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How effective are brief interventions in reducing alcohol consumption: does place, practitioner group and content matter? Findings from a systematic review and meta-regression analysis

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Abstract

Background: While the efficacy and effectiveness of brief interventions for alcohol (ABI) have been demonstrated in primary care, there is weaker evidence in other settings and reviews do not consider differences in content. We conducted a systematic review to measure the effect of ABIs on alcohol consumption by setting, practitioner group and content of intervention.

Methods: We searched MEDLINE, Embase, PsycINFO; CINAHL, Social Science Citation Index, Cochrane Library and Global Health up to January 2015 for randomised controlled trials that measured effectiveness of ABIs on alcohol consumption. We grouped outcomes into measures of quantity and frequency indices. We used multilevel meta-analysis to estimate pooled effect sizes and tested for the effect of moderators through a multiparameter Wald test. Stratified analysis of a sub-set of quantity and frequency outcomes were analysed as a sensitivity check.

Results: 53 trials were included contributing data on 29,891 individuals. ABIs reduced the quantity of alcohol consumed by 0.15 standard deviations. While neither place nor content appeared to significantly moderate intervention effectiveness, provider did in some analyses. Interventions delivered by nurses had the most effect in reducing quantity (*d*=-0.23, 95% CI [-0.33, -0.13]) but not frequency of alcohol consumption. All content groups had statistically significant mean effects, brief advice was the most effective in reducing quantity consumed (*d*=-0.20, 95% CI [-0.30, -0.09]). Effects were maintained in the stratified sensitivity analysis at first and last assessment time.

Conclusion ABIs play a small but significant role in reducing alcohol consumption Findings show the the role of nurses in delivering interventions. The lack of evidence on impact of content of intervention reinforce advice that services should select the ABI tool that best suits their service.

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Article Summary

Strengths and Limitations of the study

A key strength of this review is the methodologically innovative approach to the meta-analysis through the use of a multilevel meta-analysis.

As a second sensitivity analysis we compared findings from the multi-level model with a stratified analysis focussing on a sub-set of outcome variables. Findings from the two analyses were comparable.

Quality assessment criteria were used to assess risk of bias and the majority of studies were at low risk in relation to the randomisation procedure and monitoring of loss to follow-up.

A large proportion of studies did not provide information on other aspects of the study design including blinding of participants to the intervention, intention to treatment analysis and blinding to outcome measurement.

Our review suggested limited effect for interventions delivered in community settings, but relied on a small number of studies across a wide variety of settings.

What we already know on the topic

Screening to detect individuals drinking alcohol at hazardous or harmful levels and the delivery of a brief intervention on alcohol (ABI) to reduce their consumption have been implemented in primary care settings where their efficacy and effectiveness have been demonstrated.

There is weaker evidence for effectiveness beyond primary care, with moderate or no effect found in accident and emergency departments, college, community and general hospital settings.

Content of ABI is varied but usually focuses on structured advice involving an assessment of individual risk with feedback and advice, or brief motivational interviewing that takes a more patient-centred approach or a combination of both approaches. Existing evidence has not found much variability in effect by duration of intervention but this has not taken account differences in content.

What this study adds

Provider of the intervention does appear to matter in some outcomes, and in multilevel models interventions delivered by nurses had the most effect in reducing quantity of alcohol consumed (d=-0.23, 95% CI [-0.33, -0.13]).

Little evidence on the effectiveness of brief interventions in community settings or accident and emergency were found. University settings were associated with the greatest reduction in alcohol consumption then primary care.

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Brief advice was associated with the greatest reduction in alcohol consumption (d=-0.20, 95% CI [-0.30, -0.09]) in the multi-level model and stratified analysis, but not in reducing frequency of drinking. However, overall neither place nor content appeared to significantly moderate intervention effectiveness.

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Introduction

Excessive alcohol consumption is a major public health concern, contributing to almost 4% of deaths worldwide(1) as high as 8% of deaths among men and women in the USA and Norway and 1.4% in the UK.(2, 3) It is estimated that over ten million people in the UK drink more than the recommended daily units.(4) Screening to detect individuals drinking alcohol at hazardous or harmful levels and the delivery of a brief intervention on alcohol (ABI) to reduce their consumption have been implemented in primary care settings where their efficacy and effectiveness have been demonstrated.(1) The content of ABIs is varied, but usually focuses on structured advice involving an assessment of individual risk with feedback and advice, or brief motivational interviewing that takes a more patient-centred approach or a combination of both.(5) Existing systematic reviews have found variability in effect by duration of intervention but this has not taken account differences in content.(6-8) Although there is some emerging evidence that motivational interviewing can be more effective than 'traditional' advice across a range of health behaviours(9) this is not conclusive.(10) While the efficacy and effectiveness of ABIs have been demonstrated in primary care settings,(11-13) the evidence-base in health settings beyond primary care is weaker with moderate or no effect found in college(14, 15) and community settings.(16) Some benefits have been observed from a small number of studies in accident and emergency (A&E) departments(17, 18), as well as in general hospital settings but among mainly male patients.(19, 20) Implementation research has shown that contextual factors affecting the routine delivery of ABIs in primary health care settings are closely linked to practitioners. However, there has been little research looking at the impact of practitioners outside primary health care settings.(21, 22)

In England, the Department of Health's Alcohol strategy calls for the increased implementation of ABIs in Primary Care and A&E settings, while targets for implementing ABIs in these settings as well as antenatal clinics have been set by NHS Scotland.(23, 24) NICE guidance recommends that ABI should be offered opportunistically by a range of relevant practitioners and front-line staff, while also acknowledging that the strength of evidence was clearer in some health settings compared to others. Nevertheless, this guidance flagged the relevance of social care, criminal justice, community and voluntary sector professionals to supporting alcohol risk-reduction work.(25) This recommendation has been implemented by some Public Health Authorities rolling out interventions in sexual health clinics and community settings such as criminal justice services and has also been advocated by global health agencies including the WHO.(26) Given the international, national and local level support for the expansion of ABIs beyond primary care settings, there is an urgent need to understand how brief intervention process (including deliverer and location) and content moderates the effectiveness of brief interventions, in order to inform their implementation.(5) We therefore undertook a systematic review and meta-regression to measure the effect of ABIs on alcohol consumption and how effect differs by location, practitioner group and content of intervention.

Methods

Search strategy and selection criteria

We followed the PRISMA guidelines on reporting of systematic reviews.(27) Studies eligible for this review were randomised controlled trials of ABIs published in English. Studies targeting those aged less than 16 years were excluded, as were populations seeking help at specialist addiction, mental health services or antenatal clinics. We included studies with control groups comprising: treatment as usual; information-only; assessment only; no assessment; or non-intervention and excluded control groups consisting of other interventions, including other brief interventions such as advice and extended psychological treatments. Brief interventions were defined as *person-to-person* discussions on alcohol between one and four sessions and not more than two hours total discussion

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time. Computerized interventions tested alone, group interventions and those that target multiple behaviours were excluded.

The primary outcome of interest was a quantitative continuous measure of total alcohol consumption within a specified time-frame (standard drinks, grams of ethanol, or days of drinking) where the standardized mean difference between brief intervention and control group was measured at time of follow up.

We searched: MEDLINE; Embase; PsycINFO; CINAHL; Social Science Citation Index and Science Citation Index through Web of Science; Cochrane Effective Practice and organisation of Care Group specialised register; Alcohol and Alcohol Problems Science Database; and Global Health between 1966 and 2015. We also scanned citations and contacted experts in the field to minimise selection bias. The search terms used were: 'Brief intervention' OR 'minimal intervention' OR 'early intervention' OR 'cognitive behavioural' OR 'screening' OR 'counselling' OR 'brief advice' OR 'identification' OR 'managed care' or 'motivational interview' AND 'Alcohol drinking' or 'binge drinking' OR 'alcohol consumption' OR 'alcohol units' OR 'alcohol use and misuse' OR 'alcohol intake' OR 'alcohol rate binge drinking' OR 'beer or wine or lager or spirit drinking' AND 'randomized controlled trial' OR 'random allocation' OR 'double blind methods' OR 'clinical trial' OR 'controlled clinical trial' OR 'multi centre studies'.

Eligibility assessment was conducted independently by two reviewers. Disagreements between reviewers were resolved by consensus. We selected a list of risk of bias criteria from recommendations in the Cochrane Collaboration Reviewers' Handbook to assess the quality of the trials.(28) Criteria included: methods used to generate the allocation sequence to produce comparable groups and concealment of allocation to determine whether intervention allocations could have been foreseen before or during enrolment; blinding of participants and providers to intervention groups; blinding of outcome assessment; incomplete outcome data (including intention to treat analysis); and measurement of attrition rate.

Data were extracted into a database piloted on five studies, from each publication independently by GJM, LP, AO and JB without masking of authors' names, study site, intervention, or trial results. These researchers jointly reviewed the extracted data and 10% of studies were double extracted. Data were extracted on characteristics of trial participants, type of interventions (including content, duration, frequency, provider, setting), type of outcome measure, time of assessment and effect estimates.

We extracted continuous outcomes in the units in which they were presented and then converted to Cohen's d for comparability. When extracting continuous outcomes, we preferred estimates that were ANCOVA-adjusted for baseline score, followed by unadjusted post-test scores, and finally repeated measures or 'change score' models. Change score models were reparametrized into a raw-score metric using r=0.5, with sensitivity analysis at r=0.1 and r=0.9. Though past reviews have attempted to convert all measured to 'natural units' such as grams of ethanol, we decided that this was inadvisable because of the large number of trials in this review and because of our goal to include all relevant information, a key benefit of multilevel meta-analysis models.

Data synthesis

We grouped intervention content into three categories (Figure 1). The first was motivational interviewing, including motivational interviewing-style, advice approaches such as FRAMES, motivational enhancement therapy as adapted for Project MATCH (Project MATCH Research Group, 1998) or brief motivational interviewing. We also identified a second subset of trials that tested specific enhanced interventional protocols for motivational interviewing (e.g. Drink-less) or additions

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to motivational interviewing (e.g. cognitive behavioural approaches) from other therapeutic modalities and labelled this category motivational interviewing 'plus'. A third subset included brief advice approaches, often labelled as such without any additional information.

Intervention providers were grouped into: counsellors, including clinical and research psychologists; GPs, including primary care providers and general physicians; nurse-delivered interventions; peer-delivered interventions; and interventions delivered by different providers. Setting of intervention delivery was categorised as: accident and emergency services; community-based delivery that included a range of non-clinical settings; primary or ambulatory care; hospital inpatient services; and university services.

The systematic review protocol was registered on the PROSPERO Register at the University of York (CRD42014014799).

Statistical analyses

We grouped outcomes hierarchically. We identified an overarching set of outcomes addressing quantity of alcohol consumption, from which we created two subsets of outcomes: one including amount of alcohol consumed per unit of time and one including amount of alcohol consumed per drinking occasion. We also identified an overarching set of outcomes addressing frequency of alcohol consumption, from which we created a subset of outcomes including frequency of any drinking occasion and a subset including frequency of binge drinking occasions.

For each overarching set and subset of outcomes, we specified five models: 1) an unconditional model that included all eligible continuous outcomes; 2) a model that included a grand mean-centred covariate for time of follow-up post-baseline, to address differences in follow up; 3) a model including where the intervention was initially delivered and time of follow-up; 4) a model including the provider of the intervention and time of follow-up; and 5) a model including the content of the intervention and time of follow-up. To estimate mean effects for all groups simultaneously, we refit models with no intercept.(29) We used the statistical package metafor, which readily implements advanced meta-analysis models, in the R environment for all multilevel analyses.(30)

For our main analysis, we used a multilevel meta-analysis method to estimate pooled effect sizes.(31) Models included random effects on the effect size and study levels. Several trials tested different intervention or provider types in the same experiment, but insufficient trials did this to treat intervention as a 'within-trial' covariate. In order to adequately model these two moderators, we split the control groups in two for these trials and treated each intervention-control comparison as a separate trial. This avoided double-counting participants across intervention-control comparisons. Moreover, several studies presented results stratified by group. In our multilevel meta-analyses, we included these in the same cluster. We tested for the effect of our hypothesised moderators by conducting a multiparameter Wald test on provider, setting or content coefficients as appropriate. We additionally examined the residual heterogeneity, measured as I^2, between the time-adjusted model and the models including each of the three sets of covariates. We regarded a p-value of <0.05 as statistically significant and a p-value of <0.10 as marginal, but not significant.

Sensitivity check

In addition to sensitivity analysis on the correlation used for repeated measures conversion, we estimated a set of meta-regressions for each subset of outcomes including one effect size per relevant comparison for each of first and last follow-up in the included trials. We did this by combining intervention and control groups where appropriate, and by selecting effect sizes within studies that used shorter time periods for measurement and timeline follow-back procedures over general frequency/quantity questionnaires. We also treated non-overlapping subgroups from the same study as separate data points as suggested by Borenstein et al.(32) Sensitivity analyses were

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estimated in both Stata v 13.1 and R. We did not undertake meta-analysis of effect sizes from common time points because these models would have been poorly powered.

Results

We identified a total of 4551 records from the search of electronic databases and 41 records from key experts. A total of 52 studies met our inclusion criteria, with three studies presenting different outcomes for the same data and therefore considered as one. (33-35) One study was dropped as it only contained biological outcomes which were not included in the main analyses.(36) The review and selection process is summarised in Figure 2.

Included studies contributed data for 29,891 individuals. Table 1 presents a summary of their main characteristics as well as characteristics of the intervention (setting, provider and content) and key outcomes and time of assessment. All studies originated from Europe or North America with the exception of three studies from Australia, Taiwan and Thailand.(37-39) Almost half (45%) of the studies were conducted in the USA and 22% in the UK.

