Motivation to reduce alcohol consumption and subsequent attempts at reduction and changes in consumption in increasing and higher-risk drinkers in England: a prospective population survey

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ABSTRACT

Aims   To assess how far motivation to reduce alcohol consumption in increasing and higher-risk drinkers in England predicts self-reported attempts to reduce alcohol consumption and changes in alcohol intake during the following 6 months. **Methods**   This study used self-reported data from 2928 higher-risk drinkers in the Alcohol Toolkit Study (ATS): a series of monthly cross-sectional household surveys of adults aged 16+ years of age in England. Alcohol consumption was measured in an initial survey and in a 6-month telephone follow-up interview using the Alcohol Use Disorders Identification Test (AUDIT)-C questionnaire. Motivation was measured in the initial survey using the Motivation to Reduce Alcohol Consumption (MRAC) scale. Attempts to reduce alcohol consumption during the past 6 months were recorded at follow-up. Data were analysed using repeated-measures difference-in-differences and logistic regression models. **Results**   Participants with higher initial motivation to reduce alcohol consumption were more likely to report that they had made an attempt to reduce consumption at follow-up [adjusted odds ratio (OR_{adj}) = 2.39, 95% confidence interval (CI) = 1.75–3.29]. There was an overall reduction in alcohol consumption between initial survey and follow-up (OR_{adj} = 0.72, 95% CI = 0.65–0.79), but there was insufficient evidence of an additional effect of motivation to reduce consumption on subsequent changes in alcohol consumption, with the difference-in-differences effect instead suggesting an average increase (OR_{adj} = 1.37, 95% CI = 1.00–1.88). **Conclusions**   Increasing and higher-risk drinkers in England who report greater motivation to reduce their consumption are more likely to report making an attempt to reduce during the next 6 months, but this may not be associated with a reduction in alcohol consumption.

Keywords   Alcohol, Alcohol Toolkit Study, ATS, audit, behaviour, consumption, motivation.

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INTRODUCTION

Hazardous alcohol consumption results in a considerable burden for society globally [1]. In the United Kingdom the external costs (i.e. those not directly borne by the drinker) have been estimated at £21 billion annually and could be as high as £49 billion if all social costs to society are included [2]. Reduction, especially from hazardous levels, is beneficial to people's health [3] as well as to society [1]. In order to realize this public health potential, there

is a need for valid and appropriate measures to understand important antecedents of alcohol reduction, including the motivation to reduce consumption.

The term 'motivation' refers typically to those brain processes that energize and direct behaviour [4]. Although motivation to change a behaviour pattern such as alcohol consumption is important to initiating it [5,6], it may not achieve it if others factors outweigh it on a moment-to-moment basis [7,8]. The assessment of motivation to reduce alcohol consumption can be useful if it provides

an understanding of how and why changes in behaviour occurred, while it can also allow for the detection of smaller effects of population-level interventions than would be possible with a distal outcome.

Most studies investigating motivation with respect to alcohol consumption have been conducted in patients or problem drinkers, with relatively little research in the general population. A recent general population study in England based on the same survey as the current study found that there is a clear temporal pattern in attempts to reduce alcohol consumption, with a peak in January, but little evidence of any changes in actual consumption [7]. In the same sample, the strongest motivations for cutting down included weight, fitness, the cost of alcohol, concerns about future health problems and advice from others [9]. Close to a quarter of high-risk drinkers also stated that there was no reason for cutting down or that they did not know why they were cutting down, indicating that a clear motive may not always be necessary for behaviour change.

The current study investigates whether, for increasing risk and higher-risk drinkers in the general population, initial motivation to reduce alcohol consumption is associated prospectively with reported attempts to cut down and subsequent reduced consumption.

METHODS

Sample

This study made use of self-reported data reported in the Alcohol Toolkit Study (ATS) (version December 2016). The methodology for the ATS has been described in detail by Beard *et al.* [10]. Briefly, the ATS is a monthly cross-sectional household survey of approximately 1700 adults aged 16 years of age or older per month (wave) in England. Areas are allocated randomly to interviewers who then visit households within the locality and conduct computer-assisted face-to-face interviews with one member of a household in those areas until a pre-specified quota is fulfilled. This form of sampling has distinct benefits over conventional quota sampling, because the allocation of small areas to interviewers reduces the impact of selection bias resulting from the selection of properties, but as a result response rates cannot be calculated [11]. A subgroup of the people included in the cross-sectional survey were interviewed again 6 months later by telephone. People were eligible for follow-up after 6 months if their Alcohol Use Disorders Identification Test (AUDIT)-C score at the initial survey was > 4 and/or their full AUDIT score > 7 (indicating higher-risk drinking) [12,13], and of these 2930 were followed-up successfully. Two of these were removed prior to analysis because of missing outcome information, resulting in a study sample of 2928.

