare.[59–62]

Research assistants who spoke the local language (Runyankore) collected data in 2016–2018. Using a continuously updated parish census list of eligible adult residents, a research assistant approached a potential participant typically at their home and asked the person to participate in a study about health and wellbeing after undergoing an informed consent process. A signature or a thumbprint indicating consent to participate was obtained. Data were collected with a computer-assisted, survey-based interview tool. Survey questions had been written in English, translated into Runyankore, and then back-translated to English to verify the translation's fidelity. Question piloting and translation followed an iterative process.

The network study design entailed using name generator questions to elicit the names of other adult parish residents with whom a participant directly interacted.[63] These questions focused on social interactions related to social exchange, food exchange, financial discussions, health discussions, and emotional support.[58, 64] Another question elicited the names of any spouses. Participants provided confirmation of responses via a photographic search function on the computer. All responses represented out-going personal network ties, and were collapsed across the six name generator questions.[65] Information was also available regarding in-coming personal network ties because all the eligible nominations were also eligible study participants due to the sociocentric network design of the study, which targets everyone within a specific boundary.[63, 64] Thus, the set of unique direct ties to a participant, regardless of direction, represented a participant's personal network.[66] Ties to people who did not participate in the study were excluded, as were ties to women, because this study focused on men. Additionally, data self-reported by participants within a participant's personal network were linked to the index participant.

Ethical approval was granted by the Partners Human Research Committee at Massachusetts General Hospital, the Research Ethics Committee at Mbarara University of Science and Technology, and the Vanderbilt Human Research Protections Program. We also received clearance from the Uganda National Council of Science and Technology and the Research Secretariat in the Office of the President of the Republic of Uganda. The analyses were not pre-registered; therefore, the results should be considered exploratory.

## Measures

**Alcohol consumption behavior.**—The primary outcomes for this analysis were frequent alcohol consumption and heavy alcohol consumption. Participants reported their own frequency of alcohol consumption using the following categories as response options: within the past year (once a month or less, 2–4 times per month, 2–3 times per week, and 4 times per week), 1–5 years prior to interview, more than 5 years prior, and never. We defined *frequent alcohol consumption* as consuming alcohol 4 times per week (vs. 2–3 times per week or less). This threshold was based on a prior study of alcohol consumption across 35 countries (including Uganda) classifying high-frequency drinking as 5 times per week.[67]

Among participants who reported alcohol consumption within the past year, we administered a locally derived scale consisting of three items about alcohol consumption behavior [68]: consuming 6 or more drinks in a single sitting in the past 12 months; spending 25,000 Ugandan shillings (approximately \$10 at the time of the survey) on alcohol in the past 30 days; or being intoxicated on 3 or more of the past 30 days. The first item was the only one to refer to “drinks” and therefore also included these additional instructions: “I understand that you may share drinks and that some drinks have different sizes. For the purposes of this question, “one drink” should be considered equal to 1 shot or 1 tot of a strong alcoholic drink like waragi or vodka, or 1 full glass of a light alcoholic drink like beer”. This instruction was pilot-tested. The definition gave participants a sense of the large quantity of alcohol that 6 or more drinks represented when thinking about their response to the first item. We defined *heavy alcohol consumption* as reporting at least one of these three behaviors.[68] This study did not collect number of alcoholic drinks typically consumed because alcoholic drinks of non-standardized quantities and types are commonly consumed in this context.[69]

We used these individual-level data to calculate population-level norms of alcohol consumption behavior at the village level. Frequent alcohol consumption was considered normative in a village if >50% of men in the village reported frequent consumption of alcohol. The population-level norm for heavy alcohol consumption was defined similarly. This >50% threshold to identify population norms has been used in the social norms literature, both in Uganda[25, 30] and in other settings.[70–72]

We then combined the individual-level data with personal network data to calculate the number of male alters (i.e., men in the index participant’s personal network) who reported frequent alcohol consumption and the number of male alters who reported heavy alcohol consumption. We also created two binary variables: exposure (versus no exposure) to at least one male alter who reported frequent alcohol consumption and exposure (versus no exposure) to at least one male alter who reported heavy alcohol consumption.

