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The collectivity of drinking cultures: is the theory applicable to African settings?.

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The collectivity of drinking cultures: - is the theory applicable to African settings?

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Abstract

Aims: Skog's theory of collective drinking behaviour implies that countries with a strict informal social control of drinking alcohol would not exhibit 'collective displacement' of consumption (a linear association between population mean consumption and percentile values across the full range of the distribution), as do countries with less informal social control. This paper aimed to test this hypothesis by examining the alcohol consumption distributions in African countries with a strong informal control of alcohol.

Design, setting, participants and measurements: Data on alcohol consumption from the World Health Organization's general population surveys in 15 African countries were aggregated and analysed with respect to skewedness and collective displacement of the distribution.

Findings: The distribution of consumption was strongly positively skewed, with 10-15% of the drinkers consuming more than twice the mean consumption. There was also clear evidence of a collective displacement of the consumption distribution, and the consumption mean was a strong predictor of the distribution percentile values across the full range of the distribution. Correspondingly, consumption mean predicted the prevalence of heavy drinkers.

Conclusion: The distribution patterns of alcohol consumption in African countries are consistent with those previously observed in industrialized countries. These findings seem to counter Skog's theory of collective drinking behaviour and support the universality of the observation that prevalence of problem drinking is closely linked to mean consumption.

Introduction

Alcohol consumption in a given population is very unevenly distributed among drinkers (1-7); the majority consume less than the population average, and a minority account for most of the consumption. When comparing populations of drinkers with different consumption means, a clear pattern of regularity has been observed: the higher the average consumption, the higher is the consumption among all groups of drinkers (1, 3). Consequently, a strong association is observed between the mean consumption and the proportion of heavy drinkers; thus, the higher the mean consumption, the higher the prevalence of heavy drinkers, - and vice versa (1-3).

This strong regularity in the consumption distribution has two important implications. First, with an increase in mean – or total - alcohol consumption, an increase in alcohol related harm may be expected. This has been demonstrated for instance in cases of sudden and large changes in total alcohol consumption, such as in Denmark in 1917, (8), in Finland in 1968 (9), and in the USSR in 1985 (10). Second, prevention strategies that are effective in reducing total alcohol consumption can be expected to curb alcohol related harm. This has been demonstrated for instance with respect to price and availability policies, showing that high prices and restricted availability of alcohol affect both total alcohol consumption and the amount of alcohol related harm (11).

In his seminal work on the theory of the collectivity of drinking cultures Skog (1) offered an explanation to this strong regularity in the distribution of alcohol consumption, which can be summarized as follows. 1) The factors that influence a person's drinking behaviour tend to combine multiplicatively, which explains the skewed distribution of consumption. 2) A person's drinking behaviour is strongly influenced by the drinking behaviour in his/her personal social network and thus drinking has a very strong collective component (1). 3) This collectivity in drinking behaviour implies that "consumers at all levels of consumption tend to move in concert up and down the consumption scale" (1), which in turn explains the strong correlation between the population mean and the proportion of heavy drinkers.

Studies on the distribution of alcohol consumption have so far been undertaken in a limited number of countries that are all established market economies where alcohol consumption is widespread and well integrated (11). Also 25 years ago, Skog noted that a

limitation of his work was that data stemmed from cultures with widespread consumption and little social control of drinking. Therefore, he argued, it could well be imagined that in societies with a stricter informal social control of drinking the distribution patterns could be different (1, 12) and he concluded: " It may also be imagined that more rigid societies with a stricter informal social control may give rise to distribution patterns which deviate from those we have been able to observe up till now. The general social interaction theory of drinking behaviour does in fact predict such differences" (1). In this study we address whether this prediction applies.

Gmel and Rehm (13) reviewed Skog's theory and noted that despite the theory's strong influence on alcohol policy, it has, surprisingly, to little extent been subject to empirical testing and they called for more studies in this respect. A recent literature search (August 2012 in MedLine and Google Scholar) showed that although Skog's article is frequently cited, very few studies published over the past 15 years have empirically tested his theory. On this background we wanted to assess whether support for the theory of collectivity of drinking cultures can be found by testing Skog's prediction that the strong regularity in the distribution of consumption as observed hitherto in some industrialized countries, will not be found in societies with stricter informal control of drinking.