Design

We conducted a repeated-measures difference-in-differences analyses to investigate whether self-reported motivation to reduce alcohol consumption has, on average, resulted in actual reduction in self-reported consumption 6 months later, and supplemented this with a cross-sectional analysis to assess whether motivation at the initial survey had led subsequently to self-reported attempts to reduce consumption.

Outcomes

'Consumption' was measured by the AUDIT-C summary score at the initial survey and follow-up, and the individual questions were used to assess frequency of drinking alcohol, quantity consumed on a typical day and frequency of binge drinking occasions (defined as number of occasions on which six or more standard drinks were consumed) separately (similar to previous work [7]); Supporting information, Table S1. At both the initial survey and follow-up, respondents were asked to consider their drinking during the last 6 months before answering the AUDIT-C questions.

Secondly, 'attempts to reduce alcohol consumption' was defined based on two different metrics collected as yes/no in the follow-up interview and that were analysed separately: (1) having had 'at least one attempt to cut down drinking in previous 6 months' and (2) having had 'at least one SERIOUS attempt to cut down drinking in previous 6 months'.

The key exposure or explanatory factor of interest was 'motivation to reduce alcohol consumption' at the initial survey, which was measured using a 'Reduce Alcohol Consumption' scale (MRAC), based on the 'Motivation to Stop Scale' (MTSS) [14]. Answers to this question were recoded to 'motivated to reduce intake now', defined as a participant who answered that they 'REALLY want to cut down on drinking alcohol and intend to in the next month' or 'REALLY want to cut down on drinking alcohol and intend to in the next 3 months' or 'I want to cut down on drinking alcohol and hope to soon' to the MRAC, or to 'not motivated to reduce consumption in the near future, defined as 'I REALLY want to cut down on drinking alcohol but I don't know when I will', or 'I want to cut down on drinking alcohol but haven't thought about when', or 'I think I should cut down on drinking alcohol but don't really want to', 'I don't want to cut down on drinking alcohol', 'don't know' or if they refused to answer the MRAC.

Ethics approval for the STS was granted originally by the UCL Ethics Committee (ID 0498/001) and approval for the ATS was granted by the same committee as an extension of the STS. All respondents provided informed consent.

Statistical analyses

We investigated the hypothesis that being motivated to reduce alcohol consumption at the initial survey was associated with actual attempts during the 6 months to follow-up using logistic regression, and the hypothesis that initial motivation was associated with changes in consumption at follow-up by a difference-in-differences (DID) model. The DID model was specified as a repeated-measures ordinal regression with random-intercepts to adjust the models for consumption at the initial survey and to account for repeated measurements of individuals (i.e. at initial survey and at 6-month follow-up). The DID interaction term between time and motivation defined the additional impact of being motivated to reduce consumption on consumption over and above the average population change over time.

Models were adjusted for interview wave, season of interview or follow-up, sex, age, social position, life stage (single, pre-family, family, post-family), ethnic group, qualification and history of trying to reduce consumption at initial survey and/or had 'at least one serious attempt to cut down drinking in previous 6 months'. As a result of missing covariate data, 22 observations were removed in the multivariable models. Results are reported as parameter estimates or odds ratios (OR), 95% profile likelihood confidence intervals (CI) and *P*-values (where 0.05 is regarded as the threshold for statistical significance), while in addition approximate Bayes factors h_1 versus h_0 (BF$_{10}$) were calculated based on Bayesian information criterion (BIC) values following the methodology in Wagenmakers [15]. Relative effects were estimated using least squares mean contrasts of the mean AUDIT-C score for the DID effect = 0 versus 1, relative to the AUDIT-C score at DID = 0 at follow-up.

All analyses were conducted in R (version 3.2.4) using the *survey* (version 3.31) and *ordinal* (version 2015.6.28) packages. Evaluation of different link functions did not indicate any reason to deviate from the standard logit link function. The assumption of proportional odds was tested for all models using log-likelihood tests and was only met for a proportion of models. However, this is not unlikely, given that the test is overly conservative and has been shown to nearly always reject the assumption where there are a large number of explanatory variables, a large sample size and/or a continuous explanatory variable in the model [16,17], all of which is the case here. Therefore, instead we evaluated changes in model parameters and standard errors (SE) using partial proportional odds models relative to the full proportional odds models, and which indicated minimal changes (< ± 5.7%) in estimates and < ± 1.8% for corresponding SE (Supporting information, Table S2). Least squares means were calculated using the R *lsmeans* package (version 2.27).