In total, 69% of trials were delivered in primary or healthcare settings. Only six studies were conducted in community settings defined: as military(40-42); research sites recruiting a sample through a household survey(43); and targeted recruitment of women at risk of alcohol exposed pregnancy (defined as aged 18-44 years, with ineffective or no use of contraceptives, sexually active in the last 6 months, but not currently pregnant or planning a pregnancy) recruited via the media, in a prison, community health centre and a gynaecology centre (44); and one criminal justice setting.(45) The most common providers included counsellors, who were the sole providers of interventions in 43% of trials and physicians who accounted for 24% of trials. A minority category of different providers (8%) included a combination of Psychologists, Social Workers or Research nurses. Intervention categories were well-distributed, though a majority of trials (47%) included motivational interviewing alone and 39% included motivational interviewing 'plus'. A total of 50 trials reported 275 eligible effect sizes on outcomes measuring quantity of alcohol consumed with a mean follow up of nine months.. This is summarised in Table 2.

In total the majority (71%) of studies were categorised as low risk of bias in relation to randomisation and allocation concealment strategies. In the majority of studies the process used to assess blinding of participants and providers as well as outcome assessment was unclear. Intention to treat analysis was conducted in 47% of studies and loss to follow-up assessed in the majority (80%) of studies. This is summarised in Table 3 and risk of bias assessment for all trials is included in the Web Appendix (Online Table 1).

Meta regression on combined quantity and frequency outcomes

Interventions produced a beneficial effect at reducing the quantity of alcohol consumed by 0.15 standard deviations—a small but statistically significant effect (see Table 4). This effect persisted after controlling for time to follow-up and when examining the sub-set of outcomes. In both unconditional models and models controlling for time of follow-up, study-level heterogeneity as measured by I^2 (that is, the percentage of variation between effect sizes due to heterogeneity rather than chance) was in the small to moderate range (0-40%) as defined by the Cochrane Handbook.(28) Findings were robust to sensitivity analysis on the pre-post correlation in change score models. The mean time-adjusted effect of brief alcohol interventions on frequency of alcohol consumption outcomes was similar in magnitude (d=-0.15, 95% CI [-0.20, -0.11]), but lower in heterogeneity (I^2=23%), as compared to the effect on quantity of alcohol consumption (see Table 5). The time-adjusted effect remained statistically significant when limited to the sub-set of outcomes (frequency

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of drinking occasions *d*=-0.12, 95% CI [-0.19, -0.06] and frequency of binge drinking *d*=-0.17, 95% CI [-0.23, -0.11]).

Place

Place of intervention did not appear to fully explain heterogeneity in quantity outcomes between studies, with residual heterogeneity at 34% and a statistically marginal but non-significant joint test of moderators (*p*=0.09). Interventions conducted in university settings (*d*=-0.20, 95% CI [-0.39, -0.09]) and in primary or ambulatory care (-0.20, [-0.27, -0.13]) appeared to be most effective, with a small but statistically significant effect of the intervention. Interventions delivered in community settings (military, criminal justice, research sites and targeted recruitment) did not appear to be effective (-0.03, [-0.16, 0.10]). Place of intervention did not explain heterogeneity in the frequency outcomes (residual I^2=25%, Wald *p*=0.54). Of subgroups with statistically significant pooled effect sizes, interventions delivered in university contexts appeared to be most effective for frequency outcomes (-0.21, [-0.33, -0.08]). Analysis was hampered by small numbers of studies in several categories. Place of intervention did not explain heterogeneity when limiting the analysis to the sub-set of either quantity or frequency outcomes (all joint tests of moderators *p*>0.10).

Provider

Provider of intervention did not meaningfully explain heterogeneity in outcomes, based both on I^2 for this model (28%) and a statistically marginal but non-significant joint test of moderators (Wald *p*=0.09). Examination of effects at first time point for amount of alcohol per unit time showed that interventions delivered at least in part by nurses (*d*=-0.30, 95% CI [-0.47, -0.12]) were the most effective, with a significant joint test of moderators (Wald *p*=0.048) (Online Table 2). Interventions delivered by a range of different providers (psychologist, research nurses, social workers) were least effective and did not yield a statistically significant effect. However, few studies were included in this category of providers. Provider of intervention explained some heterogeneity when the analysis was limited to amount of alcohol per unit time (residual I^2=32%, Wald *p*=0.01) but not per drinking occasion. Provider of intervention did not explain heterogeneity in any of the frequency outcomes either combined (Wald *p*=0.17) or for drinking occasion per unit time (Wald *p*=0.73*)* but the effect was marginal, but non-significant, for bingeing occasions (Wald *p*=0.07).

Content

Content of intervention did not explain a statistically significant amount of heterogeneity for quantity outcomes (residual I^2=39%, Wald *p=0.54*), with little apparent reduction in I^2. While all content groups had statistically significant mean effects, brief advice appeared to be most effective (*d*=-0.20, 95% CI [-0.30, -0.09]) with the impact of motivational interviewing (*d*=-0.13) and motivational interviewing plus (*d*=-0.16) also statistically significant. For frequency outcomes, content of intervention did not explain a significant amount of heterogeneity (residual I^2=29%, Wald *p*=0.48). Effects by content group for motivational interviewing were similar to those in the analysis of quantity outcomes, though brief advice did not have a statistically significant effect on frequency of alcohol use (-0.08, [-0.26, 0.09]). Estimates of heterogeneity remained the same when limiting the analysis to the sub-set of either quantity or frequency outcomes.

Sensitivity check: meta-regression on subset of outcomes by first and last time point

Overall effect estimates based on first and last time point were similar to the corresponding value reported in the main analysis, but estimates of heterogeneity (measured through I^2) tend to be higher. Place of intervention explained some heterogeneity for the alcohol per unit time outcome at first time of marginal significance (residual I^2=49%, Wald *p=0.08*). Findings also suggest that provider explained some heterogeneity (residual I^2=43%, Wald *p=0.05*) with nurses having the biggest effect (*d*=-30, 95% CI [-0.41, -0.20]) and interventions delivered by different providers the least effect (*d*=-0.07, 95% CI [-0.12, -0.03]). Content of intervention explained some heterogeneity (residual I^2=43%,

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Wald *p=0.04*), brief advice was the most effective (*d*=-0.25, 95% CI [-0.42, -0.07]) and motivational interviewing least effective (*d*=-0.09, 95% CI [-0.15, -0.04]). (Figures 3-5) With the exception of content, evidence of heterogeneity did not remain significant at the last time point. There was no evidence of heterogeneity for alcohol consumed per drinking occasion or for either subset of frequency outcomes. All findings are summarised in the Online Tables 2-5.

Discussion

As established in prior reviews, our findings show that brief alcohol interventions are effective for reducing quantity and frequency of alcohol intake when delivered in primary health care settings.(11-13) However, the current review provides important new evidence on effectiveness in settings beyond primary care and on provider effects, informing us of optimum modality. In the multi-level model, neither place nor content appeared to significantly moderate intervention effectiveness: we found little evidence on the effectiveness of brief interventions in community settings or accident and emergency; brief advice was the most effective content in reducing quantity of alcohol consumed but not frequency of drinking and there seemed to be little difference in the effect of motivational intervention or MI Plus on either quantity or frequency outcomes. Our findings show that provider of intervention may matter. We observed some reductions in heterogeneity observed in the multi-level analysis of amount of alcohol consumed per unit time, and interventions delivered by nurses having the most effect in reducing quantity of alcohol consumed, but not frequency of consumption. This finding builds on other evidence showing a modest effect of brief intervention delivered by non-physicians (nurses and health care workers) in primary care settings.(22)

While place did not explain heterogeneity, findings show that university and ambulatory and primary care settings were the most effective in terms of magnitude of effect size, which is supported by previous reviews in this area.(12, 13, 15) Prior research has suggested that while ABIs delivered in A&E settings may be effective in reducing alcohol consumption among hazardous and harmful drinkers,(17) it may not provide the most appropriate context for discussion on alcohol use.(46) The brevity of visits, lack of privacy for the delivery of the intervention and severity of injury may hinder the interaction between patient and practitioner reducing effectiveness.(46-49). Other evidence shows that discussion of drinking behaviours is facilitated by a good relationship between practitioner and client.(50) Our finding of increased reduction in alcohol consumption when the intervention is delivered by a nurse is important. The majority of previous research has focussed on physician-led interventions, but there is growing evidence to support the effectiveness of nurse-led interventions across a range of settings.(51) As the largest group of health care workers with repeated patient contact and with a health promotion remit as part of their role, they are well placed to deliver ABIs.(51, 52) Barriers to nurses delivering the interventions include lack of time, worry about losing trust of the patient and inadequate training.(53, 54) Resources and training should be provided to support nurses to undertake this role and embed it within services. The provision of ABIs under the category of different providers was not associated with a reduction in consumption in alcohol. This may be related to problems with training of different providers, but the category was small and included a diverse range of providers making the finding difficult to interpret.

While our categories of intervention content did not meaningfully or statistically explain heterogeneity in either quantity or frequency outcomes in the multi-level analysis, it did in the stratified analysis for both first and last assessment time points. Effect sizes for quantity outcomes for all three classes of content were statistically significant, with brief advice yielding the largest effect. This provides important empirical evidence that brief advice can reduce alcohol intake, where evidence was previously lacking, and corroborates previous research that demonstrated no

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difference in effect between brief advice and longer lifestyle counselling in reducing harmful levels of drinking in A&E, primary care and criminal justice settings.(10, 55-57).

Strengths and Limitations

A key strength of this review is the use of a multilevel meta-analysis method to integrate all relevant effect sizes from included studies. This circumvented problems in other systematic reviews around selection of specific effect sizes for meta-analysis. However, we were unable to explicitly model correlation between outcomes within studies, though simulation evidence suggests that this may not have a large impact on estimation of intervention effects.(58) We used Cohen's d to standardise outcomes. While this is common across many systematic reviews addressing continuous outcomes, it is uncommon for systematic reviews of alcohol outcomes, where standardisation is often in terms of standard drinks or grams of ethanol consumed. This may somewhat limit comparability between reviews, but it was a critical step in using a multilevel meta-analysis model we used. As a second sensitivity analysis we compared findings from the multi-level model with a stratified analysis focussing on a sub-set of outcome variables. Findings from the two analyses were comparable. The stratified analysis of quantity of alcohol consumed per unit time suggested stronger effects of place, provider and content of intervention at first time-point of assessment than indicated in the multi-level models but with comparable effect estimates within each category. Tests for publication bias do not yet exist for multilevel meta-analyses. While our tests using all available effect sizes did not reveal significant publication bias on either quantity or frequency outcomes, it is unlikely that this is the best way to test publication bias in the context of dependent effect sizes. While we used the broadest categories appropriate for place and provider of interventions, the number of studies included in meta-analysis examining frequency outcomes meant that meta-regressions were likely underpowered. We did not examine the effect of sex, ethnicity or age as a covariate since the sample size would have been too small to conduct a multivariate meta-regression analysis. As the number of trials grows, this meta-analysis should be repeated in order to better estimate differences between categories and examine the effect of other factors.

These findings should also be viewed in context of study-level heterogeneity in our multilevel meta-analyses that was surprisingly low, given the diversity of settings, providers and modalities included in this body of evidence. One possible reason for this is that because we included all relevant outcomes, we avoided some of the 'random error' that may arise when only selecting one outcome per study. That is, including more information from each study will provide an estimate of statistical heterogeneity that more meaningfully accounts for study-level differences. This is not to say that it was inappropriate to explore this heterogeneity through structured and pre-hypothesised subgroup analyses, as was done here. Rather, the magnitude of difference in effects between studies may not be as pronounced as would be expected in a systematic review with such diverse interventions. While there was a low risk of bias in relation to some aspects of the study design (randomisation, loss to follow-up), there was a high percentage of unclear risk for many criteria limiting our ability to fully assess the risk of bias. Because of the substantial number of categories for many of our meta-regressions, we were unable to sensitivity analyse on risk of bias as that would have resulted in underpowered models.

Further research is needed to examine the effectiveness of ABIs in community settings. Our review suggested limited effect but relied on a small number of studies across a wide variety of settings. Our review excluded the use of computer-based interventions, which may be an important approach to reaching populations who do not consider themselves at risk. Some evidence shows that computer-delivered interventions with personalised feedback can effectively reduce alcohol consumption at short-term and long-term follow-up, however the evidence is weaker when comparing direct feedback between face-to-face and computerised feedback.(59) Our findings

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clearly show the importance of provider in effective delivery of ABIs and it will be important for future research to measure effectiveness of computerised feedback against different providers. Subsequent trials should also comprehensively describe intervention components to enable finer-grained analysis of the relationship between specific aspects of intervention modalities and effectiveness.

Findings of this review contribute significantly to the understanding of the key processes involved in the delivery of effective ABIs, and have important policy implications for the delivery of Alcohol Strategies both in the UK and internationally. The review provides important new evidence on the effectiveness of brief advice in reducing quantity of alcohol consumed and the role of nurses in moderating effectiveness of interventions. Resources should be prioritised to provide further support and train nurses to deliver ABIs and undertake research to understand why they are more effective so appropriate training can be provided to other practitioners.

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Data sharing agreement

No additional data are available

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Contributors

LP and CA developed the study protocol with advice from EK. LP conducted the search with assistance from DNB. LP and DNB checked the eligibility criteria of all manuscripts with help from AO. AO and JB conducted the data extraction and validation of extraction. GJM developed the statistical approach and conducted all statistical analyses in collaboration with LP. All authors commented on the manuscript.