Societies with such strict informal control of drinking behaviour are most likely those where the prevalence of drinking is lower, due to, for instance, religious norms. While an increase in alcohol consumption in many low-income-countries in recent years has caused significant concern (14-18), there are still relatively few studies that have addressed the distribution and consequences of alcohol consumption in low and middle income (LAMI) countries, including African countries (11). In a previous study we have addressed the diversity of drinking patterns in 20 African countries and demonstrated that in these countries alcohol consumption is far from widespread and in fact the majority of the population in 19 of these 20 countries were life-time abstainers (19). In many of these countries Islam is the largest religion and the low prevalence of drinking may at least in part reflect religious norms.

The present study addresses whether the distribution patterns of alcohol consumption in African countries are different from the previously observed strong regularity in two respects: - the skewedness of the distribution and the collective displacement of consumption. Following Skog's theory, a skewed distribution of consumption may well be observed in all

types of societies, whereas a collective displacement of consumption reflects mechanisms of social interaction and cannot be expected in societies where drinkers are a minority in their social networks. Thus, applying survey data from 20 African countries, the aim of this study was to put the following hypotheses to empirical test: 1) the distribution of alcohol consumption is skewed; 2) there is little or no collective displacement of alcohol consumption.

Methods

Samples and data collection

Data stem from the World Health Organization (WHO) World Health Survey (WHS) (20) collected from 20 African countries between 2002 and 2004 (see Table 1). Samples were drawn from nationally representative sampling frames. However, in Cote d'Ivoire and in Congo, a proportion of households included in the sample from rural areas could not be interviewed because of the political situation and in Comoros, only households in the two largest islands were interviewed.

A stratified, multi-stage cluster design was applied where each household had a known non-zero probability of selection. One individual respondent aged 18 years or above was randomly selected from each eligible household using Kish tables. The final sample from the 20 African countries included 77,150 adults aged 18 years and older. The response rates were generally very high and varied between 54 and 98% (median = 90%) at the household level and between 85 and 99% (median=98%) at the individual level for each country.

In all countries identical questionnaires were used during face-to-face interviews. The instruments and sampling designs are described in more detail elsewhere (20, 21).

Measurements

The respondents were asked whether they had ever drunk alcohol (response categories 'Yes' and 'No'). Those who responded affirmatively were asked how many standard drinks were consumed each day in the past seven days and the responses were used to calculate the total number of standard drinks consumed in the previous week. A show card with pictorials

was used to illustrate what was meant by a "standard" drink. This was stated to be equivalent to 10 grams of ethanol. The analyses were confined to those who had consumed one or more drinks in the previous week ('current drinkers') (total n= 11,082). Those who reported a high alcohol intake in the previous week were defined as heavy drinkers; the limit was set to more than 30 drinks for men and more than 20 drinks for women.

Analyses

Calculations of distributions of alcohol consumption and prevalence of heavy drinking were carried out for each country on individual level data. In all countries, except Mauritius, the majority of the respondents were life time abstainers. For the further aggregate level analyses, we applied only data from population samples where more than 100 respondents were current drinkers (see Table 1). Data from 15 countries met this criterion (see Table 1).

The analyses were conducted applying the same methods as in Skog's work (1) in order to obtain comparable assessments of the skewedness of the distribution and the collective displacement. With respect to the former, the proportion exceeding 2 times the mean consumption and the ratio between mean and median consumption were applied. Collective displacement was assessed by regressing logged mean consumption on logged percentiles of consumption; i.e. the 25, 50, 75, 90 and 95 percentiles, in ordinary least square linear regression models (1). If there is a collective displacement; i.e. a significant association between mean consumption and all five percentile values, a significant association between mean consumption and prevalence of heavy drinkers is expected (1). This was assessed in a regression analysis and a linear regression model provided the best model fit

All analyses were re-run applying 3 weights to account for the complex survey design. Post stratification adjustments by age group and gender were made using the UN population figures for the respective countries as the reference population.