We conducted additional subgroup analysis of 'increasing risk' (AUDIT between 8 and 15; *n* = 1330) and 'higher-risk and possible dependent' (AUDIT > 15; *n* = 168) drinkers. Sensitivity analyses including only those participants who indicated that they were not trying to restrict their alcohol consumption at the time of the initial interview (but who may have indicated they planned to reduce consumption soon) were conducted, to minimize confounding from the association between motivation and subsequent consumption by people already trying to reduce consumption at the initial survey. Further sensitivity analyses aimed to explore exposure–response associations by, in the sensitivity analysis sample above, to define a three-level variable defined as 'motivated to reduce intake in the next 3 months' (defined as an answer of 'REALLY want to cut down on drinking alcohol and intend to in the next month' or 'REALLY want to cut down on drinking alcohol and intend to in the next 3 months'), 'motivated to reduce intake sometime in the future' (defined as an answer of 'I REALLY want to cut down on drinking alcohol but I don't know when I will' or 'I want to cut down on drinking alcohol but haven't thought about when') and 'no intention to reduce intake' otherwise (defined as an answer of 'I think I should cut down on drinking alcohol but don't really want to', 'I don't want to cut down on drinking alcohol', 'don't know' or if they refused to answer the question).

RESULTS

The initial sample characteristics are given in Table 1. Hazardous drinkers (AUDIT-C score ≥ 4) make up 38.3% of the whole sample and, because of the criteria for follow-up, more than 99% of the subsample who were followed-up were AUDIT-C-positive. The subsample that was followed-up included slightly older (55+) individuals than the initial sample, but otherwise was comparable in terms of social position, academic qualifications, ethnicity and regional distribution.

The distribution of motivation in this sample is shown in Supporting information, Table S3 and the corresponding distribution of AUDIT-C scores and individual item responses in Supporting information, Table S4. Alcohol consumption as measured by the AUDIT-C tool was different for those who did not want to reduce their intake at the initial survey, with lower average consumption at follow-up (*P* < 0.01), but for those who wanted to reduce their intake there was no difference between baseline or follow-up (*P*~0.70) (Fig. 1).

Table 2 shows the associations between initial alcohol consumption and follow-up stratified by motivation to reduce consumption at initial survey, and Fig. 2 illustrates how these translate into overall changes in consumption for the first model in Table 2. Between initial survey and

Table 1 Sample demographics.

		Full ATS (weighted)				Followed-up[a]		Followed-up and wanting to reduce alcohol	
		all data	(%)	High risk[b]	(%)	Unweighted	(%)	Unweighted	(%)
n		57341.0		14978.0		2928		686	
Sex	Male	28100.0	49.0	9903.0	66.1	1902	65.0	407	59.3
	Female	29245.7	51.0	5588.9	37.3	1026	35.0	279	40.7
Age (years)	16–24	8223.8	14.3	2856.8	19.1	347	11.9	54	7.9
	25–34	9590.7	16.7	2615.5	17.5	277	9.5	55	8.0
	35–44	9567.7	16.7	2660.3	17.8	405	13.8	104	15.2
	45–54	9967.6	17.4	3195.4	21.3	599	20.5	170	24.8
	55–64	8055.6	14.0	2304.7	15.4	647	22.1	158	23.0
	65+	11940.4	20.8	1859.1	12.4	653	22.3	145	21.1
NRS social grade[c]	AB	15504.3	27.0	5003.4	33.4	1053	36.0	269	39.2
	C1	15730.1	27.4	4611.6	30.8	1005	34.3	246	35.9
	C2	12604.8	22.0	3420.6	22.8	455	15.5	82	12.0
	D	8638.2	15.1	1575.9	10.5	240	8.2	51	7.4
	E	4868.4	8.5	880.4	5.9	175	6.0	38	5.5
Region	London	4660.8	8.1	716.8	4.8	200	6.8	59	8.6
	South East	8371.6	14.6	2244.5	15.0	366	12.5	115	16.8
	South West	3359.4	5.9	815.9	5.4	177	6.0	39	5.7
	East Anglia	1277.2	2.2	344.1	2.3	61	2.1	11	1.6
	East Midlands	2971.8	5.2	623.5	4.2	108	3.7	30	4.4
	West Midlands	3245.9	5.7	671	4.5	159	5.4	41	6.0
	Yorks/Humberside	3439.6	6.0	1257.5	8.4	355	12.1	63	9.2
	North West	3862.5	6.7	1371.2	9.2	302	10.3	69	10.1
	North	2323.4	4.1	894.3	6.0	200	6.8	48	7.0
Life stage[d]	Single	8168.9	14.2	3165.6	21.1	357	12.2	66	9.6
	Pre-family	3680.8	6.4	1293.5	8.6	163	5.6	28	4.1
	Family	17833.3	31.1	4300.7	28.7	696	23.8	172	25.1
	Post-family	27582.7	48.1	6723.2	44.9	1712	58.5	420	61.2
Ethnicity	White	49385.6	86.1	14910.3	99.5	2817	96.2	656	95.6
	Non-white	7684.3	13.4	519.7	3.5	100	3.4	28	4.1
Plan to cut down on alcohol use	No	12462.7	21.7	12351.2	82.5	2242	76.6	0	0.0
	Yes	3162.4	5.5	3133.6	20.9	686	23.4	686	100.0
AUDIT-C-positive (≥ 4)	No	35 397,5	61.7	73.0	0.5	13	0.4	5	0.7
	Yes	21948.3	38.3	15419.0	99.5	2915	99.6	681	99.3
Qualification	GCSE/O-level/CSE	11181.5	19.5	2822.8	18.8	497	17.0	113	16.5
	Vocational	5063.4	8.8	1533.4	10.2	248	8.5	56	8.2
	A-level or equivalent	10695.7	18.7	3605.3	24.1	600	20.5	125	18.2
	Bachelor degree (or equivalent)	13054.1	22.8	3944.7	26.3	854	29.2	213	31.0
	Masters or PhD (or equivalent)	4477.1	7.8	1371.8	9.2	305	10.4	106	15.5
	Other	3807	6.6	921	6.1	175	6.0	38	5.5
	No formal qualification	8335.5	14.5	1143.9	7.6	227	7.8	32	4.7
	Studying	479.6	0.8	116.6	0.8	16	0.5	2	0.3
	Don't know	251.9	0.4	32.5	0.2	6	0.2	1	0.1