**Perceived norms about alcohol consumption behavior.**—Four questions elicited participants' perceptions about norms of alcohol consumption among other men in their villages. They were asked to report their perceptions of the frequency with which most other adult men in their village consumed any alcohol, consumed 6 or more drinks in a single sitting, spent 25,000 Ugandan shillings on alcohol in the past 30 days, or were intoxicated on 3 or more of the past 30 days. "Other adult men in your village" was set as the social reference group.[73, 74] Our pre-testing questionnaire suggested that this reference group was easily understood by participants as a group to which they belonged.[50] Responses about perceived norms were re-coded in the same way as personal reports.

To identify misperceived norms, we compared participants' perceptions about most other men's alcohol consumption behavior against the actual population norms of alcohol consumption behavior at the village level. Take, for example, a participant who lived in a village where heavy alcohol consumption was not normative. If this participant mistakenly perceived that most other men in their village engaged in heavy alcohol consumption, then this participant would be considered as misperceiving the norm (in this case, overestimating the extent to which heavy alcohol consumption was normative). This approach to measuring misperceived norms draws on methods from previous studies in this setting[8, 25, 75] and elsewhere.[30, 76–79]

**Additional covariates.**—To adjust for other sources of potential exposure, we asked participants to report whether they had lived during childhood with an adult who consumed alcohol excessively or misused drugs. Married or cohabiting participants were also asked whether they believed their partner engaged in any past year alcohol consumption.

To adjust for personal attitude about alcohol consumption, we asked participants how they personally felt about intoxication among men, using a Likert scale. Due to skewness in responses, we grouped together the responses 'never okay to drink' and 'okay to drink but not to get drunk' into one category ('thought intoxication was not okay') and 'okay to get occasionally drunk as long as it does not interfere with responsibilities', 'okay to get drunk even if it interferes with responsibilities', and 'a frequent drunk is okay if that is what the individual wants to do' into the other category ('thought intoxication was okay'). This question was adapted by locally piloting a version similar to one used in the United States.[80]

Finally, participants reported their religion, education (completed primary school versus did not complete primary school), marital status, and HIV status (negative, positive, unknown). Household wealth quintile was created using a household asset-based index.[81] A positive symptom screen for depression was measured using a locally adapted depression subscale of the Hopkins Symptom Checklist.[82] The total number of male alters in a participant's personal network and village of residence were also recorded.

### Statistical analysis

We first examined the prevalence of alcohol consumption behavior and perceived norms of alcohol consumption behavior within socio-demographic, exposure, and attitude categories. To estimate the association between reported consumption and perceived norms, we fitted

Poisson regression models with cluster-correlated robust estimates of variance to adjust for clustering at the village level. The primary outcomes for these analyses were the binary variables for frequent and heavy alcohol consumption. With a binary dependent variable, the modified Poisson regression model has been shown to yield estimated incidence rate ratios that can be interpreted straightforwardly as relative risk ratios.[83] The primary explanatory variable of interest was misperceiving alcohol consumption norms (binary). Regression models adjusted for sociodemographic factors, exposure to alcohol consumption behavior of others, and personal attitudes about intoxication. Analyses were conducted with Stata version 16.[84]

We conducted several sensitivity analyses to assess the robustness of our findings. First, we excluded 39 participants who reported belonging to a traditionally abstinent religion (Born Again Pentecostal, Muslim, Seventh Day Adventist).[85–89] We then included religion (Catholic, Protestant, other) in the regression models. Second, we re-fitted the regression models to data for only married/cohabiting men. In these regression models, we additionally adjusted for perception of their partner's alcohol consumption. Third, we reclassified frequent alcohol consumption as 2 times per week for both the outcome and main explanatory variable and re-fitted the general model. Fourth, we fitted linear probability models with identical outcomes and explanatory variables and village fixed effects, and accounted for network autocorrelation by specifying a weight based off an adjacency matrix (using the *Inam* package in R).[90] Finally, based on results from the primary regression analyses, we used methods proposed by Vanderweele and Ding to calculate the e-value,[91, 92] which represents the minimum strength of association (on the risk ratio scale) that an unobserved confounder would need to have with both the exposure (norm misperception) and the outcomes (frequent or heavy alcohol consumption) to completely account for the estimated associations, conditional on the included covariates.