Results

The mean consumption among current drinkers varied substantially and was unrelated to the prevalence of current drinkers. The distribution of alcohol consumption was skew in all 15

population samples, which is illustrated by the following. The mean/median ratio varied between 1.4 and 2.1, much resembling the ratios reported by Skog (varying between 1.3 and 2.7). Moreover, we found that between 9 and 16% of the current drinkers consumed more than twice the average (i.e. mean consumption per current drinker * 2 is close to 85^{th} percentile or between 85^{th} and 90^{th} percentile) (Table 1). This also resembles Skog's findings; i.e. in his population samples from European countries, the USA and Australia the proportion exceeding twice the mean consumption typically varied between 10 and 15% (1). To further illustrate the skew distributions, we found that the heaviest drinkers; i.e. those who consumed more than twice the mean, accounted for almost half of the previous week consumption (mostly varying between 40 and 50%).

Table 1 about here

The collective displacement of the distribution was analysed by regressing logged mean consumption on the five logged percentile values; X_{25}, X_{50}, X_{75}, X_{90}, and X_{95}. For all five percentiles the mean consumption was a strong predictor, but more so for the highest percentiles (X_{90} and X_{95}) than for the lowest percentile (X_{25}) (Table 2). The residual standard deviation indicate the reliability of the prediction and this was lower for the highest percentiles, suggesting better accuracy. The relationship between the percentiles and mean consumption is also illustrated in Figure 1. There was a clear regularity in the distributions; the higher the mean consumption, the higher were all the five corresponding percentiles, thus reflecting a clear collective displacement of the distribution. These findings are consistent with those of Skog (reported in Table 2) in two important respects; the mean consumption predicted all the percentile values, indicating a collective shift with a change in mean consumption, and the prediction was more accurate for the higher percentile values. As could be expected from these findings, there was also a strong association between mean consumption and prevalence of heavy drinkers. An increase in mean consumption of 1 standard drink per week was associated with an increase by 1.46 % in the prevalence of heavy drinkers (parameter estimate 1.46; SE=0.08, $t=17.6$, $p < .001$). As the measures of mean consumption and heavy drinkers were not the same as those in Skog's study, these parameter

estimates were not comparable. These analyses were re-run applying weighted individual level variables, and the results were roughly the same.

Table 2 about here

Figure 1 about here

The analyses were re-run also for a smaller number of samples (n=5) from countries with a fairly high proportion of Muslims and allegedly more informal social control of drinking behaviour; i.e. Burkina Faso (60%), Chad (53%), Cote d'Ivoire (35%), Ethiopia (34%), and Tunisia (98%) . The results from these analyses did not differ significantly from those based on all 15 samples; i.e. the measures of skewedness were of the same magnitude and the associations between consumption mean and the percentile values were fairly similar (see Tables 1 and 2). Also for these 5 samples there was a strong positive association between mean consumption and prevalence of heavy drinkers (parameter estimate 1.50; SE=0.20, t=7.7, p = .005).

Discussion

This study demonstrated that also in African countries the distribution of alcohol consumption was strongly skewed. Moreover, there was a collective displacement of the distribution and consequently a close association between the mean consumption and the prevalence of heavy drinkers. These findings resembled those reported from drinking cultures where drinking is widespread and well integrated (1-6). Compared to Skog's findings from 21 population surveys in eight industrialized countries, the present findings from 15 African countries were very similar. The mean/median ratio and the proportion of drinkers exceeding twice the mean consumption were both very similar to what Skog found. Thus, the skewedness of the distribution in African countries resembled very much that of the industrialized countries presented in Skog's work. However, the collective displacement found in the African samples was also very similar to what Skog observed, but this finding counters Skog's prediction and therefore fails to support the theory of collective drinking behaviour. We will in the following offer some hints at how this may be explained.