[a]Two people deleted because of missing Alcohol Use Disorders Identification Test (AUDIT) answers; [b]AUDIT-C score > 4 or AUDIT score > 7; [c]higher and intermediate managerial, administrative, professional occupations (AB); supervisory, clerical and junior managerial, administrative, professional occupations (C1); skilled manual occupations (C2); semi-skilled and unskilled manual occupations, unemployed and lowest-grade occupations (D); semi-skilled and unskilled manual occupations, unemployed and lowest-grade occupations (E). [d]single is defined as up to aged 39, not married and no children in household; pre-family is aged up to 39, married or living with partner, no children in household; family (children in household); post-family is aged 40 and above and no children in household. ATS = Alcohol Toolkit Study.
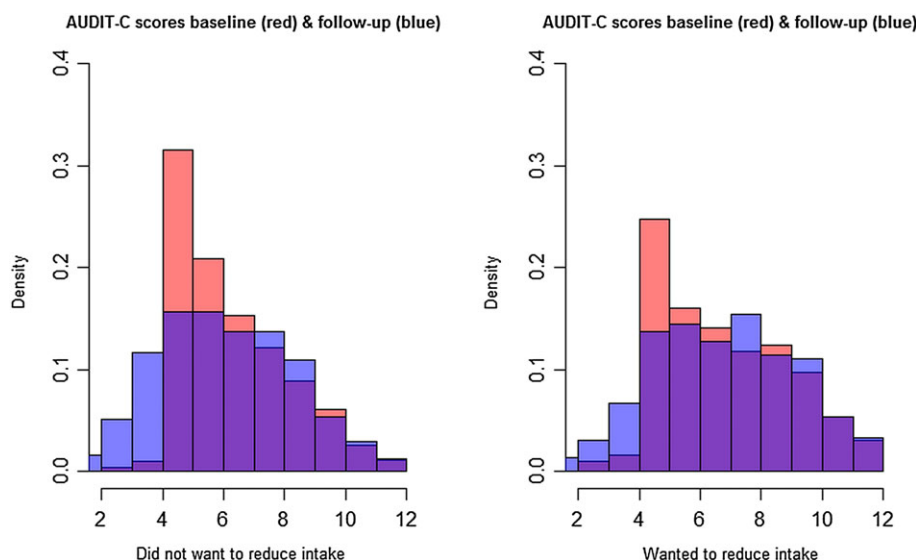
Figure 1 Histogram of Alcohol Use Disorders Identification Test (AUDIT)-C scores at the initial survey and follow-up, stratified by motivation to reduce intake now (definition 1) reported in the initial survey [Colour figure can be viewed at wileyonlinelibrary.com]

follow-up average consumption reduced [OR = 0.72 (0.65–0.79); log-odds −0.334]. Participants who indicated that they were motivated to reduce consumption at initial survey consumed, on average, more than those who did not report a positive motivation (OR = 1.74, 95% CI = 1.30–2.3; log-odds = 0.555), with only a small reduction in OR after adjustment for confounding factors (OR = 1.51, 95% CI = 1.12–2.03; log-odds 0.413). There was no evidence of a greater reduction in average consumption for people who reported being motivated in the initial survey; instead there was weak evidence (BF$_{10}$ = 2.72) that people who indicated that they were motivated to reduce initial consumption had an increased likelihood of consuming more at follow-up than non-motivated participants (OR = 1.37, 95% CI = 1.00–1.88; log-odds 0.314), although this equated to a relative increase of only 4% in the average AUDIT-C score. When the first three AUDIT questions, indicating frequency of drinking events, number of drinks at an occasion and binge drinking events, were analysed separately, there was also no strong evidence that behaviour had changed as a result of motivation.