## RESULTS

From 2016 to 2018, 719 men were interviewed (91% response rate), with 57 to 117 men interviewed per village. One person was deemed ineligible for the study because he was acutely intoxicated at each of multiple interview attempts. While everyone responded to the items about personal alcohol consumption, five did not report their perception about norms of frequent alcohol consumption and six did not report their perception about norms of heavy alcohol consumption. Fewer than 1% of observations for other variables were missing. The mean age was 40 years [standard deviation (SD) = 16], most participants [489 (68%)] had completed primary school or more and most [468 (65%)] were married/cohabiting. The median number of male alters was 5 [interquartile range (IQR) = 3 – 8]. While most men identified as Protestant [503 (70%)] or Catholic [174 (24%)], 39 (5%) identified as adherents of traditionally abstinent religions [Born-Again Pentecostal (n=29), Muslim (n=9), and Seventh-Day Adventist (n=1)]. None of the participants from traditionally abstinent religions reported frequent alcohol consumption and only one reported heavy alcohol consumption. Most participants [455 (63%)] did not think intoxication was okay.

Overall, 377 men (52%) reported consuming alcohol within the past 12 months, 86 men (12%) reported frequent alcohol consumption, and 181 (25%) reported heavy alcohol consumption. Nineteen men (3%) reported frequent but not heavy alcohol consumption, 114 (16%) men reported heavy but not frequent alcohol consumption, and 67 men (9%) reported both frequent and heavy alcohol consumption. The median number of male alters who reported frequent alcohol consumption was 0 (IQR = 0–1) and the median number of male alters who reported heavy consumption was 1 (IQR = 0–2).

The prevalence of self-reported frequent and heavy alcohol consumption ranged from 0–44% across sociodemographic subgroups (Table 1). Across villages, 7–24% of men reported frequent alcohol consumption and 16–37% of men reported heavy alcohol consumption. Thus, by definition, neither frequent nor heavy alcohol consumption were normative (because each was reported by fewer than 50% of men within each village). Moreover, even when a less stringent threshold was used to define frequent consumption (two or more times per week), this behavior was not normative in any village (i.e., the prevalence of frequent alcohol consumption according to this lower threshold ranged from 22–43% across villages)

While the population data demonstrated that frequent and heavy alcohol consumption were not normative, 527 men (74%) incorrectly thought that most adult men in their own village engaged in frequent alcohol consumption and 576 men (81%) incorrectly thought that most adult men in their own village engaged in heavy alcohol consumption. Most men misperceived alcohol consumption norms, by overestimating rates of potentially harmful consumption, irrespective of sociodemographic and other subgroups (Table 2).

In a multivariable Poisson regression model, misperceiving the norm was associated with a greater risk of frequent alcohol consumption after adjustment for sociodemographic factors (adjusted relative risk [aRR]=3.82; 95% confidence interval [CI] = 1.61–9.09). After additionally adjusting for personal attitudes about intoxication and exposure to others' consumption behavior, the estimated association remained statistically significant (aRR=3.98; 95% CI, 1.69–9.34) (Table 3). Similarly, misperceiving the norm was associated with a greater risk of heavy alcohol consumption in the fully adjusted multivariable regression model (aRR=4.75; 95% CI 2.33–9.69) (Table 4).

Results from sensitivity analyses suggest that our findings remained qualitatively similar after excluding men belonging to traditionally abstinent religions (Supporting information, Table S1) and in the subgroup of married/cohabiting men (Supporting information, Table S2). Additionally, the pattern of results remained similar when we defined frequent consumption as 2 times per week for the whole population (Supporting information, Table S3), when we included the number of male alters who reported frequent consumption and heavy consumption (instead of the binary variables for exposure to at least one male alter who reported frequent consumption and heavy alcohol consumption) (Supporting information, Table S4), and when we accounted for network autocorrelation (Supporting information, Table S5). Finally, we calculated an e-value of 7.42 for the frequent alcohol consumption model and an e-value of 8.97 for the heavy alcohol consumption model. These e-values suggest that an unobserved confounder would need to have an estimated association with both one's own alcohol consumption behavior and perceived norm exceeding 7, on



the risk ratio scale, to shift the associations estimated in our study to a null risk ratio of 1. Alternatively, an unobserved confounder would need to have an estimated association with both one's own alcohol consumption behavior and perceived norm exceeding 2.5, on the risk ratio scale, to shift the associations estimated in our study to such a degree that the 95% CI could completely exclude a null risk ratio of 1.