It is possible that the underlying mechanisms explaining the regularities in consumption distribution patterns, are more universal across socio-cultural systems than

Skog's theory of the distribution of alcohol consumption predicts. There are some indications that the distributional regularities which have been observed for alcohol consumption, apply also for distributions of consumption or behaviour in other domains. A skewed distribution of consumption has been reported for various other consumption goods such as tap water (22) and prescription drugs (23) and can probably be found for many or most consumer behaviours. But even a collective displacement of the distribution has been reported for other behaviours, such as gambling behaviour (24, 25). Furthermore, parallels to the observed strong correlation between population mean and prevalence of heavy drinking were described by Rose and Day (26) with respect to three other health risk factors; systolic blood pressure, body mass index, and salt intake.

Taking these observations together, there seems to be a variety of areas where the prevalence of problems – and probably also the population distribution as a whole – varies systematically with the population mean. In Skog's theory (1), this could be explained by two hypotheses about drinking behaviour; a) the multiplicative combination of influencing factors, and b) the interaction and mutual influences on behaviour in social networks. While the former of these hypotheses can easily be assumed to apply for a wide range of human behaviours, the latter may not necessarily do so. It is therefore possible that social interaction and mutual influence in social networks are not necessarily prerequisites for a strong regularity in the distribution patterns of alcohol consumption. Moreover, based on the present findings as well as those from previous studies related to other health problems (23-26) it seems possible that only the first hypothesis – a multiplicative combination of individual and environmental risk factors – would be necessary to explain the observed strong association between population mean and the prevalence of associated problems.

Some strengths and limitations of this study should be noted. The data from the WHO world health survey provides an important source for assessment of various aspects of alcohol consumption in African countries. In particular the (relatively) large sample sizes and the high response rates are important when analysing alcohol consumption in countries with low prevalence of drinkers. Moreover, the identical sampling strategies and measurements allow for comparative analyses across many countries that are different in several respects. However, the measurement of alcohol consumption was based on relatively few questions, the main focus being on consumption in the previous week. This measurement resembles the one used by Lemmens and co-workers (3) and probably gives a more reliable and precise estimate

of consumption volume among regular/weekly drinkers. On the other hand, it differs from Skog's measurement of annual consumption (1). Moreover, it should be noted that both volume and concentration of alcohol consumed may be especially difficult to estimate in this region where the common homebrew drinks consumed are often shared between several drinkers all drinking from one container. Another limitation of this study is that informal social control of drinking behaviour in these 20 African countries could not be assessed directly. However, given that a high proportion of Muslims in a population implies more informal social control of drinking, the sensitivity analyses of the smaller number of samples, which obtained very similar results to the overall analyses, suggest that the collective displacement of consumption is not restricted to societies with little informal social control of drinking.

Finally, some implications of this study may be drawn. One implication is that for prevention. The collectivity of the distribution and the close association between population mean and prevalence of heavy drinkers observed also in African countries, suggest that effective measures aimed at all drinkers (population strategy) are likely to reduce the total consumption as well as the prevalence of heavy drinkers (11), and thereby reduce the associated problems also in these countries. Yet, a significant challenge in this respect is that implementation of such measures will often rely on acceptance of a collective responsibility for the health and wellbeing of the population (26) and they may not be politically attractive (27). Another implication is the call for further studies, such as replications of the present study in various socio-cultural systems and further empirical tests of Skog's influential theory (13). Moreover, a further development of theoretical underpinnings for the observed regularities in consumption distribution patterns seems warranted, whether it regards drinking behaviour in particular or a broader array of health behaviours.