Results of the subgroup analyses are shown in Table 3 and indicate that, although there is only limited statistical power to investigate this, there is evidence that stronger effects leading to reduced consumption at follow-up are present in higher-risk and possibly dependent drinkers compared to increasing risk drinkers, with effects ranging from approximately 5–10% reductions, depending on the measure, in consumption.

The sensitivity analyses based on only those participants who were not trying to reduce consumption at initial survey (Supporting information, Table S5) did not change the inferences of the main analyses. Further sensitivity

analyses of exposure–response associations supported the above interpretation, and indicated that although increasing motivation at initial survey was associated with initial higher consumption, there was no evidence of an exposure–response in the additional effect of motivation on reduction of consumption (the DID effect) (Supporting information, Table S6).

To assess whether participants who reported they planned on reducing their initial consumption had attempted to do so at follow-up (despite the above analyses indicating there was no evidence of an actual reduction in consumption), we assessed associations between initial motivation and the reporting of a subsequent attempt, or serious attempt, to reduce consumption at follow-up (Table 4). These analyses indicated that the participants who reported that they planned to reduce consumption reported more often that they had made an attempt within the 6 months prior to follow-up, and indicated a twofold likelihood of having at least one attempt after adjustment for confounding (OR = 2.39, 95% CI = 1.75–3.29; BF$_{10}$ > 100). A similar pattern was observed for serious attempts, although the Bayes factor indicates insufficient statistical power to adjust for confounding factors. The study does not have sufficient statistical power to investigate only those participants who indicated that they had not tried to reduce consumption prior to the initial survey or to stratify by 'increased risk' and 'higher risk and possible dependence' (BF~0; data not shown).

DISCUSSION

Among increasing and higher-risk drinkers in England, those with higher initial motivation were more likely to report they had made an attempt to reduce consumption at

Table 2 Repeated measures ordinal regression model results for Alcohol Use Disorders Identification Test-C (AUDIT-C) score (n = 2928).

Variable	Crude estimates			Adjusted estimates[a]			No DID (adjusted estimates[a])		
	Estimate (log-odds)[f]	95% profile likelihood	P-value	Estimate (log-odds)	95% profile likelihood	P-value	Estimate (log-odds)	95% profile likelihood	P-value
AUDIT-C sum score									
Wanting to reduce intake	0.555	0.265: 0.846	< 0.001	0.413	0.117: 0.710	0.006	0.564	0.310: 0.819	< 0.001
AUDIT-C at follow-up (6 months)[b]	−0.351	−0.451: −0.252	< 0.001	−0.334	−0.437: −0.231	< 0.001	−0.303	−0.401: −0.205	< 0.001
DID interaction[b]	0.326	0.009: 0.644	0.044	0.314	−0.003: 0.630	0.052	NA		
Relative DID effect[c]	+3.8%			+3.9%					
Bayes factor (BF10)	> 100[d]			2.72[e]			31.59[d]		
How often do you have a drink containing alcohol? (AUDIT question 1)									
Wanting to reduce intake	0.717	0.196: 1.238	0.007	0.592	0.119: 1.065	0.014	0.744	0.306: 1.181	< 0.001
Frequency at follow-up (6 months)	−0.675	−0.790: −0.560	< 0.001	−0.633	−0.753: −0.512	< 0.001	−0.601	−0.715: −0.487	< 0.001
DID interaction	0.410	0.064: 0.756	0.020	0.301	−0.058: 0.660	0.101	NA		
Relative DID effect[d]	+2.5%			+2.4%					
BF10	0.00[d]			> 100[e]			> 100[d]		
How many units of alcohol do you drink on a typical day when you are drinking? (AUDIT question 2)									
Wanting to reduce intake	0.063	−0.240: 0.365	0.686	0.062	−0.235: 0.359	0.683	0.130	−0.122: 0.381	0.312
Quantity at follow-up (6 months)	−0.371	−0.473: −0.269	< 0.001	−0.360	−0.465: −0.255	< 0.001	−0.346	−0.446: −0.247	< 0.001
DID interaction	0.141	−0.182: 0.464	0.393	0.138	−0.184: 0.459	0.401	NA		
Relative DID effect[d]	+1.6%			+1.6%					
BF10	> 100[d]			> 100[e]			> 100[d]		
How often have you had 6 or more units if female, or 8 or more if male, on a single occasion in the last year? (AUDIT question 3)									
Wanting to reduce	0.623	0.332: 0.913	< 0.001	0.452	0.154: 0.749	0.003	0.534	0.284: 0.784	< 0.001
Binge frequency at follow-up (6 months)	0.040	−0.062: 0.143	0.442	0.064	−0.041: 0.170	0.234	0.081	−0.020: 0.181	0.117
DID interaction	0.182	−0.146: 0.509	0.277	0.166	−0.160: 0.493	0.318	NA		
Relative DID effect[d]	+2.7%			+2.6%					
BF10	> 100[d]			0.00[e]			0.00[d]		