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Table 2: Summary risk of bias assessment

Item	High risk % (k)	Low risk % (k)	Unclear risk % (k)
Allocation concealment	2% (1)	72% (36)	26% (13)
Blinding of participants and providers	12% (6)	30% (15)	58% (29)
Blinding of outcome assessment	10% (5)	42% (21)	48% (24)
Intention to treat analysis	6% (3)	48% (24)	46% (23)
Loss to follow up	20% (10)	80% (40)	0% (0)

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Table 3: Summary of study characteristics

Characteristic	% of trials Mean (SD)	Number
TRIALS		
Place of intervention		
A&E	20%	10
Non-health settings	12%	6
Ambulatory or primary care	38%	19
Hospital inpatient services	10%	5
University	20%	10
Provider		
Counsellor/mental health clinician	44%	22
Different providers	8%	4
GP	22%	11
Nurse	18%	9
Peer intervention	4%	2
Combination	12%	6
GP and nurse	8%	4
GP and counsellor	4%	2
Content		
Brief advice	24%	12
Motivational interviewing	48%	24
Motivational interviewing 'plus'	40%	20
OUTCOMES		
Quantity		275
Mean follow-up (months)	9.0 (8.3)	
Frequency		108
Mean follow-up (months)	11.1 (10.5)	

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Table 4 Results of multi-level meta-regression for quantity outcomes

Outcomes	Group name	All quantity outcomes				Amount of alcohol per unit time				Amount of alcohol per drinking occasion			
		ES (95% CI)	k (n)	I^2 (%)	*p*	ES (95% CI)	k (n)	I^2 (%)	*p*	ES (95% CI)	k (n)	I^2 (%)	*p*
Overall	Mean effect	-0.15 (-0.20, -0.10)	50 (268)	37%		-0.17 (-0.22, -0.12)	47 (144)	38%		-0.10 (-0.18, -0.01)	15 (59)	36%	
Overall, time-adjusted	Mean effect	-0.15 (-0.20, -0.11)	50 (268)	36%	0.03	-0.17 (-0.22, -0.12)	47 (144)	38%	0.21	-0.11 (-0.19, -0.03)	15 (59)	34%	0.09
	Time (month)	0.003 (0.0003, 0.006)				0.002 (-0.001, 0.006)				0.005 (-0.001, 0.01)			
Place of intervention	A&E	-0.10 (-0.19, -0.002)	10 (44)	34%	0.12	-0.12 (-0.22, -0.01)	9 (26)	37%	0.17	-0.001 (-0.14, 0.13)	4 (8)	28%	0.17
	Ambulatory or primary care	-0.20 (-0.27, -0.13)	19 (84)			-0.22 (-0.29, -0.14)	19 (51)			-0.14 (-0.25, -0.03)	7 (18)		
	Hospital inpatient services	-0.14 (-0.29, 0.01)	5 (13)			-0.15 (-0.31, 0.006)	5 (12)			N/A	N/A		
	Non-health settings	-0.03 (-0.16, 0.10)	6 (15)			-0.04 (-0.18, 0.11)	5 (11)			-0.01 (-0.30, 0.29)	1 (4)		
	University	-0.20 (-0.39, -0.09)	10 (112)			-0.21 (-0.23, -0.09)	9 (44)			-0.22 (-0.39, -0.06)	3 (29)		
Provider	Counsellor/mental health clinician	-0.11 (-0.17, -0.05)	24 (163)	34%	0.09	-0.10 (-0.17, -0.04)	22 (79)	32%	0.01	-0.11 (-0.23, 0.01)	8 (41)	43%	0.67
	Different providers	-0.12 (-0.27, 0.03)	4 (10)			-0.12 (-0.25, 0.02)	4 (10)			N/A			
	Physician	-0.12 (-0.20, -0.04)	17 (65)			-0.14 (-0.22, -0.06)	17 (40)			0.02 (-0.16, 0.21)	6 (10)		
	Nurse	-0.23 (-0.33, -0.13)	13 (41)			-0.28 (-0.38, -0.18)	12 (29)			-0.18 (-0.37, -0.003)	5 (9)		
	Peer intervention	-0.08 (-0.29, 0.13)	2 (10)			-0.05 (-0.28, 0.17)	2 (3)			-0.004 (-0.28, 0.27)	2 (3)		
Content	Brief advice	-0.20 (-0.31, -0.09)	12 (26)	39%	0.54	-0.22 (-0.34, -0.11)	11 (18)	59%	0.31	-0.16 (-0.37, 0.05)	3 (6)	43%	0.89
	Motivational interviewing	-0.13 (-0.19, -0.07)	24 (132)			-0.13 (-0.20, -0.07)	24 (73)			-0.11 (-0.22, 0.004)	9 (28)		
	Motivational interviewing plus	-0.16 (-0.23, -0.09)	20 (110)			-0.19 (-0.27, -0.11)	17 (53)			-0.10 (-0.24, 0.03)	6 (25)		

k=number of studies, *n*=number of effect sizes, *p* is the value from a multiparameter Wald test of coefficients. Models for place, provider and content include mean-centred time as a covariate, but not in the multiparameter Wald test.

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Table 5 Results of multi-level meta-regression for frequency outcomes

Outcomes	Group name	All frequency outcomes				Drinking occasions per unit time				Bingeing occasions per unit time			
		ES (95% CI)	k (n)	I^2 (%)	*p*	ES (95% CI)	k (n)	I^2 (%)	*p*	ES (95% CI)	k (n)	I^2 (%)	*p*
Overall	Mean effect	-0.15 (-0.20, -0.11)	26 (114)	23%		-0.12 (-0.19, -0.06)	16 (38)	23%		-0.17 (-0.23, -0.11)	15 (76)	20%	
Overall, time-adjusted	Mean effect	-0.16 (-0.20, -0.11)	26 (114)	23%	0.36	-0.12 (-0.19, -0.06)	16 (38)	24%	0.55	-0.18 (-0.24, -0.11)	15 (76)	20%	0.56
	Time (month)	0.002 (-0.002, 0.005)				0.002 (-0.004, 0.007)				0.001 (-0.003, 0.006)			
Place of intervention	A&E	-0.11 (-0.21, -0.005)	5 (26)	25%	0.54	-0.13 (-0.26, -0.0002)	4 (12)	28%	0.41	-0.11 (-0.22, 0.01)	3 (14)	20%	0.25
	Ambulatory or primary care	-0.18 (-0.26, -0.10)	10 (40)			-0.07 (-0.19, 0.06)	5 (12)			-0.24 (-0.33, -0.15)	6 (28)		
	Hospital inpatient services	-0.21 (-0.47, 0.04)	2 (2)			-0.50 (-0.94, -0.06)	1 (1)			-0.07 (-0.37, 0.23)	1 (1)		
	Non-health settings	-0.08 (-0.22, 0.06)	4 (7)			-0.11 (-0.32, 0.11)	2 (3)			-0.06 (-0.24, 0.13)	2 (4)		
	University	-0.21 (-0.33, -0.08)	5 (39)			-0.18 (-0.36, -0.003)	4 (10)			-0.21 (-0.37, -0.05)	3 (29)		
	Counsellor/mental health clinician	-0.11 (-0.17, -0.04)	14 (73)	23%	0.17	-0.12 (-0.22, -0.02)	9 (25)	32%	0.73	-0.12 (-0.20, -0.05)	9 (48)	18%	0.07
Provider	Different providers	-0.24 (-0.52, 0.03)	1 (1)			-0.25 (-0.56, 0.07)	1 (1)			N/A			
	Physician	-0.13 (-0.22, -0.04)	10 (30)			-0.03 (-0.19, 0.13)	6 (8)			-0.18 (-0.28, -0.07)	5 (22)		
	Nurse	-0.19 (-0.31, -0.07)	7 (22)			-0.20 (-0.31, 0.01)	4 (5)			-0.17 (-0.31, -0.02)	3 (17)		
	Peer intervention	-0.06 (-0.27, 0.13)	2 (3)			-0.08 (-0.31, 0.16)	2 (3)			N/A			
Content	Brief advice	-0.08 (-0.26, 0.09)	3 (7)	29%	0.48	0.17 (-0.11, 0.44)	2 (4)	26%	0.10	-0.23 (-0.44, -0.02)	2 (3)	26%	0.52
	Motivational interviewing	-0.15 (-0.21, -0.08)	15 (58)			-0.15 (-0.23, -0.06)	9 (20)			-0.14 (-0.23, -0.06)	9 (38)		
	Motivational interviewing plus	-0.19 (-0.27, -0.11)	11 (49)			-0.13 (-0.24, -0.03)	7 (14)			-0.21 (-0.31, -0.11)	6 (35)		

k=number of studies, *n*=number of effect sizes, *p* is the value from a multiparameter Wald test of coefficients. Models for place, provider and content include mean-centred time as a covariate, but not in the multiparameter Wald test.

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Table 1 Characteristics of Included studies

		Sample	Intervention					Outcomes	
Author	**Country**	**n† % F, age (yrs)**	**Setting**	**Provider**	**Arm**	**Content**	**Total mins** (sessions)	**Definition (Q=Quantity, F= Frequency)**	**Time (mths)**
Aalto 2000	Finland	118, 100%, 41	GP	GP/nurse	1	MI	70-130 (7)	**Q:** Amount per week; usual amount per occasion (Grams); **F:** Drinking times per week	36
				GP only	2	MI	30-60 (7)		
					C	TAU			
Aalto 2001	Finland	296, 0%, 41	GP	GP/ nurse	1	MI	70-130 (7)	**Q:** Grams per week/ per occasion **F:** Drinking times per week	36
				GP only	2	MI	30-60 (7)		
					C	TAU			
Anderson 1992	UK	154, 0%, 44	GP	GP	1	Brief advice	10 (1)	**Q:** Breath alcohol (mg/100 ml); HSQ quant/freq and interview (grams/week)	12
					2	TAU			
Antti-Poika 1988	Finland	120, 0%, 39	A&E	Nurse	1	Brief advice	NR (1)	**Q:** Grams of absolute alcohol during 1 week period	6 (P-I)
					C	NR			
Baer 2001	USA	508, 55%, NR	College	Counsellor	1	MI	Unclear (NR)	**Q:** Mean drinks per drinking day; **F:** Drinking days per average week	24; 36
					C	Screening			
Beich, 2007	Denmark	6897, 62%, 36	GP	GP	1	MI Plus	10 (1)	**Q:** Usual weekly consumption of beer, wine and spirits (units/week)	12
					C	Screening			
Bernstein 2010	USA	835, 56%, 88%>18	A&E	Peer	1	MI	Unclear (1)	**Q:** Max drinks per day; Mean drinks per drinking day; Mean drinks per week **F:** Drinking days per month	3, 12
					C	Screening			
Butler 2009	USA	114, 65%, 20	College	Media	1	Brief advice	11 (1)	**Q:** Standard drinks per week; **F:** Binge episodes; drinking occasions; drinking occasions	1 (P-I)
				Counsellor	2	MI	41 (1)		
					C	Screening			
Carey 2006	USA	509, 65%, 19	College	Counsellor	1	MI	65 (1)	**Q:** Drinks per drinking day; **F:** Drinks per week; Heavy drinking frequency	6 or 12
					2	MI Plus	70 (1)		
					C	Screening			
Cherpitel 2010	Poland	446, 17%, 54% >30	A&E	Nurse	1	MI plus	15-20 (3)	**Q:** Drinks per drinking day; Maximum drinks per occasion last month**; F:** Drinking days per week	12
					C	Screening			
					C	Assessment			
Chick 1985	UK	156, 0%, 18-65	A&E	Nurse	1	Brief advice	60 (1)	**Q:** Consumption on past week (units) **B:** Mean cell volume (fl); Y-GT (IU/l)	12
					2	Screening			
Cordoba 1998	Spain	229, 0%, 36.5	GP	GP	1	Branded	15 (1)	**Q:** Alcohol consumption units/week	12
					C	Simple advice			

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		Sample	Intervention					Outcomes	
Author	**Country**	**n† % F, age (yrs)**	**Setting**	**Provider**	**Arm**	**Content**	**Total mins** (sessions)	**Definition (Q=Quantity, F= Frequency)**	**Time (mths)**
Crawford 2004	UK	599, 21%, 44	A&E	Nurse	1 C	MI Information	30 (3)	**Q:** Mean units per drinking day; Mean weekly units	6 or 12
Crawford 2014	UK	802, 54%, 27	GP	Nurse	1 C	Brief Advice Information	2-3 (1)	**Q:** Mean units on drinking days; Weekly alcohol consumption in units	6
Curry 2003	USA	333, 35%, 47	GP	GP and counsellor	1 C	MI Plus TAU	47 (1)	**Q:** Drinks per week	12
Daeppen 2007	Switzerland	987, 22%, 36.7	A&E	Counsellor	1 C C	MI Assessment Nothing	17 (1)	**Q:** Number of drinks per occasion/last week (last year) **F:** Number of binge drinking occasions per month/per week (last year)	12
Daeppen 2011	Switzerland	2831, 0%, 19.9	Community (Military)	Counsellor	1 C	MI Assessment	15.8 (2)	**Q:** Change in drinks per week **F:** Change in binge drinking occasions per month	6
Drummond 2014	UK	1204, 35%, 34.6	A&E	Counsellor	1 2 C	Branded MI Information	20 (1) 20 (1)	**Q:** Average daily drinks	6, 12 (P-I)
Field 2010	USA	1439, 18%, 33	A&E	Counsellor	1 C	MI TAU + Assess	Unclear (1)	**Q:** Change in: alcohol per week; max. amount in a day in past 6 mths; **F:** Change in percent days heavy drinking;	6, 12
Fleming 1997; Manwell 2000, Grossberg 2004	USA	774, 38%, 29% 18-30	GP	GP and nurse	1 C	Branded Information	30 (2)	**Q:** No. drinks in past 7 days **F:** No. binge drinking episodes in last 30 days [binge drinking defined as having more than 4 drinks per occasion]	6, 12, 24, 36, 48 (P-I)
Fleming 1999	USA	158, 34%, 65-75	GP	GP / nurse	1 C	Branded Information	30 (2)	**Q:** Number of drinks in last week; **F:** Number of binge drinking occasions in last month;	6, 12
Fleming 2009	USA	986, 51%, 21	GP	GP	1 C	Branded Information	30 (2)	**Q:** Mean number of drinks; **F:** Mean number of drinking days; Mean number of heavy drinking days (last 28 days)	6
Freyer-Adam 2008	Germany	595, 6%, 41	Hospital	GP Different providers*	1 2 C	MI MI TAU	unclear (1) 78 (1)	**Q:** Average daily alcohol intake (grams); Total alcohol intake in past week (grams)	12
Gaume 2011	Switzerland	572, 0%, 19.9	Community (Military)	Counsellor	1 2 C	MI^ MI ^ Assessment	21.8 (1) 21.8 (1)	**Q:** Mean change in number of standard (~10 g of alcohol) drinks per week; **F:** Mean change in heavy episodes (6 drinks or more) per month	6