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References

1. Skog O-J. The collectivity of drinking cultures: a theory of the distribution of alcohol consumption. British Journal of Addiction. 1985;80:83-99.
2. Skog O-J. Drinking and the distribution of alcohol consumption. In: Pittman DJ, Raskin H, editors. White society, culture, and drinking patterns reexamined. New Brunswick, NJ: Alcohol Research Documnetation; 1991. p. 135-56.
3. Lemmens PHHM. Measurement and distribution of alcohol consumption. Maastricht: University of Maastricht; 1991.
4. Greenfield TK, Rogers JD. Who drinks most of the alcohol in the US? The policy implications. Journal of Studies on Alcohol. 1999;60:78-89.
5. Stockwell T, Zhao J, Thomas G. Should alcohol policies aim to reduce total alcohol consumption? New analyses of Canadian drinking patterns. Addiction Research and Theory. 2009;17:135-51.
6. Rehm J, Kehoe T, Gmel G, Stinson F, Grant B, Gmel G. Statistical modeling of volume of alcohol exposure for epidemiological studies of population health: the US example. Population Health Metrics. 2010;8(1):3.
7. Bruun K, Edwards G, Lumio M, Mäkelä K, Pan L, Popham R, et al. Alcohol control policies in public health perspective. Helsinki: The Finnish Foundation for Alcohol Studies; 1975.
8. Anderson P. Global use of alcohol, drugs and tobacco. Drug and Alcohol Review. 2006;25(6):489-502.
9. Poikolainen K. Increase in alcohol-related hospitalizations in Finland 1969-1975. British Journal of Addiction. 1980;75(3):281-91.
10. Shkolnikov VM, Nemtsov A. The anti-alcohol campaign and variations in Russian mortality. In: Bobadilla JL, Costello CA, Mitchell F, editors. Premature death in the nrew independent states. Washington, DC: National Academy Press; 1997.
11. Babor T, Caetano R, Casswell S, Edwards G, Giesbrecht N, Graham K, et al. Alcohol: No ordinary commodity. Research and public policy. Second edition. Oxford: Oxford University Press; 2010.
12. Skog O-J. Social interaction and the distribution of alcohol consumption. Journal of Drug Issues. 1980;10:71-92.
13. Gmel G, Rehm J. The empirical testability of Skog's theory of collective drinking behaviour. Drug and Alcohol Review. 2000;19:391-9.
14. Room R, Cotrim BC, Gureje O, Jernigan D, Makela K, Marshall M, et al. Alcohol policies in developing societies: perspectives from a project. Journal of Substance Use. 2000;5(1):2-5.
15. Willis J. Potent brews : a social history of alcohol in East Africa, 1850-1999. Oxford: Currey; 2002. XII, 304 s. p.
16. World Health Organization . Substance Abuse Department. Global status report on alcohol. Geneva: WHO; 1999. ix, 391 s. p.
17. Parry CD, Pluddemann A, Steyn K, Bradshaw D, Norman R, Laubscher R. Alcohol use in South Africa: findings from the first Demographic and Health Survey (1998). J Stud Alcohol. 2005;66(1):91-7.
18. Saxena S. Alcohol, Europe and the developing countries. Addiction. 1997;92 Suppl 1:S43-8.
19. Clausen T, Rossow I, Naidoo N, Kowal P. Diverse alcohol drinking patterns in 20 African countries. Addiction. 2009;104(7):1147-54.
20. Ustun TB, Chatterji, S., Mechbal, A., Murray, C.J.L., WHS collaborating groups. . The World Health Surveys. In: Murray CJ, Evans, D.B., editor. Health Systems Performance Assessment: debates, methods, and empiricism. Geneva: World Health Organization; 2003. p. 797-808.
21. World Health Organization. World Health Survey. Geneva: World Health Organization; 2008 [cited 2008 230608]; Available from: http://www.who.int/healthinfo/survey/en/index.html.

22. Mons MN, van der Wielen JM, Blokker EJ, Sinclair MI, Hulshof KF, Dangendorf F, et al. Estimation of the consumption of cold tap water for microbiological risk assessment: an overview of studies and statistical analysis of data. Journal of Water and Health. 2007;5(Suppl 1):151-70.
23. Bramness JG, Rossow I. Can the total consumption of a medicinal drug be used as an indicator of excessive use? The case of carisoprodol. Drugs: Education, Prevention, and Policy. 2010;17(2):168-80.
24. Lund I. The Population Mean and the Proportion of Frequent Gamblers: Is the Theory of Total Consumption Valid for Gambling? Journal of Gambling Studies. 2008;24(2):247-56.
25. Hansen M, Rossow I. Adolescent Gambling and Problem Gambling: Does the Total Consumption Model Apply? Journal of Gambling Studies. 2008;24(2):135-49.
26. Rose G, Day S. The population mean predicts the number of deviant individuals. BMJ. 1990;301:1031-4.
27. Room R. Preventing alcohol problems: popular approaches are ineffective, effective approaches are politically impossible. 13th Alcohol Policy Conference; 13-16 March; Boston, Massachusetts2003.