[a]22 observations removed because of missing covariate data. Adjusted for: wave, season of interview or follow-up, sex, age, social grade, life stage, ethnicity, qualification and 'at least one serious attempt to cut down drinking in previous 6 months'; [b]difference-in-differences (DID) effect; [c]least squares means contrast in AUDIT score at follow-up averaged over other covariates; [d]compared to intercept-only model; [e]compared to 'crude estimate' model; [f]log-odds are presented to enable calculation of linear combinations of estimates (for example, OR for DID effect of participants motivated to reduce intake in model 1 = e(0.555−0.351 + 0.326)). OR = odds ratio; NA = not available.
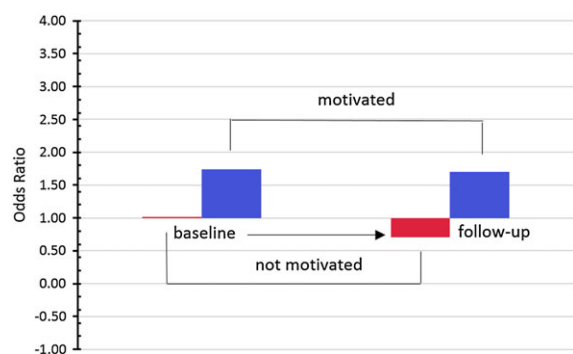
Figure 2 Example: average change in Alcohol Use Disorders Identification Test (AUDIT)-C score relative to non-motivated baseline score. Note that follow-up odds ratios are calculated as $\exp(\beta_{motivation} + \beta_{time} (+ \beta_{DIDinteraction}))$ [Colour figure can be viewed at wileyonlinelibrary.com]

follow-up. There was an overall reduction in alcohol consumption between initial survey and follow-up but there was a non-significant tendency for those with lower initial motivation to report greater reductions overall, although there was some evidence that this was related mainly to the behaviour of increasing risk drinkers, with data indicating that higher-risk and possibly dependent drinkers who were motivated to reduce consumption at the time of the initial survey reduced their consumption by 5–10% more than those not motivated. Thus, motivation was associated prospectively with reporting an attempt to reduce 6 months later, but this did not translate into a reduction in alcohol consumption. These findings indicate that the MRAC scale can be used in this population in so far that the motivation appears to generate a later attempt. People reporting wanting to reduce their intake in the near future have, on average, a higher consumption than other people, and this remains the case 6 months later. There is insufficient evidence of an association between motivation and change in alcohol consumption, with the possible exception of higher-risk and possibly dependent drinkers; motivation measured by the scale is unrelated to the success of subsequent attempts.

Table 3 Repeated measures ordinal regression model results for Alcohol Use Disorders Identification Test-C (AUDIT-C) score, stratified by severity.

Variable	Increasing risk (n = 1330)			Higher risk and possible dependency (n = 168)		
	Estimate[a] (log-odds)	95% profile likelihood	P-value	Estimate[a] (log-odds)	95% profile likelihood	P-value
AUDIT-C sum score						
Wanting to reduce intake	−0.358	−0.720: 0.004	0.052	0.156	−0.677: 0.988	0.714
AUDIT-C at follow-up (6 months)	−0.689	−0.838: −0.539	< 0.01	−1.067	−1.550: −0.584	< 0.001
DID interaction[b]	0.592	0.157: 1.026	0.008	−0.947	−1.847: −0.047	0.040
Relative DID effect[c]		+6.8%			−9.5%	
Bayes factor (BF$_{10}$)		> 100			> 100	
How often do you have a drink containing alcohol? (AUDIT question 1)						
Wanting to reduce intake	0.483	−0.239: 1.205	0.190	0.654	−0.447: 1.754	0.244
Frequency at follow-up (6 months)	−0.788	−0.966: −0.610	< 0.001	−0.780	−1.325: −0.266	0.003
DID interaction	0.489	−0.002: 0.981	0.051	−0.502	−1.512: 0.507	0.330
Relative DID effect[d]		+3.0%			−5.1%	
BF$_{10}$		> 100			1.19	
How many units of alcohol do you drink on a typical day when you are drinking? (AUDIT question 2)						
Wanting to reduce intake	−0.696	−1.085: −0.306	< 0.001	−0.443	−1.194: 0.308	0.248
Quantity at follow-up (6 months)	−0.596	−0.748: −0.444	< 0.001	−0.905	−1.386: −0.424	< 0.001
DID interaction	0.303	−0.133: 0.739	0.173	−0.529	−1.401: 0.344	0.235
Relative DID effect[d]		+4.9%			−8.3%	
BF$_{10}$		> 100			> 100	
How often have you had 6 or more units if female, or 8 or more if male, on a single occasion in the last year? (AUDIT question 3)						
Wanting to reduce	−0.283	−0.652: 0.086	0.133	0.317	−0.630: 1.264	0.512
Binge frequency at follow-up (6 months)	−0.432	−0.588: −0.276	< 0.001	−0.889	−1.430: −0.348	0.001
DID interaction	0.542	0.090: 0.994	0.019	−0.806	−1.807: 0.196	0.115
Relative DID effect[d]		+6.4%			−5.1%	
BF$_{10}$		24.4			36.6	