## DISCUSSION

In this whole-population network study of men across eight villages in rural Uganda, 25% reported heavy alcohol consumption and 12% reported frequent alcohol consumption. However, most men overestimated local population rates of potentially harmful alcohol consumption behavior and mistakenly thought that heavy and frequent alcohol consumption were normative among men in their village. These norm misperceptions were pervasive across social strata and strongly correlated with individual alcohol consumption behavior. The estimated associations were statistically significant, large in magnitude, and robust to potential confounding by unobserved variables.

Our study extends the literature on perceived norms and alcohol consumption in two key ways. First, we provide strong evidence of these phenomena in a general adult population of men in a low-resource setting in sub-Saharan Africa. Our findings are consistent with research on alcohol consumption among college students in other contexts [17, 93] and with perceived social pressure to consume alcohol in Uganda.[94] Second, we provide initial evidence that perceptions concerning consumption within a population-based social reference group substantially matter for individual behavior regardless of consumption behavior by family members or network ties.

Taken together, these novel findings offer considerable support for a population-wide social norms approach to reduce frequent and heavy alcohol consumption among men in rural Uganda. Communicating true alcohol consumption norms that represent moderate (or less) consumption behavior across the population could be especially effective given that most men already think intoxication is not acceptable, especially when it interferes with responsibilities. Additionally, reducing alcohol consumption by focusing on positive community norms may be more palatable in this context than discussing alcohol use disorder directly, given high stigma associated with mental and behavioral health issues.[6–8] Exemplar messages might take the form of 'Most men in your village choose to drink alcohol three or fewer times per week or not at all,' 'Most single (or young or married, etc.) men in your village never have six or more drinks when consuming alcohol,' and 'Most men do not think it is okay to get drunk'. Such messages could be shared via various platforms such as billboards, radio shows, community meetings, social media, and text messages. This information could also be embedded in peer-based counseling interventions, financial incentive programs, or couples-based support programs.[95–97] Creation of such messages in collaboration with community members may maximize their credibility and reach.[17, 43, 98]

This kind of messaging could influence behavior across the population in multiple ways. First, it would encourage reductions in alcohol consumption among people who consume

alcohol frequently or heavily. Second, men who had consumed alcohol in moderate amounts, and who had previously misperceived most other men to engage in frequent or heavy alcohol consumption, would be supported to continue consuming alcohol moderately or even less often because they would learn that most men typically consume alcohol less than they had thought. Similarly, this kind of messaging would also support men who do not consume alcohol and who had overestimated the norms so that they could continue to remain abstinent. Both the moderate consumption group and the abstinent group who had misperceived norms would learn that they are part of a larger moderately consuming or abstinent population. Additionally, male alters who had overestimated the norms might become less supportive of their contacts who do engage in heavy or frequent alcohol consumption. Finally, applying a social norms approach to reduce harmful levels of alcohol consumption in this context would not ignore the long cultural tradition of alcohol consumption during ceremonies and social events in Uganda,[99] nor would it preclude or stigmatize the informal production and selling of alcohol as an income-generating activity for some households.[100]

### Limitations

First, although the population prevalence of alcohol consumption in this parish is similar to that reported elsewhere in Uganda,[9, 10] personal alcohol consumption may be under-reported.[101–103] Research using objective biomarkers to assess consumption levels would be helpful to determine actual population norms for comparison with perceived norms. However, population norms based on objective measurements would be unlikely to differ substantively. Moreover, some evidence suggests that, although there may be errors at the individual level, norms based on aggregated measures from survey data closely reflect norms based on aggregate measures of objective markers.[104] Second, our estimates could be subject to confounding by a variable unmeasured in our surveys. However, the estimated e-value suggests that any such confounding would need to be extremely strong in order to explain away the observed estimates. Third, this study was conducted among a small set of villages so we cannot claim generalizability of findings to the national population or other countries. However, findings provide a foundation for conducting research on misperceived alcohol use norms in similar sub-Saharan contexts (e.g., in South Africa which has similar national rates of heavy episodic drinking and alcohol use disorder among men).[105]