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		Sample	Intervention					Outcomes	
Author	**Country**	**n† % F, age (yrs)**	**Setting**	**Provider**	**Arm**	**Content**	**Total mins** (sessions)	**Definition (Q=Quantity, F= Frequency)**	**Time (mths)**
Gaume 2014	Switzerland	431, 0%, 19	Community (Military)	Different providers	1 C	MI Assessment	20-30 (1)	**Q:** Number of drinks/day **F:** Number of drinking days/week	3
Gentilello 1999	USA	762, 18%, 35.4	A&E	Counsellor	1 C	MI Assessment	30 (1)	**Q:** Changes in the no. of drinks consumed per week	6, 12
Gottlieb-Hansen 2012	Denmark	772, 49%, 60	Community (Research)	Different providers	1 C	MI Information	15 (2)	**Q:** Number of drinks per week	6, 12
Heather 1987	UK	104, 25%, 36.4	GP	GP	1 2 C	Branded Brief advice Assessment	NR	**Q:** Heaviest months consumption in last 6 months(units); Last month's consumption (units)	6
Holloway 2007	UK	215, 15%, 44	Hospital	Nurse Media 	1 2 C	MI Media TAU	20 (1) NR	**Q:** Change from baseline in alcohol units in the past 7 days; Change in maximum units in 1 day **F:** Change in drink days in last week;	6
Ingersoll 2013	USA	217, 100%, 27.9	Community (Research)	Counsellor 	1 C	MI, Branded Information	60 (1)	**Q:** Drinks per drinking day	3, 6
Juarez 2006	USA	122, 53%, 19.4	College	Counsellor Counsellor Media Counsellor 	1 2 3 4 C	BA, MI BA, MI BA, MI BA, MI Assessment	60-80 (1) 40-60 (1) Unclear (1) 40-60 (1)	**Q:** Drinks per day; Maximum BAC	2
Kulesza 2010	USA	114, 72%, 20	College	Counsellor	1 2 C	MI Plus MI Plus Waiting List	10 (1) 50 (1)	**Q:** The Daily Drinking Questionnaire;	6 wks
Kulesza 2013	USA	268, 71%, 20	College	Counsellor	1 2 C	MI Plus MI Plus Discussion	10 (1) 50 (1)	**Q:** Average no. drinks/week	4 wks (P-I)
Larimer 2000	USA	159, NR< 18.8	College	Peer	1 2 C	MI Plus MI Plus TAU	60 (1) 60 (1)	**Q:** BAC (based on quantity & rate of consumption peak; Number of drinks over past month; Total average use; **F:** Frequency of use	12
Liu 2011	Taiwan	616, 0%, 41	A&E	Counsellor	1 C	MI TAU	60 (2)	**Q:** No. drinks in last 3 months (QDS); **F:** No. days heavy drinking (≥5 drinks) in last 3 mths (QDS); No. days heavy drinking in the previous week (TLFB)	4
Lock 2006	UK	127, 100%,	GP	Nurse	1	Branded	5-10	**Q:** Units per week	12 (P-I)

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		Sample	Intervention					Outcomes	
Author	**Country**	**n† % F, age (yrs)**	**Setting**	**Provider**	**Arm**	**Content**	**Total mins** (sessions)	**Definition (Q=Quantity, F= Frequency)**	**Time (mths)**
		44.1			C	TAU			
Maisto 2001	USA	301, 31%, 45.6	GP	Researcher	1	Brief advice	10-15 (1)	**Q:** No. of drinks in last 30 days **F:** No. of days of 1-6 drinks in last 30 days;	6, 12
				Counsellor	2	MI	60-85 (1)		
					3	Control			
Murphy 2001	USA	99, 54%, 19.6	College	Counsellor	1	MI	45 (1)	**Q:** Drinks per week; **F:** Binge drinking days per week [4+ drinks for women; 5+ drinks for men]; Drinking days per week;	9
				Counsellor	2	Brief advice	50 (1)		
					C	Assessment			
Noknoy 2010	Thailand	59, 9%, 37	GP	Nurse	1	MI	45 (3)	**Q:** Average drinking per drinking day during the previous week (drinks/drinking day)	6
					C	Assessment			
Richmond 1995	Australia	378, 43%, 37.7	GP	GP	1	Branded	30-55 (1)	**Q:** No units of ethanol in the last 7 days	6, 12
					2	Brief advice	5 (1)		
					C	Nothing			
Rubio 2010	Spain	752, 35%, 18-65	GP	GP	1	Branded	20-30 (2)	**Q:** No. of drinks in last 7 days [mean/SD]; **F:** No. of binge episodes (last 30 days) [mean/SD] (> 4 drinks for women and 5 for men in a single occasion)	12
					C	Information			
Rubio 2014	USA	330, 100%, 24	GP	Different providers	1	MI	70 (1)	**Q:** Drinks per day	6 wks, 6, 12 PP
					2	Control			
Saitz 2007	USA	341, 29%, 45	Hospital	Counsellor	1	MI	30 (1)	**Q:** Change decrease in number drinks/day **F:** Change decrease in heavy drinking episodes	12
					C	TAU			
Schaus 2009	USA	363, 52%, 20.6	GP	GP	1	MI Plus	40 (2)	**Q:** Average drinks per sitting/week; Typical BAC; Peak BAC; Peak no. drinks in sitting; **F:** No. days drinking 4+ drinks in month; No. times drunk in typical week.	6, 9
					C	Information			
Senft 1997	USA	516, 30%. 41.9	GP	GP/ counsellor	1	MI	15 (1)	**Q:** Drinks/drinking day over past 6 months; Total SECs past 3 months; **F:** Drinking days/week over past 6 months;	6, 12
					C	TAU			
					C	Referral to GP			
Shiles 2014	UK	154, NR, 51	Hospital	Nurse	1	Brief advice	10 (1)	**Q:** Daily units of alcohol in last week	3, 12
					C	TAU			
Smith 2003	UK	151, 0%, 24	Hospital	Nurse	1	MI	NR	**Q:** 84-day alcohol consumption; Alcohol consumption in a typical week	3, 12
					C	TAU			
Wagener 2012	USA	152, 45%, 20.9	College	Media	1	MI	45 (1)	**Q:** Peak BAC; Typical BAC) Weekly alcohol consumption using DDQ	10 wks
				Counsellor	2	MI	105-135 (1)		

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		Sample	Intervention					Outcomes	
Author	**Country**	**n† % F, age (yrs)**	**Setting**	**Provider**	**Arm**	**Content**	**Total mins** (sessions)	**Definition (Q=Quantity, F= Frequency)**	**Time (mths)**
				Counsellor	3	MI	NR (1)		
					C	Assessment			
Walters 2009	USA	279	College	Counsellor	1	MI (no feedback)	40 (1)	**Q:** No. of drinks per week; Peak BAC	3, 6
				Counsellor	2	MI (feedback)			
				Media	3				
					C	Assessment			
Watt 2008	UK	269	Community (CJS)	Different providers	1	MI	15-20	**Q:** No. of units consumed per week; **F:** Number of drinking days in the past 3 months	3, 12 (PI)
					C	NR			

NR= not reported
Sample: † n denotes eligible sample randomised at baseline; F=Female
Setting: CJS=Criminal Justice Service GP=General Practice; A&E=Accident and Emergency;
Providers: *Different providers defined as (Psychologist, Social Worker or Research nurse)
Content: ^ Stratified by heavy episodic and non-heavy episodic users. TAU= Treatment as usual; BA Brief advice; MI= Motivational Interviewing
Arm: C=Control group
Outcome: QDS=Quick Drinking Screen; TFLB=Alcohol Timeline Follow-Back; DDQ=Daily Drinking Questionnaire
Outcome time = All outcomes measured in months post baseline, unless specified: PI = Post Intervention; wks=weeks, PP= Post partum

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Figure 1 Categories and definitions of Interventions by Content, Provider and Setting

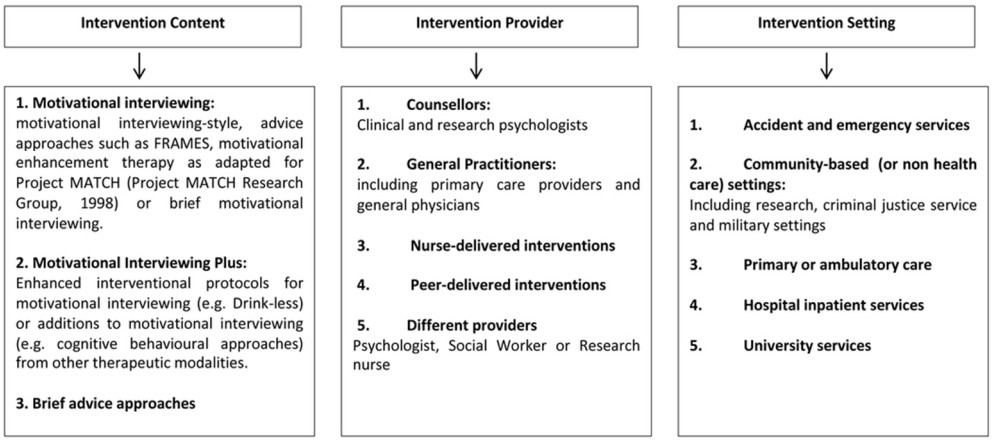

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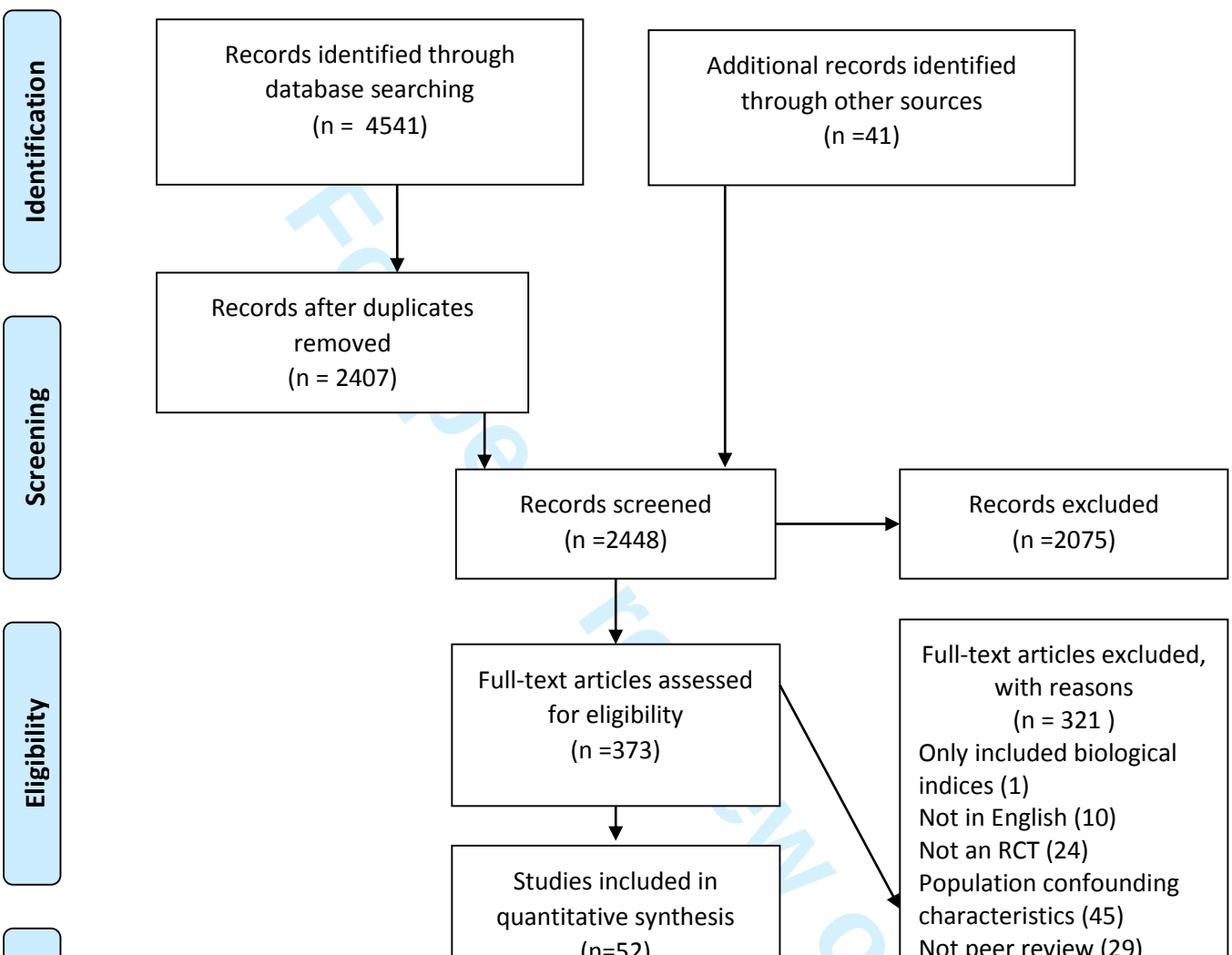
Figure 2: Flow chart of systematic review and study selection