Table 1.

Proportion of life time abstainers, proportion of current drinkers among all respondents (per cent), number of current drinkers, current drinkers' proportion of of non-abstainers (per cent), and among current drinkers: - estimated mean consumption (in standard drinks per week), ratio between mean and median consumption, proportion drinking over twice the mean (per cent) (P(2m)), and proportion of heavy drinkers (per cent), by country.

	Life time abstainers	Current drinkers			Among current drinkers			
	Proportion of all respon-dents	Number (n)	Propor-tion of all respon-dents	Prop-ortion of non-abstainers	Mean consum-ption	Ratio mean to median consum-ption	P(2m)	Prop-ortion heavy drinkers
Burkina Faso	66.0	1329	27.6	81.2	19.0	2.1	16.6	24.3
Chad	76.4	895	19.3	81.8	29.5	1.8	12.4	34.1
Congo	54.5	601	27.3	60.0	8.3	1.4	10.5	6.5
Cote d'Ivoire	64.4	717	22.9	64.3	10.6	1.5	10.6	5.4
Ethiopia	62.0	1169	23.7	62.4	8.2	1.4	11.5	3.7
Ghana	55.0	878	22.3	49.6	8.2	2.0	8.8	3.5
Kenya	74.9	596	13.5	53.8	8.4	1.4	11.6	3.5
Malawi	79.7	367	6.9	34.0	12.8	1.8	12.0	9.8
Mauritius	40.9	1140	29.3	49.6	7.0	1.8	11.6	1.8
Namibia	63.2	1074	26.9	73.1	8.2	1.4	11.8	4.5
South Africa	68.7	604	24.4	78.0	12.9	1.6	9.3	9.4
Swaziland	88.1	190	9.2	77.3	10.4	1.7	10.5	6.8
Tunisia	88.9	159	3.5	31.5	17.7	2.0	13.2	15.1
Zambia	72.9	625	15.4	56.8	12.6	1.4	11.8	9.1
Zimbabwe	78.7	504	12.5	58.7	9.7	1.6	12.5	4.8

Table 2. Assessment of collectivity: Estimates from OLS regression models of five percentile values (coefficient of correlation between ln mean consumption and ln percentile value, regression coefficient and residual standard deviation for), for all samples in African countries, for a sub-set of samples from countries with high proportion of Muslims, and Skog's data.

	All samples (n=15)			High proportion Muslims samples (n=5)			Skog's data		
Percentile value	Corre-lation	Regr coeff	Residual standard deviation	Corre-lation	Regr coeff	Residual standard deviation	Corre-lation	Regr coeff	Residual standard deviation
X_{25}	.759	0.797	.176	.841	0.670*	.144	.964	1.278	.317
X_{50}	.841	0.801	.137	.891	0.708*	.124	.988	1.146	.158
X_{75}	.886	0.996	.141	.864	0.880*	.173	.993	1.065	.110
X_{90}	.953	1.088	.095	.969	1.025**	.092	.996	.955	.077
X_{95}	.981	1.067	.059	.980	1.099**	.079	.994	.888	.084

Note: For all samples (n=15) the regression coefficients were all statistically significant: p <.001. For the high proportion Muslims samples (n=5) the regression coefficients were statistically significant: * p <.05; ** p <.01

Figure 1. Distribution of alcohol consumption in percentiles (25^{th}, 50^{th},75^{th}, 90^{th}, and 95^{th}) by mean consumption in different population samples. Logged values.