[a]Models not adjusted further for covariates, because BF$_{10}$ were all ~ 0, indicating no statistical power to differentiate between null model and more complex multivariable models; [b]difference-in-differences (DID) effect; [c]least-squares means contrast in AUDIT score at follow-up averaged over other covariates; [d]least-squares means difference.

Table 4 Logistic regression model results for attempt to reduce alcohol consumption.

Variable	Crude estimates			Adjusted estimates[a]		
	Odds ratio	95% profile likelihood	P-value	Odds ratio	95% profile likelihood	P-value
At least one attempt to cut down drinking in previous 6 months (n = 2871)						
Wanting to reduce intake in next 3 months (initial survey)	5.82	4.49: 7.58	< 0.001	2.39	1.75: 3.29	< 0.001
AUDIT-C				1.14	1.08: 1.19	< 0.001
Trying to reduce consumption at initial survey				0.62	0.41: 0.93	0.020
having tried to reduce in previous 12 months (initial survey)				2.56	1.73: 3.78	< 0.001
Bayes factor (BF$_{10}$)		> 100[b]			> 100[c]	
At least one attempt to cut down drinking in previous 6 months—people who had not made an attempt in year prior to 1st interview only (n = 2206)						
Wanting to reduce intake in next 3 months (initial survey)	2.09	1.16: 3.68	0.012	1.37	0.71: 2.57	0.341
AUDIT-C				1.14	1.07: 1.21	< 0.001
Having tried to reduce in previous 12 months (initial survey)				2.74	1.83: 4.07	< 0.001
BF$_{10}$		> 100[b]			> 100[b]	
At least one serious attempt to cut down drinking in previous 6 months (N = 2871)						
Wanting to reduce intake in next 3 months (initial survey)	4.41	3.37: 5.76	< 0.001	1.96	1.41: 2.72	< 0.001
AUDIT-C				1.08	1.01: 1.14	0.020
Trying to reduce consumption at initial survey				0.42	0.32: 0.55	< 0.001
having tried to reduce in previous 12 months (initial survey)				1.92	1.38: 2.66	< 0.001
BF$_{10}$		> 100[b]			0.00[c]	
At least one serious attempt to cut down drinking in previous 6 months—people who had not made an attempt in year prior to 1st interview only (n = 2206)						
Wanting to reduce intake in next 3 months (initial survey)	2.68	1.29: 5.12	0.005	1.89	0.83: 3.96	0.107
AUDIT-C				1.12	1.03: 1.21	0.010
Having tried to reduce in previous 12 months (initial survey)				1.88	1.08: 3.96	0.020
BF$_{10}$		0.601[b]			0.00[c]	

[a]n = 2662. Adjusted for wave, season of follow-up interview, sex, age, social grade, life stage, ethnicity, qualification, initial Alcohol Use Disorders Identification Test-C score, having tried to reduce alcohol consumption in the 12 months prior to the initial survey and trying to reduce consumption at initial survey; [b]compared to intercept-only model; [c]compared to 'crude estimate' model.

Previous studies have found similarly that those reporting motivators to cut down (e.g. cost, health and advice from others) tend to be more dependent than those reporting that there were no reasons for reducing their alcohol consumption [9]. The results from this study confirm findings from our previous assessment of temporal trends in consumption and motivation in the English population [7]. It is, however, important to put these findings into context in that, on average, at an individual level consumption during the 6-month period between initial survey and follow-up interview had reduced. Overall we investigated a downwards shift in the distribution of consumption rather than a change in number of units directly; this is the consequence of the use of AUDIT

questions in the ATS which require ordinal regression analyses (i.e. the probability of shifting a category in AUDIT-C).

These analyses indicate that increasing and higher-risk drinkers who are highly motivated to reduce consumption also tend to consume more than the average at the initial survey, and do not reduce their consumption despite their reported motivation and attempts to cut down.