### Conclusion

In this whole-population study of alcohol consumption behavior among men in eight villages in rural Uganda, we found that most men incorrectly thought that frequent and heavy alcohol consumption were common among men in their villages when, in fact, such behaviors were not typical at the village level nor within personal networks. These misperceived norms were strongly associated with individual consumption behavior. Interventions to correct these misperceptions may hold promise for reducing problematic or hazardous alcohol use among men in this setting.

### Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Prevalence of self-reported frequent and heavy alcohol consumption among men in eight villages in Rwampara District, southwest Uganda (N=719).

	N (%) Participants	n (%) Reporting personal frequent alcohol consumption	n (%) Reporting personal heavy alcohol consumption
Total	719 (100%)	86 (12%)	181 (25%)
Age (years)			
18–25	160 (22%)	11 (7%)	36 (23%)
26–35	174 (24%)	21 (12%)	44 (25%)
36–45	139 (19%)	15 (11%)	39 (28%)
46–55	126 (18%)	21 (17%)	34 (27%)
56	115 (16%)	17 (15%)	26 (23%)
Marital status			
Not married / cohabiting	251 (35%)	30 (12%)	68 (27%)
Married / cohabiting as if married	468 (65%)	56 (12%)	113 (24%)
Religion			
Protestant	503 (70%)	58 (12%)	120 (24%)
Catholic	174 (24%)	28 (16%)	60 (34%)
Born-again Pentecostal	9 (1%)	0 (0%)	1 (11%)
Muslim	29 (4%)	0 (0%)	0 (0%)
Other (Not religious; Other; Seventh Day Adventist)	4 (1%)	0 (0%)	0 (0%)
Education			
None / some primary education	230 (32%)	36 (16%)	64 (28%)
Completed primary education or more	489 (68%)	50 (10%)	117 (24%)
Household asset wealth			
1st quintile (poorest)	123 (17%)	26 (21%)	44 (36%)
2nd quintile	145 (20%)	18 (12%)	43 (30%)
3rd quintile	136 (19%)	12 (9%)	27 (20%)
4th quintile	156 (22%)	20 (13%)	40 (26%)
5th quintile (least poor)	159 (22%)	10 (6%)	27 (17%)
Personal attitudes about intoxication			
Did not think intoxication was okay	455 (63%)	27 (6%)	74 (16%)
Thought intoxication was okay	264 (37%)	59 (22%)	107 (41%)

	N (%) Participants	n (%) Reporting personal frequent alcohol consumption	n (%) Reporting personal heavy alcohol consumption
Had childhood exposure to adult who consumed alcohol excessively or who misused drugs			
No	297 (41%)	30 (10%)	57 (19%)
Yes	421 (59%)	56 (13%)	123 (29%)
Participant reported spouse/partner to have consumed alcohol in past 12 months (among married or cohabiting men only, n=468)			
No	266 (58%)	24 (9%)	53 (20%)
Yes	194 (42%)	30 (15%)	58 (30%)
Personal network size			
0–2 male alters	107 (15%)	7 (7%)	16 (15%)
3–8 male alters	433 (60%)	56 (13%)	125 (29%)
9 male alters	179 (25%)	23 (13%)	40 (22%)
Exposure to frequent alcohol consumption by men in personal network			
No male alters reported frequent alcohol consumption	370 (51%)	23 (6%)	-
At least one male alter reported frequent alcohol consumption	349 (49%)	63 (18%)	-
Exposure to heavy alcohol consumption by men in personal network			
No male alters reported heavy alcohol consumption	192 (27%)	-	29 (15%)
At least one male alter reported heavy alcohol consumption	527 (73%)	-	152 (29%)

Notes: Frequent alcohol consumption was defined as alcohol consumption 4 times per week. Heavy alcohol consumption was defined as reporting consumption of 6 drinks on one occasion at least once in the past 12 months, spending excessive money on alcohol in the past 30 days, or being intoxicated 3 or more times in the past 30 days.