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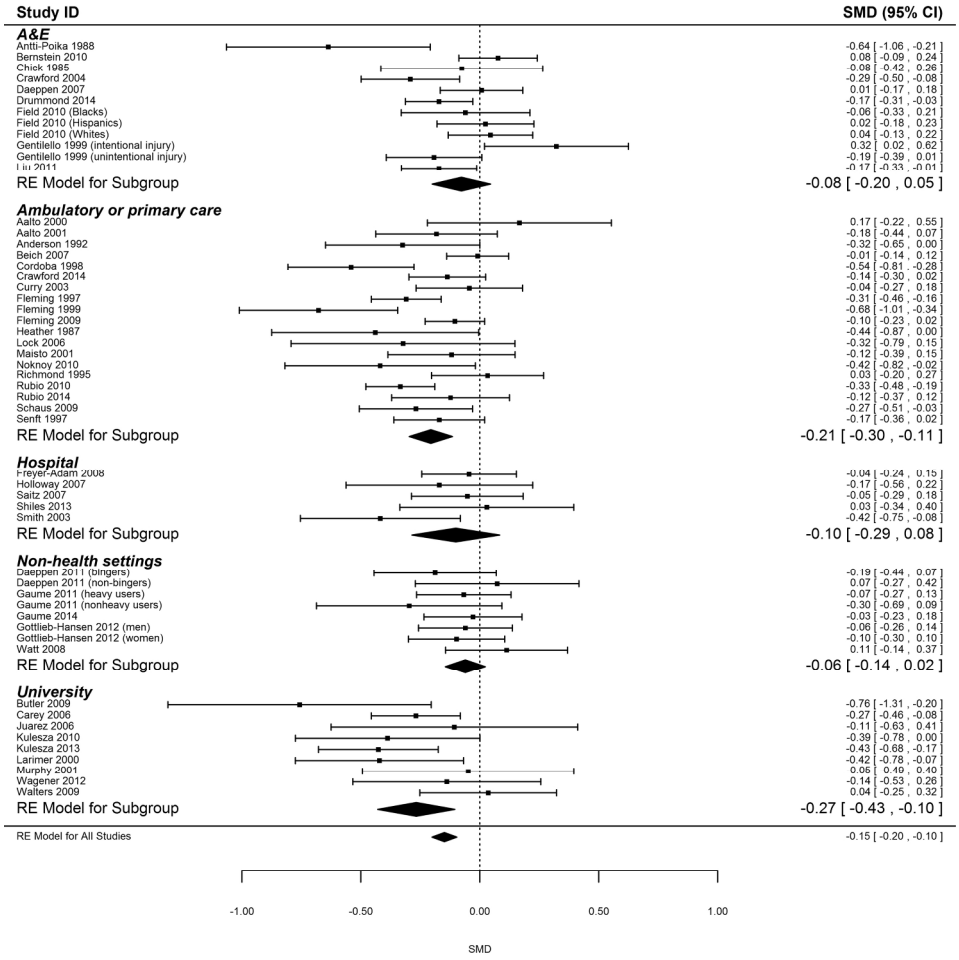

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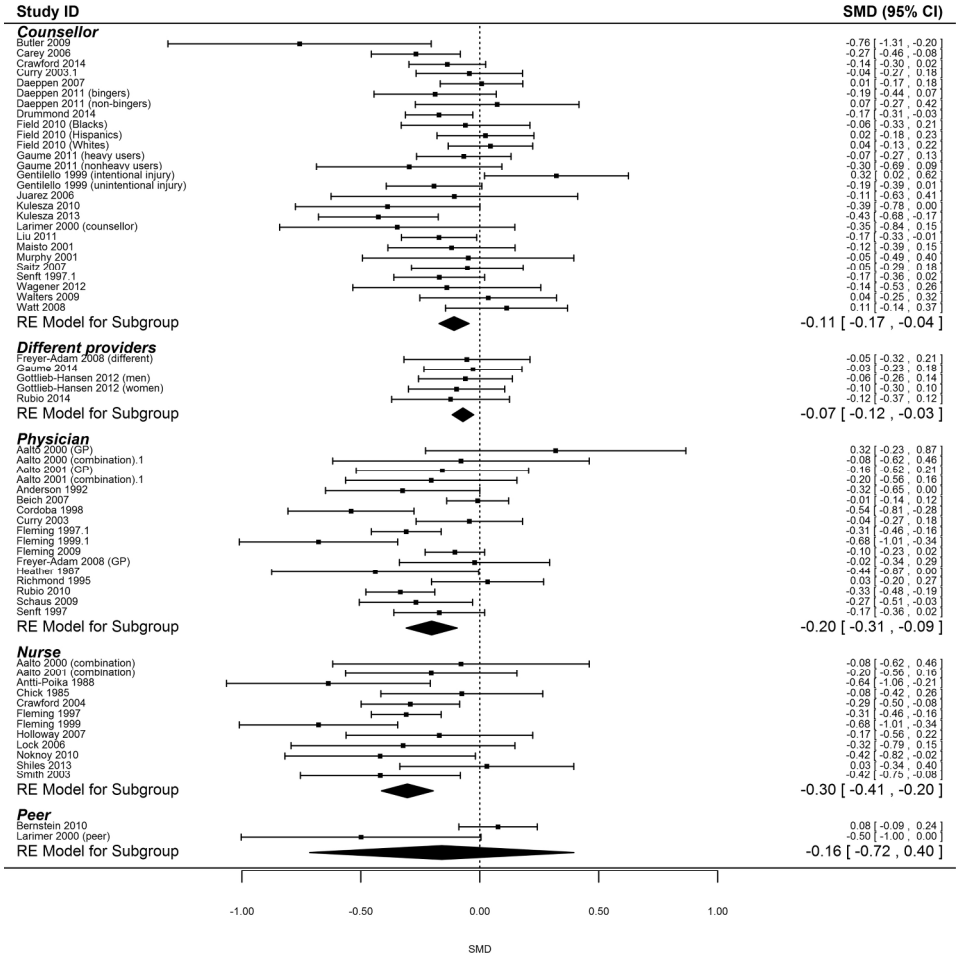

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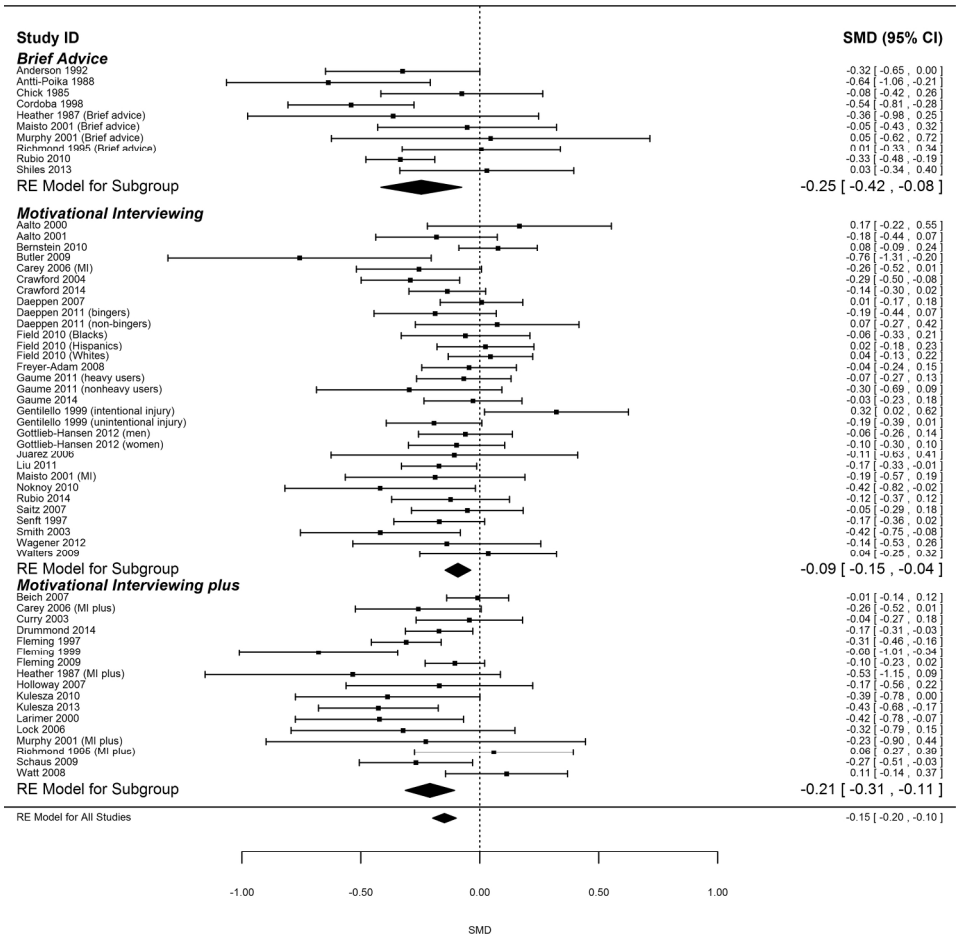

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Web Appendices

The medline search strategy is summarised below:

1 Randomized Controlled Trial/ (366634)
2 Random Allocation/ (79124)
3 Double-Blind Method/ (125165)
4 Clinical Trial/ (490650)
5 Clinical trial, phase i.pt. (14574)
6 Clinical trial, phase ii.pt. (24041)
7 clinical trial, phase iii.pt. (9034)
8 clinical trial, phase iv.pt. (898)
9 controlled clinical trial.pt. (87662)
10 randomized controlled trial.pt. (366634)
11 multicenter study.pt. (167388)
12 clinical trial.pt. (490650)
13 exp Clinical Trials as topic/ (277707)
14 Randomized Controlled Trials as Topic/ (90747)
15 Single Blind Method/ (18370)
16 or/1-15 (1009657)
17 case report.tw. (178692)
18 letter/ (782419)
19 historical article/ (294857)
20 case-control studies/ (172380)
21 cohort studies/ (158274)
22 cross-sectional studies/ (165889)
23 or/17-22 (1707664)
24 16 not 23 (937394)
25 Motivational Interviewing/ (93)
26 (Brief intervention or minimal intervention or early intervention or cognitive behav* or screen* or counsel* or brief advice or structured advice or identification or managed care or motivational interview).ab,ti. (856434) 27 25 or 26 (856487)
28 (((alcohol* or beer or wine or lager or spirit* or drink) adj3 (consum* or unit or use* or intake or binge or abuse* or misuse*)) or drink* rate* or drunk*).ab,ti. (76049)
29 Alcohol Drinking/ (50093)
30 Binge Drinking/ (124)
31 Ethanol/ (71297)
32 28 or 29 or 30 or 31 (157841)
33 24 and 27 and 32 (1331)
34 animals/ (5263469)
35 33 not 34 (1328)

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Online Table 1: Study Level risk of bias assessment

Study	Allocation	Blinding	Loss to follow up	Outcome	Intention to Treat Analysis
Aalto 2000	Adequate	C	A	C	A
Aalto 2001	Adequate	C	A	C	A
Anderson 1992	Unclear	C	A	C	A
Antti-Poika 1988	Unclear	C	A	C	C
Baer 2001	Unclear	C	B	C	A
Beich, 2007	Adequate	D	A	B	A
Bernstein 2010	Adequate	B	A	C	C
Butler 2009	Adequate	C	A	C	C
Carey 2006	Unclear	D	A	C	C
Cherpitel 2010	Adequate	B	A	A	B
Chick 1985	Inadequate	D	A	A	C
Cordoba 1998	Adequate	D	B	C	B
Crawford 2004	Adequate	B	B	B	A
Crawford 2014	Adequate	B	A	A	A
Curry 2003	Unclear	C	A	A	A
Daeppen 2007	Adequate	C	A	A	C
Daeppen 2011	Adequate	B	A	A	A
Drummond 2014	Adequate	B	A	A	A
Field 2010	Adequate	B	B	A	C
Fleming 1997; Manwell 2000, Grossberg 2004	Adequate	B	A	A	C
Fleming 1999	Unclear	B	A	C	C
Fleming 2009	Adequate	A	A	A	A
Freyer-Adam 2008	Adequate	B	A	B	C
Gaume 2011	Adequate	C	A	C	C
Gaume 2014	Unclear	C	A	A	C
Gentilello 1999	Adequate	C	A	C	A
Gottlieb-Hansen 2012	Adequate	D	A	B	A
Heather 1987	Unclear	C	A	A	C

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Study	Allocation	Blinding	Loss to follow up	Outcome	Intention to Treat Analysis
Holloway 2007	Adequate	C	A	A	A
Ingersoll 2013	Adequate	C	A	A	C
Juarez 2006	Unclear	C	B	C	C
Kulesza 2010	Unclear	C	A	C	C
Kulesza 2013	Unclear	C	A	C	C
Larimer 2000	Unclear	C	B	C	A
Liu 2011	Adequate	C	A	A	A
Lock 2006	Adequate	C	A	A	C
Maisto 2001	Adequate	C	B	C	B
Murphy 2001	Adequate	C	B	C	C
Noknoy 2010	Adequate	C	A	A	A
Richmond 1995	Adequate	C	A	C	A
Rubio 2010	Adequate	C	B	A	A
Rubio 2014	Adequate	C	A	A	C
Saitz 2007	Adequate	D	A	B	A
Schaus 2009	Adequate	C	A	C	A
Senft 1997	Unclear	B	A	A	C
Shiles 2014	Adequate	C	A	A	A
Smith 2003	Adequate	B	A	C	A
Wagener 2012	Adequate	C	B	C	C
Walters 2009	Adequate	A	A	C	A
Watt 2008	Adequate	B	A	C	C

Allocation concealment: Adequate allocation concealment (e.g. allocation by a central office unaware of subject characteristics; serially numbered, opaque, sealed envelopes; on-site computer system combined with allocations kept in a locked unreadable computer file that can be accessed only after the characteristics of an enrolled participant have been entered; or other description that contained elements convincing of concealment); Unclear allocation concealment (authors either did not report an allocation concealment approach at all or report an approach that did not fall in the category A or C); inadequate allocation concealment (alternation or reference to case numbers, dates of birth, day of the week; any procedure that is entirely transparent before allocation, such as an open list of random numbers or other description that contained elements convincing of none concealment)
Blinding of participants: A= double blind; B= single blind (blinding of participants); C= unclear D= not done
Loss to follow up: A= Loss to follow up completely recorded for each group; B= Loss to follow-up incompletely recorded (data reported only for one group or for the overall sample); C= Unclear or not done
Outcome assessment: A= Blind to treatment allocation at outcome assessment; B= Not blind to treatment allocation at outcome assessment; C= Unclear
Intention to Treat Analysis: A= Intention to Treat Analysis conducted; B= Not conducted; C=Not clea

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Online table 2: Amount of alcohol per unit time

Outcomes	Group name	First time point				Last time point			
		ES (95% CI)	k	I^2 (%)	*p*	ES (95% CI)	k	I^2 (%)	*p*
Overall	Mean effect	-0.15 (-0.20, -0.10)	53	53%		-0.15 (-0.19, -0.10)	53	53%	
Place of intervention	A&E	-0.08 (-0.20, 0.05)	12	49%	0.08	-0.12 (-0.23, -0.02)	11	36%	0.29
	Ambulatory or primary care	-0.21 (-0.30, -0.11)	19			-0.18 (-0.28, -0.09)	20		
	Hospital inpatient services	-0.10 (-0.29, 0.08)	5			-0.10 (-0.28, 0.07)	5		
	Non-health settings	-0.06 (-0.14, 0.02)	8			-0.05 (-0.15, 0.05)	8		
Provider	University	-0.27 (-0.43, -0.10)	9			-0.24 (-0.42, -0.06)	9		
	Counsellor/mental health clinician	-0.11 (-0.17, -0.04)	27	43%	0.048	-0.13 (-0.18, -0.07)	26	36%	0.12
	Different providers	-0.07 (-0.12, -0.03)	5			-0.04 (-0.18, 0.10)	5		
	Physician	-0.20 (-0.31, -0.09)	17			-0.18 (-0.28, -0.07)	18		
	Nurse	-0.30 (-0.41, -0.20)	12			-0.27 (-0.38, -0.16)	13		
	Peer intervention	-0.16 (-3.76, 3.44)*	2			-0.19 (-3.20, 2.81)	2		
Content	Brief advice	-0.25 (-0.42, -0.07)	10	43%	0.04	-0.24 (-0.43, -0.06)	10	40%	0.07
	Motivational interviewing	-0.09 (-0.15, -0.04)	31			-0.10 (-0.15, -0.06)	30		
	Motivational interviewing plus	-0.21 (-0.31, -0.11)	17			-0.16 (-0.27, -0.07)	18		

k=number of effect sizes, *p* is the value from a multiparameter Wald test of coefficients.