We have previously reported a related finding: temporal changes in attempts to cut down in the English population appear unrelated to trends in alcohol consumption [7], but in the wider literature the results are mixed and may depend upon the specific population [5,6,18,19]. We

evaluated the predictive power of motivation and self-efficacy in relation to attempts and reduced consumption at follow-up. Previous research indicated that both constructs can be important [6], but also that they have variable predictive validity in relation to drinking outcomes [6,20]. This begs the question as to how useful self-reported questions on motivation to reduce alcohol consumption really are; something also already highlighted by others [6]. However, others have argued that the process from motivating to an attempt to change a behaviour and succeeding can be distinct, and determined by different factors [21]. The motivation scale in this study was adapted from the 'Motivation to Stop Smoking Scale' developed and validated in relation to smoking cessation [14,22–25]. Consistent with the current findings, motivation to stop smoking is related typically to cessation attempts but unrelated to the success of attempts [26].

This study has several limitations. Although this study was based on a relatively large sample size ($n = 2928$), only approximately 10% of participants indicated that they were planning to reduce their intake within the subsequent 3 months ($n = 298$); this gives limited power of the study to investigate between-group differences and conduct sub-group analyses. However, given that the current study was able to detect minimal increased odds for the DID estimator in the order of 35%, it is questionable whether smaller effects are meaningful. Moreover, a further limitation was that only 20% ($n = 2928$) of all increasing and higher-risk drinkers ($n = 14\,978$) could be followed-up.

Problems with the validity of self-reported alcohol consumption are well documented (for example [27–29]), and in this repeated-measures sample there is some evidence of reporting bias. Reported consumption in this sample reduced from the initial survey to follow-up, regardless of motivation to change, whereas there is evidence in this of a (small) opposite effect in the temporal analyses of the full ATS survey [7]. In the absence of an unbiased estimation of consumption at both time-points, it remains unknown how much reporting bias may have impacted our results.

The lack of an effect of motivation to reduce consumption at the initial survey on an actual reduction in consumption of alcohol observed in this study can have two explanations: the lack of effect is correct, or the instrument used to measure consumption is not sensitive enough. The AUDIT tool used here to measure alcohol consumption does not include questions referring specifically to current consumption, nor does it stipulate a time-frame for which participants are asked to estimate consumption. It has, however, been demonstrated that AUDIT questions reflect current consumption and can be used to assess temporal changes [7,30–32], and in this study we similarly observe an overall decrease in individual self-reported consumption during a 6-month period. This indicates that the lack of an association between motivation and consumption can

most probably not be ascribed to the use of the measurement tool.

We assessed the impact of direct self-reported motivation at aggregated population-level only. There will, of course, have been individuals in this study sample who planned to reduce their consumption at the initial survey and had successfully done so at follow-up, while other individual factors such as, for example, the indirect effects of social networks [18], were not included.

The main strength of the current study is that the ATS methodology is firmly established and based on the longer-running Smoking Toolkit Study [33]. This study has the benefit that initial survey and follow-up measures of the same individuals were conducted using the same methodology allowing for a within-subject repeated-measures design.

Furthermore, seasonal variation in both motivation and consumption which have been reported for the United Kingdom and elsewhere [7,34,35] could be taken into account both through the use of individual-level repeated-measures models and additional adjustment for time (i.e. month) and season.

In summary, this study indicated that, in an English population of increasing and higher-risk drinkers, approximately 20% reported they were planning to cut down their consumption of alcohol in the near future, and that a higher proportion of these reported an attempt or serious attempt during the subsequent 6 months compared with those who did not plan to reduce consumption. However, 6 months later there was no evidence that the group motivated to cut down initial consumption had succeeded in reducing their alcohol consumption compared with those reporting less motivation during the initial survey, with the possible exception of higher-risk and possibly dependent drinkers. Our findings suggest that being motivated to reduce alcohol consumption is insufficient to achieve measurable change in consumption, implying that interventions may focus more usefully upon other factors important to drinking reduction, and that motivation is not a reliable outcome of intervention effectiveness.

Author contributions

F.V., J.B. and M.H. conceived the study. J.B., E.B. and S.M. managed data collection. F.V. conducted the statistical analyses. All authors were involved in the interpretation of the results. F.V. wrote the first draft, and all authors commented on this and subsequent iterations. All authors read and approved the final version.

Declaration of interests

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Supporting Information

Additional Supporting Information may be found online in the supporting information tab for this article.

Table S1 AUDIT-c scores used in the Alcohol Toolkit Study.
Table S2 Sensitivity analysis of proportional odds assumption.
Table S3 Distribution of answers to motivation to reduce alcohol consumption (at baseline).
Table S4 Median AUDIT scores in follow-up group.
Table S5 Repeated measures ordinal regression model results for AUDIT-c score people answering no to 'are you currently trying to reduce your consumption ($n = 2,242$).
Table S6 Repeated measures ordinal regression model results for AUDIT-c score people answering no to 'are you currently trying to reduce your consumption ($n = 2,242$): 3-level motivational scale.