**Table 2.**

Misperceptions of normative alcohol consumption behavior among men in eight villages in Rwampara District, southwest Uganda (N=719).

	Participants who misperceived frequent alcohol consumption as the norm		Participants who misperceived heavy alcohol consumption as the norm	
	n	(%)	n	(%)
Total	527	(74%)	576	(81%)
Age (years)				
18–25	119	(75%)	136	(85%)
26–35	131	(76%)	144	(85%)
36–45	96	(70%)	108	(78%)
46–55	92	(73%)	99	(79%)
56	85	(75%)	84	(74%)
Marital status				
Not married / cohabiting	183	(73%)	206	(83%)
Married / cohabiting as if married	344	(74%)	370	(80%)
Religion				
Protestant	353	(71%)	392	(79%)
Catholic	142	(82%)	151	(87%)
Born-again Pentecostal	8	(89%)	9	(100%)
Muslim	22	(76%)	22	(79%)
Other (Not religious; Other; Seventh Day Adventist)	2	(50%)	2	(50%)
Education				
None / some primary education	186	(81%)	197	(86%)
Completed primary education or more	341	(70%)	379	(78%)
Household asset wealth				
1st quintile (poorest)	97	(80%)	104	(85%)
2nd quintile	110	(76%)	118	(82%)
3rd quintile	94	(70%)	108	(80%)
4th quintile	107	(69%)	120	(77%)
5th quintile (least poor)	119	(75%)	126	(80%)
Personal attitudes about intoxication				
Did not think intoxication was okay	333	(74%)	357	(79%)
Thought intoxication was okay	194	(74%)	219	(84%)
Had childhood exposure to adult who consumed alcohol excessively or who misused drugs				
No	212	(72%)	230	(78%)
Yes	314	(75%)	345	(83%)
Participant reported spouse/partner to have consumed alcohol in past 12 months (among married or cohabiting men only, n=467)				
No	189	(72%)	209	(79%)
Yes	151	(78%)	157	(81%)

	Participants who misperceived frequent alcohol consumption as the norm		Participants who misperceived heavy alcohol consumption as the norm	
	n	(%)	n	(%)
Personal network size				
0–2 male alters	80	(76%)	85	(82%)
3–8 male alters	325	(75%)	347	(81%)
9 male alters	122	(69%)	144	(81%)
Exposure to frequent alcohol consumption by men in personal network				
No male alters reported frequent alcohol consumption	263	(72%)	-	-
At least one male alter reported frequent consumption	264	(76%)	-	-
Exposure to heavy alcohol consumption by men in personal network				
No male alters reported heavy alcohol consumption	-	-	150	(80%)
At least one male alter reported heavy alcohol consumption	-	-	426	(81%)

Notes: Frequent alcohol consumption was defined as alcohol consumption 4 times per week. Heavy alcohol consumption was defined as reporting consumption of 6 drinks on one occasion at least once in the past 12 months, spending excessive money on alcohol in the past 30 days, or being intoxicated 3 or more times in the past 30 days.

Modified Poisson regression models estimating associations between perceived norms and frequent alcohol consumption among men in eight villages in Rwampara District, southwestern Uganda.