*This estimate was sensitive to type of maximum likelihood estimator used. We present this estimate without the Knapp-Hartung modification in the forest plot for interpretability.

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Online table 3: amount of alcohol per occasion

Outcomes	Group name	First time point				Last time point			
		ES (95% CI)	k	I^2 (%)	*p*	ES (95% CI)	k	I^2 (%)	*p*
Overall	Mean effect	-0.09 (-0.18, -0.001)	15	51%		-0.06 (-0.15, 0.03)	15	39%	
Place of intervention	A&E	0.005 (-0.29, 0.29)	4	44%	0.39	-0.01 (-0.23, 0.21)	4	43%	0.65
	Ambulatory or primary care	-0.14 (-0.28, 0.003)	7			-0.06 (-0.26, 0.13)	7		
	Hospital inpatient services	N/A				N/A			
	Non-health settings	-0.08 (-0.38, 0.23)	1			-0.02 (-0.35, 0.31)	1		
	University	-0.18 (-0.47, 0.10)	3			-0.16 (-0.46, 0.14)	3		
Provider	Counsellor/mental health clinician	-0.11 (-0.23, 0.002)	8	50%	0.75	-0.07 (-0.19, 0.06)	8	36%	0.47
	Different providers	N/A				N/A			
	Physician	-0.07 (-0.26, 0.12)	6			0.05 (-0.12, 0.22)	6		
	Nurse	-0.12 (-0.44, 0.20)	5			-0.11 (-0.43, 0.21)	5		
	Peer intervention	0.01 (-2.03, 2.06)	2			-0.02 (-1.04, 0.98)	2		
Content	Brief advice	-0.23 (-0.60, 0.14)	3	42%	0.48	-0.17 (-0.54, 0.19)	3	30%	0.57
	Motivational interviewing	-0.07 (-0.24, 0.09)	9			-0.05 (-0.20, 0.10)	9		
	Motivational interviewing plus	-0.11 (-0.25, 0.03)	6			-0.06 (-0.21, 0.09)	6		

k=number of effect sizes, *p* is the value from a multiparameter Wald test of coefficients.

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Online table 4: drinking occasions per unit time

Outcomes	Group name	First time point				Last time point			
		ES (95% CI)	k	I^2 (%)	*p*	ES (95% CI)	k	I^2 (%)	*p*
Overall	Mean effect	-0.12 (-0.20, -0.05)	16	34%		-0.14 (-0.22, -0.05)	16	45%	
Place of intervention	A&E	-0.11 (-0.29, 0.08)	4	36%	0.42	-0.14 (-0.39, 0.12)	4	50%	0.53
	Ambulatory or primary care	-0.08 (-0.21, 0.04)	5			-0.08 (-0.20, 0.05)	5		
	Hospital inpatient services	-0.51 (-0.89, -0.12)	1			-0.51 (-0.89, -0.12)	1		
	Non-health settings	-0.14 (-1.85, 1.58)	2			-0.14 (-1.84, 1.56)	2		
	University	-0.25 (-0.75, 0.25)	4			-0.23 (-0.83, 0.37)	4		
Provider	Counsellor/mental health clinician	-0.12 (-0.26, 0.01)	9	38%	0.89	-0.14 (-0.30, 0.02)	7	47%	0.83
	Different providers	-0.26 (-0.47, -0.05)	1			-0.26 (-0.47, -0.05)	1		
	Physician	-0.10 (-0.23, 0.02)	6			-0.09 (-0.21, 0.04)	5		
	Nurse	-0.21 (-0.55, 0.13)	4			-0.21 (-0.55, 0.13)	4		
	Peer intervention	-0.07 (-1.08, 0.95)	2			-0.07 (-1.08, 0.95)	2		
Content	Brief advice	0.17 (-1.96, 2.30)	2	28%	0.32	0.13 (-2.00, 2.26)	2	41%	0.36
	Motivational interviewing	-0.14 (-0.27, -0.01)	9			-0.16 (-0.30, -0.01)	7		
	Motivational interviewing plus	-0.12 (-0.23, -0.01)	7			-0.11 (-0.22, -0.002)	5		

k=number of effect sizes, *p* is the value from a multiparameter Wald test of coefficients.

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Online table 5: binge drinking occasions per unit time

Outcomes	Group name	First time point				Last time point			
		ES (95% CI)	k	I^2 (%)	*p*	ES (95% CI)	k	I^2 (%)	*p*
Overall	Mean effect	-0.15 (-0.22, -0.08)	19	38%		-0.14 (-0.22, -0.06)	22	50%	
Place of intervention	A&E	-0.09 (-0.29, 0.10)	5	24%	0.18	-0.11 (-0.35, 0.13)	5	57%	0.70
	Ambulatory or primary care	-0.20 (-0.30, 0.10)	6			-0.21 (-0.36, -0.06)	7		
	Hospital inpatient services	-0.06 (-0.30, 0.17)	1			-0.06 (-0.30, 0.17)	1		
	Non-health settings	-0.06 (-0.28, 0.16)	4			-0.06 (-0.28, 0.16)	4		
	University	-0.31 (-0.73, 0.11)	3			-0.21 (-1.17, 0.74)	3		
	Counsellor/mental health clinician	-0.12 (-0.22, -0.02)	13	36%	0.36	-0.09 (-0.20, 0.01)	11	21%	0.11
Provider	Different providers	N/A				N/A			
	Physician	-0.20 (-0.30, -0.09)	5			-0.20 (-0.27, -0.03)	6		
	Nurse	-0.24 (-0.52, 0.04)	3			-0.32 (-0.57, -0.08)	4		
	Peer intervention	N/A				N/A			
Content	Brief advice	-0.26 (-1.17, 0.65)	2	24%	0.25	-0.26 (-1.17, 0.65)	2	46%	0.71
	Motivational interviewing	-0.11 (-0.21, -0.02)	13			-0.12 (-0.23, -0.01)	11		
	Motivational interviewing plus	-0.18 (-0.29, -0.08)	6			-0.14 (-0.31, 0.03)	7		

k=number of effect sizes, *p* is the value from a multiparameter Wald test of coefficients.

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PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3 and 4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	4 and 5
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	6
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	4 and 5
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	5
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	4 and 5
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	5
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	5 and 6
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	6

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PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	5
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	6
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	6 &12
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	13-16
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	18 & Online Table 1
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	24-26
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	20-23
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	7
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	8 & online tables 3-6
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	8-9
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	9
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	8-9
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	11

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BMJ Open

How effective are brief interventions in reducing alcohol consumption: does setting, practitioner group and content matter? Findings from a systematic review and meta-regression analysis

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How effective are brief interventions in reducing alcohol consumption: does setting, practitioner group and content matter? Findings from a systematic review and meta-regression analysis

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Abstract

Background: While the efficacy and effectiveness of brief interventions for alcohol (ABI) have been demonstrated in primary care, there is weaker evidence in other settings and reviews do not consider differences in content. We conducted a systematic review to measure the effect of ABIs on alcohol consumption and how it differs by setting, practitioner group and content of intervention.

Methods: We searched MEDLINE, Embase, PsycINFO; CINAHL, Social Science Citation Index, Cochrane Library and Global Health up to January 2015 for randomised controlled trials that measured effectiveness of ABIs on alcohol consumption. We grouped outcomes into measures of quantity and frequency indices. We used multilevel meta-analysis to estimate pooled effect sizes and tested for the effect of moderators through a multiparameter Wald test. Stratified analysis of a sub-set of quantity and frequency outcomes was conducted as a sensitivity check.

Results: 52 trials were included contributing data on 29,891 individuals. ABIs reduced the quantity of alcohol consumed by 0.15 standard deviations. While neither setting nor content appeared to significantly moderate intervention effectiveness, provider did in some analyses. Interventions delivered by nurses had the most effect in reducing quantity (*d*=-0.23, 95% CI [-0.33, -0.13]) but not frequency of alcohol consumption. All content groups had statistically significant mean effects, brief advice was the most effective in reducing quantity consumed (*d*=-0.20, 95% CI [-0.30, -0.09]). Effects were maintained in the stratified sensitivity analysis at first and last assessment time.

Conclusion ABIs play a small but significant role in reducing alcohol consumption. Findings show the positive role of nurses in delivering interventions. The lack of evidence on impact of content of intervention reinforce advice that services should select the ABI tool that best suits their needs.

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Article Summary

Strengths and Limitations of the study

A key strength of this review is the methodologically innovative approach to the meta-analysis through the use of a multilevel meta-analysis.

As a second sensitivity analysis we compared findings from the multi-level model with a stratified analysis focussing on a sub-set of outcome variables. Findings from the two analyses were comparable.

Quality assessment criteria were used to assess risk of bias and the majority of studies were at low risk in relation to the randomisation procedure and monitoring of loss to follow-up.

A large proportion of studies did not provide information on other aspects of the study design including blinding of participants to the intervention, intention to treat analysis and blinding to outcome measurement.

Our review suggested limited effect for interventions delivered in community settings, but relied on a small number of studies across a wide variety of settings.

What we already know on the topic

Screening to detect individuals drinking alcohol at hazardous or harmful levels and the delivery of a brief intervention on alcohol (ABI) to reduce their consumption have been implemented in primary care settings where their efficacy and effectiveness have been demonstrated.

There is weaker evidence for effectiveness beyond primary care, with moderate or no effect found in accident and emergency departments, college, community and general hospital settings.

Content of ABI is varied but usually focuses on structured advice involving an assessment of individual risk with feedback and advice, or brief motivational interviewing that takes a more patient-centred approach or a combination of both approaches. Existing evidence has not found much variability in effect by duration of intervention but this has not taken account differences in content.

What this study adds

Provider of the intervention does appear to matter in some outcomes, and in multilevel models interventions delivered by nurses had the greatest effect in reducing quantity of alcohol consumed (d=-0.23, 95% CI [-0.33, -0.13]).

Little evidence on the effectiveness of brief interventions in community settings or accident and emergency were found. University settings were associated with the greatest reduction in alcohol consumption then primary care.

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Brief advice was associated with the greatest reduction in alcohol consumption (d=-0.20, 95% CI [-0.30, -0.09]) in the multi-level model and stratified analysis, but not in reducing frequency of drinking. However, overall neither setting nor content appeared to significantly moderate intervention effectiveness.

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Introduction

Excessive alcohol consumption is a major public health concern, contributing to almost 4% of deaths worldwide(1), ranging from as high as 8% of deaths among men and women in the USA and Norway to 1.4% in the UK.(2, 3) It is estimated that over ten million people in the UK alone drink more than the recommended daily units.(4) Screening to detect individuals drinking alcohol at hazardous or harmful levels and the delivery of a brief intervention on alcohol (ABI) to reduce their consumption have been implemented in primary care settings where their efficacy and effectiveness have been demonstrated.(1) The content of ABIs is varied, but usually focuses on the provision of structured advice, involving an assessment of individual risk with feedback and advice, or brief motivational interviewing that takes a more patient-centred approach, or a combination of both.(5) Existing systematic reviews have found variability in effect by duration of intervention or number of visits, but this has not taken into account differences in content or provider.(6-10) Although there is some emerging evidence that motivational interviewing can be more effective than 'traditional' advice (based on a provider-centred definition of a problem) across a range of health behaviours(11), this is not conclusive.(12) Further, while the efficacy and effectiveness of ABIs have been demonstrated in primary care settings,(13-15) the evidence-base in health settings beyond primary care is weaker with moderate or no effect found in college(16, 17) and community settings.(18) Some benefits have been observed from a small number of studies in accident and emergency (A&E) departments(19, 20), as well as in general hospital settings but among mainly male patients.(21, 22) Implementation research has shown that contextual factors affecting the routine delivery of ABIs in primary health care settings are closely linked to practitioners. However, there has been little research looking at the impact of practitioners on intervention effectiveness outside primary health care settings.(23, 24)

In England, the Government's Alcohol Strategy calls for the increased implementation of ABIs in Primary Care and A&E settings, while targets for implementing ABIs in these settings as well as antenatal clinics have been set by NHS Scotland.(25, 26) NICE guidance recommends that ABI should be offered opportunistically by a range of relevant practitioners and front-line staff, while also acknowledging that the strength of evidence was clearer in some health settings compared to others. Nevertheless, this guidance flagged the relevance of social care, criminal justice, community and voluntary sector professionals to supporting alcohol risk-reduction work.(27) This recommendation has been implemented by some Public Health Authorities, rolling out interventions in sexual health clinics and community settings such as criminal justice services, and has also been advocated by global health agencies including the WHO.(28) Given the international, national and local level support for the expansion of ABIs beyond primary care settings, there is an urgent need to understand how brief intervention process (including setting, provider and content) moderates their effectiveness in order to inform their implementation.(5) We therefore undertook a systematic review and meta-regression to measure the effect of ABIs on alcohol consumption and how effect differs by setting, provider group and content of intervention.