**Table 3.**

	Frequent alcohol consumption (n=708)		
	aRR	(95% CI)	p-value
Perceived norm			
Incorrectly thought that most men in own village consume alcohol frequently	3.98	(1.69, 9.34)	0.002
Correctly thought that frequent alcohol consumption was not the norm	REF		
Exposure to frequent alcohol consumption by men in personal network			
At least one male alter reported frequent alcohol consumption	2.43	(1.56, 3.79)	<0.001
No male alters reported frequent alcohol consumption	REF		
Personal attitude about intoxication			
Thought intoxication was okay	3.58	(2.50, 5.12)	<0.001
Did not think intoxication was okay	REF		
Number of male alters in personal social network	1.01	(1.00, 1.03)	0.121
Childhood exposure to adult who consumed alcohol excessively or who misused drugs			
Had exposure	1.22	(0.85, 1.76)	0.278
Did not have exposure	REF		
Self-reported HIV serostatus			
HIV serostatus unknown	1.95	(1.50, 2.52)	<0.001
HIV positive	1.60	(1.02, 2.50)	0.039
HIV negative	REF		
Depression status			
Symptoms indicate probable depression	0.96	(0.48, 1.92)	0.918
Symptoms did not indicate probable depression	REF		
Age (in years)	1.01	(1.00, 1.02)	0.036
Marital status			
Married / cohabiting	0.85	(0.69, 1.05)	0.133
Divorced/separated/single	REF		
Education level			

Frequent alcohol consumption (n=708)			
	aRR	(95% CI)	p-value
Completed primary education	0.96	(0.64, 1.43)	0.828
Did not complete primary education	REF		
Household asset wealth			
1st quintile (poorest)	2.23	(1.34, 3.71)	0.002
2nd quintile	1.46	(0.97, 2.21)	0.072
3rd quintile	1.35	(0.94, 1.93)	0.104
4th quintile	1.87	(1.04, 3.38)	0.037
5th quintile (least poor)	REF		

Notes: Each column represents one multivariable Poisson regression model fitted to the data. aRR = Adjusted relative risk ratio. CI = Confidence Interval. REF = Reference category for dichotomous and categorical variables. Frequent alcohol consumption was defined as alcohol consumption 4 times per week.

Modified Poisson regression models estimating associations between perceived norms and heavy alcohol consumption among men in eight villages in Rwampara District, southwestern Uganda.

**Table 4.**

	Heavy alcohol consumption (n=707)		
	aRR	95% CI	p-value
Perceived norm			
Incorrectly thought that most men in own village consume alcohol heavily	4.75	(2.33, 9.69)	<0.001
Correctly thought that heavy alcohol consumption was not the norm	REF		
Exposure to heavy alcohol consumption by men in personal network			
At least one male alter reported heavy alcohol consumption	1.59	(0.95, 2.64)	0.075
No male alters reported heavy alcohol consumption	REF		
Personal attitude about intoxication			
Thought intoxication was okay	2.21	(1.98, 2.48)	<0.001
Did not think intoxication was okay	REF		
Number of male alters in personal social network	0.99	(0.98, 1.01)	0.483
Childhood exposure to adult who consumed alcohol excessively or who misused drugs			
Had exposure	1.34	(0.94, 1.91)	0.106
Did not have exposure	REF		
Self-reported HIV serostatus			
HIV serostatus unknown	1.73	(1.53, 1.97)	<0.001
HIV positive	0.92	(0.57, 1.49)	0.743
HIV negative	REF		
Depression status			
Symptoms indicate probable depression	1.19	(0.80, 1.78)	0.389
Symptoms did not indicate probable depression	REF		
Age (in years)	1.00	(1.00, 1.01)	0.182
Marital status			
Married / cohabiting	0.95	(0.75, 1.20)	0.658
Divorced/separated/single	REF		
Education level			

<b>Heavy alcohol consumption</b>			
<b>(n=707)</b>			
	<b>aRR</b>	<b>(95% CI)</b>	<b>p-value</b>
Completed primary education	1.10	(0.74, 1.64)	0.640
Did not complete primary education	REF		
Household asset wealth			
1st quintile (poorest)	1.47	(1.15, 1.89)	0.003
2nd quintile	1.41	(1.00, 2.00)	0.051
3rd quintile	1.05	(0.78, 1.43)	0.740
4th quintile	1.36	(1.04, 1.77)	0.024
5th quintile (least poor)	REF		

Notes: Each column represents one multivariable Poisson regression model fitted to the data. aRR = Adjusted relative risk ratio. CI = Confidence Interval. REF = Reference category for dichotomous and categorical variables. Heavy alcohol consumption was defined as reporting consumption of 6 drinks on one occasion at least once in the past 12 months, spending excessive money on alcohol in the past 30 days, or being intoxicated 3 or more times in the past 30 days.