Methods

Search strategy and selection criteria

We followed the PRISMA guidelines on reporting of systematic reviews.(29) Studies eligible for this review were peer reviewed randomised controlled trials of ABIs published in English. We included all populations aged 16 years or older but excluded populations with complex health problems, for example studies of people living with HIV, TB, HCV or homeless populations where it is difficult to generalize findings to the general population. Similarly we excluded populations seeking help at specialist addiction, mental health services or antenatal clinics. We included studies with control groups comprising: treatment as usual; information-only; assessment only; no assessment; or non-

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intervention, and excluded control groups consisting of other interventions, including other brief interventions such as advice and extended psychological treatments. Brief interventions were defined as *person-to-person* discussions on alcohol between one and four sessions and not more than two hours total intervention time. Computerized interventions tested alone, group interventions and those that target multiple behaviours were excluded. We also excluded studies where no measure of alcohol consumption was reported.

The primary outcome of interest was a quantitative continuous measure of total alcohol consumption within a specified time-frame (standard drinks, grams of ethanol, or days of drinking) where the standardized mean difference between brief intervention and control group was measured at time of follow up.

We searched: MEDLINE; Embase; PsycINFO; CINAHL; Social Science Citation Index and Science Citation Index through Web of Science; Cochrane Effective Practice and Organisation of Care Group specialised register; and Global Health between 1966 and 2015. The search was conducted in January 2015. We also scanned citations and contacted experts in the field to minimise selection bias. The search terms used were: 'Brief intervention' OR 'minimal intervention' OR 'early intervention' OR 'cognitive behavioural' OR 'screening' OR 'counselling' OR 'brief advice' OR 'identification' OR 'managed care' or 'motivational interview' AND 'Alcohol drinking' or 'binge drinking' OR 'alcohol consumption' OR 'alcohol units' OR 'alcohol use and misuse' OR 'alcohol intake' OR 'alcohol rate binge drinking' OR 'beer or wine or lager or spirit drinking' AND 'randomized controlled trial' OR 'random allocation' OR 'double blind methods' OR 'clinical trial' OR 'controlled clinical trial' OR 'multi centre studies'. Searches were tailored to the search functionality of each database (see Web Appendix).

Eligibility assessment was conducted independently by two reviewers. Disagreements between reviewers were resolved by consensus. We selected a list of risk of bias criteria from recommendations in the Cochrane Collaboration Reviewers' Handbook to assess the quality of the trials.(30) Criteria included: methods used to generate the allocation sequence to produce comparable groups and concealment of allocation to determine whether intervention allocations could have been foreseen before or during enrolment; blinding of participants and providers to intervention groups; blinding of outcome assessment; incomplete outcome data (including intention to treat analysis); and measurement of attrition rate.

Data were extracted from each publication into a database piloted on five studies, independently by GJM, LP, AO and JB without masking of authors' names, study site, intervention, or trial results. These researchers jointly reviewed the extracted data and 10% of studies were double extracted. Data were extracted on characteristics of trial participants, type of interventions (including content, duration, frequency, provider, setting), type of outcome measure, time of assessment and effect estimates.

We extracted continuous outcomes in the units in which they were presented and then converted to Cohen's d for comparability. When extracting continuous outcomes, we preferred estimates that were ANCOVA-adjusted for baseline score, followed by unadjusted post-test scores, and finally repeated measures or 'change score' models. Change score models were reparametrized into a raw-score metric using r=0.5, with sensitivity analysis at r=0.1 and r=0.9. Though past reviews have attempted to convert all measures to 'natural units' such as grams of ethanol, we decided that this was inadvisable because of the large number of trials in this review and because of our goal to include all relevant information, a key benefit of multilevel meta-analysis models.

Data synthesis

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We grouped intervention content into three categories (Figure 1). The first was motivational interviewing, including motivational interviewing-style, advice approaches such as FRAMES, motivational enhancement therapy as adapted for Project MATCH (Project MATCH Research Group, 1998) or brief motivational interviewing. We also identified a second subset of trials that tested specific enhanced interventional protocols for motivational interviewing (e.g. Drink-less) or additions to motivational interviewing (e.g. cognitive behavioural approaches) from other therapeutic modalities and labelled this category motivational interviewing 'plus'. A third subset included brief advice approaches, often labelled as such without any additional information.

Intervention providers were grouped into: counsellors (defined as any mental health providers including clinical and research psychologists or clinical social workers); GPs (including primary care providers and general physicians); nurses (including research or clinical nurses on secondment); peer-delivered; and different providers (but with no fixed provider). Setting of intervention delivery was categorised as: accident and emergency services; community-based delivery that included a range of non-clinical settings; primary or ambulatory care delivered in clinical settings as outpatient services; hospital inpatient services; and university services.

The systematic review protocol was registered on PROSPERO at the University of York (CRD42014014799).

Statistical analyses

We grouped outcomes hierarchically. We identified an overarching set of outcomes addressing quantity of alcohol consumption, from which we created two subsets of outcomes: (i) amount of alcohol consumed per unit of time; and and (ii) amount of alcohol consumed per drinking occasion. We also identified an overarching set of outcomes addressing frequency of alcohol consumption, from which we created a subset of outcomes including: (i) frequency of any drinking occasion; and (ii) frequency of binge drinking occasions.

For each overarching set and subset of outcomes, we specified five models: 1) an unconditional model that included all eligible continuous outcomes; 2) a model that included a grand mean-centred covariate for time of follow-up post-baseline, to address differences in follow up; 3) a model including where the intervention was initially delivered and time of follow-up; 4) a model including the provider of the intervention and time of follow-up; and 5) a model including the content of the intervention and time of follow-up. To estimate mean effects for all groups simultaneously, we refit models with no intercept.(31) We used the statistical package metafor,(32) which implements advanced meta-analysis models, in the R environment for all multilevel analyses.

For our main analysis, we used a multilevel meta-analysis method to estimate pooled effect sizes.(33) Models included random effects on the effect size and study levels because of anticipated heterogeneity both within and across studies. Several trials tested different intervention or provider types in the same experiment, but insufficient trials did this to treat intervention as a 'within-trial' covariate. In order to adequately model these two moderators, we split the control groups in two for these trials and treated each intervention-control comparison as a separate trial. This avoided double-counting participants across intervention-control comparisons. Moreover, several studies presented results stratified by group. In our multilevel meta-analyses, we included these in the same cluster. We tested for the effect of our hypothesised moderators by conducting a multiparameter Wald test on provider, setting or content coefficients as appropriate. We additionally examined the residual heterogeneity, measured as I^2, between the time-adjusted model and the models including each of the three sets of covariates. We regarded a p-value of <0.05 as statistically significant and a p-value of <0.10 as marginal, but not significant.

Sensitivity check

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In addition to sensitivity analysis on the correlation used for repeated measures conversion, we estimated a set of meta-regressions for each subset of outcomes including one effect size per relevant comparison for each of first and last follow-up in the included trials. We did this by combining intervention and control groups where appropriate, and by selecting effect sizes within studies that used shorter time periods for measurement and timeline follow-back procedures over general frequency/quantity questionnaires. We also treated non-overlapping subgroups from the same study as separate data points as suggested by Borenstein et al.(34) Sensitivity analyses were estimated in both Stata v 13.1 (Stata Corp. 2013) and R .(35) We did not undertake meta-analysis of effect sizes from common time points because these models would have been poorly powered.

Results

We identified a total of 4551 records from the search of electronic databases and 41 records from key experts. A total of 52 studies met our inclusion criteria, with three studies presenting different outcomes for the same data and therefore considered as one. (36-38) One study was dropped as it only contained biological outcomes which were not included in the main analyses.(39) The review and selection process is summarised in Figure 2.

Included studies contributed data for 29,891 individuals. Table 1 presents a summary of study characteristics (country, age, sex and sample size) as well as type of intervention (setting, provider and content), key outcomes and time of assessment. Most studies originated from Europe or North America with the exception of three studies from Australia, Taiwan and Thailand.(40-42) Almost half (45%) of the studies were conducted in the USA and 22% in the UK.

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Table 1 Characteristics of Included studies

		Sample	Intervention					Outcomes	
Author	**Country**	**n† % F, age (yrs)**	**Setting**	**Provider**	**Arm**	**Content**	**Total mins** (sessions)	**Definition (Q=Quantity, F= Frequency)**	**Time (mths)**
Aalto 2000(43)	Finland	118, 100%, 41	GP	GP/nurse	1	MI	70-130 (7)	**Q:** Amount per week; usual amount per occasion (Grams); **F:** Drinking times per week	36
				GP only	2	MI	30-60 (7)		
				N/A	C	TAU			
Aalto 2001(44)	Finland	296, 0%, 41	GP	GP/ nurse	1	MI	70-130 (7)	**Q:** Grams per week/ per occasion **F:** Drinking times per week	36
				GP only	2	MI	30-60 (7)		
				N/A	C	TAU			
Anderson 1992(45)	UK	154, 0%, 44	GP	GP	1	Brief advice	10 (1)	**Q:** Breath alcohol (mg/100 ml); HSQ quant/freq and interview (grams/week)	12
					2	TAU			
Antti-Poika 1988(46)	Finland	120, 0%, 39	A&E	Nurse	1	Brief advice	NR (1)	**Q:** Grams of absolute alcohol during 1 week period	6 (P-I)
					C	NR			
Baer 2001(47)	USA	508, 55%, NR	College	Counsellor	1	MI	Unclear (NR)	**Q:** Mean drinks per drinking day; **F:** Drinking days per average week	24; 36
					C	Screening			
Beich, 2007(48)	Denmark	6897, 62%, 36	GP	GP	1	MI Plus	10 (1)	**Q:** Usual weekly consumption of beer, wine and spirits (units/week)	12
					C	Screening			
Bernstein 2010(49)	USA	835, 56%, 88%>18	A&E	Peer	1	MI	Unclear (1)	**Q:** Max drinks per day; Mean drinks per drinking day; Mean drinks per week **F:** Drinking days per month	3, 12
					C	Screening			
Butler 2009(50)	USA	114, 65%, 20	College	Media	1	Brief advice	11 (1)	**Q:** Standard drinks per week; **F:** Binge episodes; drinking occasions; drinking occasions	1 (P-I)
				Counsellor	2	MI	41 (1)		
				N/A	C	Screening			
Carey 2006(51)	USA	509, 65%, 19	College	Counsellor	1	MI	65 (1)	**Q:** Drinks per drinking day; **F:** Drinks per week; Heavy drinking frequency	6 or 12
					2	MI Plus	70 (1)		
					C	Screening			
Cherpitel 2010(52)	Poland	446, 17%, 54% >30	A&E	Nurse	1	MI plus	15-20 (3)	**Q:** Drinks per drinking day; Maximum drinks per occasion last month**; F:** Drinking days per week	12
					C	Screening			
					C	Assessment			
Chick 1985(53)	UK	156, 0%, 18-65	A&E	Nurse	1	Brief advice	60 (1)	**Q:** Consumption on past week (units)	12
					2	Screening			
Cordoba 1998(54)	Spain	229, 0%, 36.5	GP	GP	1	Branded	15 (1)	**Q:** Alcohol consumption units/week	12
					C	Simple advice			

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		Sample	Intervention					Outcomes	
Author	**Country**	**n† % F, age (yrs)**	**Setting**	**Provider**	**Arm**	**Content**	**Total mins** (sessions)	**Definition (Q=Quantity, F= Frequency)**	**Time (mths)**
Crawford 2004(55)	UK	599, 21%, 44	A&E	Nurse	1 C	MI Information	30 (3)	**Q:** Mean units per drinking day; Mean weekly units	6 or 12
Crawford 2014(56)	UK	802, 54%, 27	GP	Nurse	1 C	Brief Advice Information	2-3 (1)	**Q:** Mean units on drinking days; Weekly alcohol consumption in units	6
Curry 2003(57)	USA	333, 35%, 47	GP	GP and counsellor	1 C	MI Plus TAU	47 (1)	**Q:** Drinks per week	12
Daeppen 2007(58)	Switzerland	987, 22%, 36.7	A&E	Counsellor	1 C C	MI Assessment Nothing	17 (1)	**Q:** Number of drinks per occasion/last week (last year) **F:** Number of binge drinking occasions per month/per week (last year)	12
Daeppen 2011(59)	Switzerland	2831, 0%, 19.9	Community (Military)	Counsellor	1 C	MI Assessment	15.8 (2)	**Q:** Change in drinks per week **F:** Change in binge drinking occasions per month	6
Drummond 2014(60)	UK	1204, 35%, 34.6	A&E	Counsellor	1 2 C	Branded MI Information	20 (1) 20 (1)	**Q:** Average daily drinks	6, 12 (P-I)
Field 2010(61)	USA	1439, 18%, 33	A&E	Counsellor	1 C	MI TAU + Assess	Unclear (1)	**Q:** Change in: alcohol per week; max. amount in a day in past 6 mths; **F:** Change in percent days heavy drinking;	6, 12
Fleming 1997; Manwell 2000, Grossberg 2004(36-38)	USA	774, 38%, 29% 18-30	GP	GP and nurse	1 C	Branded Information	30 (2)	**Q:** No. drinks in past 7 days **F:** No. binge drinking episodes in last 30 days [binge drinking defined as having more than 4 drinks per occasion]	6, 12, 24, 36, 48 (P-I)
Fleming 1999(62)	USA	158, 34%, 65-75	GP	GP / nurse	1 C	Branded Information	30 (2)	**Q:** Number of drinks in last week; **F:** Number of binge drinking occasions in last month;	6, 12
Fleming 2010(63)	USA	986, 51%, 21	GP	GP	1 C	Branded Information	30 (2)	**Q:** Mean number of drinks; **F:** Mean number of drinking days; Mean number of heavy drinking days (last 28 days)	6
Freyer-Adam 2008(64)	Germany	595, 6%, 41	Hospital	GP Different providers*	1 2 C	MI MI TAU	unclear (1) 78 (1)	**Q:** Average daily alcohol intake (grams); Total alcohol intake in past week (grams)	12
Gaume 2011(65)	Switzerland	572, 0%, 19.9	Community (Military)	Counsellor	1 2 C	MI^ MI ^ Assessment	21.8 (1) 21.8 (1)	**Q:** Mean change in number of standard (~10 g of alcohol) drinks per week; **F:** Mean change in heavy episodes (6 drinks or more) per month	6

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		Sample	Intervention					Outcomes	
Author	**Country**	**n† % F, age (yrs)**	**Setting**	**Provider**	**Arm**	**Content**	**Total mins** (sessions)	**Definition (Q=Quantity, F= Frequency)**	**Time (mths)**
Gaume 2014(66)	Switzerland	431, 0%, 19	Community (Military)	Different providers	1	MI	20-30 (1)	**Q:** Number of drinks/day **F:** Number of drinking days/week	3
					C	Assessment			
Gentilello 1999(67)	USA	762, 18%, 35.4	A&E	Counsellor	1	MI	30 (1)	**Q:** Changes in the no. of drinks consumed per week	6, 12
					C	Assessment			
Gottlieb-Hansen 2012(68)	Denmark	772, 49%, 60	Community (Research)	Different providers	1	MI	15 (2)	**Q:** Number of drinks per week	6, 12
					C	Information			
Heather 1987(69)	UK	104, 25%, 36.4	GP	GP	1	Branded	NR	**Q:** Heaviest months consumption in last 6 months(units); Last month's consumption (units)	6
					2	Brief advice			
					C	Assessment			
Holloway 2007(70)	UK	215, 15%, 44	Hospital	Nurse	1	MI	20 (1)	**Q:** Change from baseline in alcohol units in the past 7 days; Change in maximum units in 1 day **F:** Change in drink days in last week;	6
				Media	2	Media	NR		
				N/A	C	TAU			
Ingersoll 2013(71)	USA	217, 100%, 27.9	Community (Research)	Counsellor	1	MI, Branded	60 (1)	**Q:** Drinks per drinking day	3, 6
				N/A	C	Information			
Juarez 2006(72)	USA	122, 53%, 19.4	College	Counsellor	1	BA, MI	60-80 (1)	**Q:** Drinks per day; Maximum BAC	2
				Counsellor	2	BA, MI	40-60 (1)		
				Media	3	BA, MI	Unclear (1)		
				Counsellor	4	BA, MI	40-60 (1)		
				N/A	C	Assessment			
Kulesza 2010(73)	USA	114, 72%, 20	College	Counsellor	1	MI Plus	10 (1)	**Q:** The Daily Drinking Questionnaire;	6 wks
					2	MI Plus	50 (1)		
					C	Waiting List			
Kulesza 2013(74)	USA	268, 71%, 20	College	Counsellor	1	MI Plus	10 (1)	**Q:** Average no. drinks/week	4 wks (P-I)
					2	MI Plus	50 (1)		
					C	Discussion			
Larimer 2001(75)	USA	159, NR< 18.8	College	Peer	1	MI Plus	60 (1)	**Q:** BAC (based on quantity & rate of consumption peak; Number of drinks over past month; Total average use; **F:** Frequency of use	12
					2	MI Plus	60 (1)		
					C	TAU			
Liu 2011(40)	Taiwan	616, 0%, 41	A&E	Counsellor	1	MI	60 (2)	**Q:** No. drinks in last 3 months (QDS); **F:** No. days heavy drinking (≥5 drinks) in last 3 mths (QDS); No. days heavy drinking in the previous week (TLFB)	4
					C	TAU			

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		Sample	Intervention					Outcomes	
Author	**Country**	**n† % F, age (yrs)**	**Setting**	**Provider**	**Arm**	**Content**	**Total mins** (sessions)	**Definition (Q=Quantity, F= Frequency)**	**Time (mths)**
Lock 2006(76)	UK	127, 100%, 44.1	GP	Nurse	1 C	Branded TAU	5-10	**Q:** Units per week	12 (P-I)
Maisto 2001(77)	USA	301, 31%, 45.6	GP	Researcher Counsellor N/A	1 2 3	Brief advice MI Control	10-15 (1) 60-85 (1)	**Q:** No. of drinks in last 30 days **F:** No. of days of 1-6 drinks in last 30 days;	6, 12
Murphy 2001(78)	USA	99, 54%, 19.6	College	Counsellor Counsellor N/A	1 2 C	MI Brief advice Assessment	45 (1) 50 (1)	**Q:** Drinks per week; **F:** Binge drinking days per week [4+ drinks for women; 5+ drinks for men]; Drinking days per week;	9
Noknoy 2010(41)	Thailand	59, 9%, 37	GP	Nurse	1 C	MI Assessment	45 (3)	**Q:** Average drinking per drinking day during the previous week (drinks/drinking day)	6
Richmond 1995(42)	Australia	378, 43%, 37.7	GP	GP	1 2 C	Branded Brief advice Nothing	30-55 (1) 5 (1)	**Q:** No units of ethanol in the last 7 days	6, 12
Rubio 2010(79)	Spain	752, 35%, 18-65	GP	GP	1 C	Branded Information	20-30 (2)	**Q:** No. of drinks in last 7 days [mean/SD]; **F:** No. of binge episodes (last 30 days) [mean/SD] (> 4 drinks for women and 5 for men in a single occasion)	12
Rubio 2014(80)	USA	330, 100%, 24	GP	Different providers	1 2	MI Control	70 (1)	**Q:** Drinks per day	6 wks, 6, 12 PP
Saitz 2007(81)	USA	341, 29%, 45	Hospital	Counsellor	1 C	MI TAU	30 (1)	**Q:** Change decrease in number drinks/day **F:** Change decrease in heavy drinking episodes	12
Schaus 2009(82)	USA	363, 52%, 20.6	GP	GP	1 C	MI Plus Information	40 (2)	**Q:** Average drinks per sitting/week; Typical BAC; Peak BAC; Peak no. drinks in sitting; **F:** No. days drinking 4+ drinks in month; No. times drunk in typical week.	6, 9
Senft 1997(83)	USA	516, 30%. 41.9	GP	GP/ counsellor	1 C C	MI TAU Referral to GP	15 (1)	**Q:** Drinks/drinking day over past 6 months; Total SECs past 3 months; **F:** Drinking days/week over past 6 months;	6, 12
Shiles 2014(84)	UK	154, NR, 51	Hospital	Nurse	1 C	Brief advice TAU	10 (1)	**Q:** Daily units of alcohol in last week	3, 12
Smith 2003(85)	UK	151, 0%, 24	Hospital	Nurse	1 C	MI TAU	NR	**Q:** 84-day alcohol consumption; Alcohol consumption in a typical week	3, 12
Wagener	USA	152, 45%, 20.9	College	Media	1	MI	45 (1)	**Q:** Peak BAC; Typical BAC) Weekly alcohol consumption using	10 wks

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		Sample	Intervention					Outcomes	
Author	**Country**	**n† % F, age (yrs)**	**Setting**	**Provider**	**Arm**	**Content**	**Total mins** (sessions)	**Definition (Q=Quantity, F= Frequency)**	**Time (mths)**
2012(86)				Counsellor	2	MI	105-135 (1)	DDQ	
				Counsellor	3	MI	NR (1)		
				N/A	C	Assessment			
Walters 2009(87)	USA	279	College	Counsellor	1	MI (no feedback)	40 (1)	**Q:** No. of drinks per week; Peak BAC	3, 6
				Counsellor	2	MI (feedback)			
				Media	3				
					C	Assessment			
Watt 2008(88)	UK	269	Community (CJS)	Different providers	1	MI	15-20	**Q:** No. of units consumed per week; **F:** Number of drinking days in the past 3 months	3, 12 (PI)
					C	NR			

NR= not reported
Sample: † n denotes eligible sample randomised at baseline; F=Female
Setting: CJS=Criminal Justice Service GP=General Practice; A&E=Accident and Emergency;
Providers: *Different providers defined as (Psychologist, Social Worker or Research nurse)
Content: ^ Stratified by heavy episodic and non-heavy episodic users. TAU= Treatment as usual; BA Brief advice; MI= Motivational Interviewing
Arm: C=Control group
Outcome: QDS=Quick Drinking Screen; TFLB=Alcohol Timeline Follow-Back; DDQ=Daily Drinking Questionnaire
Outcome time = All outcomes measured in months post baseline, unless specified: PI = Post Intervention; wks=weeks, PP= Post partum

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In total, 68% of trials were delivered in primary or healthcare settings (hospital or A&E). Only six studies were conducted in community settings defined as: military(59, 65, 66); research sites recruiting a sample through a household survey(68); and women at risk of alcohol exposed pregnancy (defined as aged 18-44 years, with ineffective or no use of contraceptives, sexually active in the last 6 months, but not currently pregnant or planning a pregnancy) recruited via the media, in a prison, community health centre and a gynaecology centre (71); and one criminal justice setting.(88) The most common providers included counsellors, who were the sole providers of interventions in 43% of trials, and physicians who accounted for 24% of trials. A minority category of different providers (8%) included a combination of psychologists, social workers or research nurses. Intervention categories were well-distributed, though a majority of trials (47%) included motivational interviewing alone and 39% included motivational interviewing 'plus'. A total of 50 trials reported 275 eligible effect sizes on outcomes measuring quantity of alcohol consumed with a mean follow up of nine months. This is summarised in Table 2.

Table 2: Summary of study characteristics

TRIALS		
Setting of intervention		
A&E	20%	10
Non-health settings	12%	6
Ambulatory or primary care	38%	19
Hospital inpatient services	10%	5
University	20%	10
Provider		
Counsellor/mental health clinician	44%	22
Different providers	8%	4
GP	22%	11
Nurse	18%	9
Peer intervention	4%	2
Combination	12%	6
GP and nurse	8%	4
GP and counsellor	4%	2
Content		
Brief advice	24%	12
Motivational interviewing	48%	24
Motivational interviewing 'plus'	40%	20
OUTCOMES		
Quantity		50
Mean follow-up in months (SD)	9.0 (8.3)	
Quantity per unit time	94%	47
Quantity per drinking occasion	30%	15
Frequency		26
Mean follow-up in months (SD)	11.1 (10.5)	
Frequency of any drinking occasion per unit time	32%	16
Frequency of binge drinking occasions per unit time	30%	15

A & E= Accident and Emergency GP=General Practice SD=Standard Deviation

The majority (71%) of studies were categorised as low risk of bias in relation to randomisation and allocation concealment strategies. In the majority of studies the process used to assess blinding of participants and providers as well as outcome assessment was unclear. Intention to treat analysis was conducted in 47% of studies and loss to follow-up assessed in the majority (80%) of studies. This is summarised in Table 3 and risk of bias assessment for all trials is included in the Web Appendix (Online Table 1)

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Table 3: Summary risk of bias assessment

	Score - Proportion (number of estimates)		
Risk of bias indicator	**High risk % (k)**	**Low risk % (k)**	**Unclear risk % (k)**
Allocation concealment	2% (1)	72% (36)	26% (13)
Blinding of participants and providers	12% (6)	30% (15)	58% (29)
Blinding of outcome assessment	10% (5)	42% (21)	48% (24)
Intention to treat analysis	6% (3)	48% (24)	46% (23)
Loss to follow up	20% (10)	80% (40)	0% (0)

Meta regression on combined quantity and frequency outcomes

Interventions produced a beneficial effect at reducing the quantity of alcohol consumed by 0.15 standard deviations—a small but statistically significant effect (see Table 4). This effect persisted after controlling for time to follow-up and when examining the sub-set of outcomes. In both unconditional models and models controlling for time of follow-up, study-level heterogeneity as measured by I^2 (that is, the percentage of variation between effect sizes due to heterogeneity rather than chance) was in the small to moderate range (0-40%) as defined by the Cochrane Handbook.(30) Findings were robust to sensitivity analysis on the pre-post correlation in change score models. The mean time-adjusted effect of brief alcohol interventions on frequency of alcohol consumption outcomes was similar in magnitude (*d*=-0.15, 95% CI [-0.20, -0.11]), but lower in heterogeneity (I^2=23%), compared with the effect on quantity of alcohol consumption (see Table 5). The time-adjusted effect remained statistically significant when limited to the sub-set of outcomes (frequency of drinking occasions *d*=-0.12, 95% CI [-0.19, -0.06] and frequency of binge drinking *d*=-0.17, 95% CI [-0.23, -0.11]).

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Table 4 Results of multi-level meta-regression for quantity outcomes

Outcomes	Group name	All quantity outcomes				Quantity of alcohol per unit time				Quantity of alcohol per drinking occasion			
		ES (95% CI)	k (n)	I^2 (%)	*p*	ES (95% CI)	k (n)	I^2 (%)	*p*	ES (95% CI)	k (n)	I^2 (%)	*p*
Overall	Mean effect	-0.15 (-0.20, -0.10)	50 (268)	37%		-0.17 (-0.22, -0.12)	47 (144)	38%		-0.10 (-0.18, -0.01)	15 (59)	36%	
Overall, time-adjusted	Mean effect	-0.15 (-0.20, -0.11)	50 (268)	36%	0.03	-0.17 (-0.22, -0.12)	47 (144)	38%	0.21	-0.11 (-0.19, -0.03)	15 (59)	34%	0.09
	Time (month)	0.003 (0.0003, 0.006)				0.002 (-0.001, 0.006)				0.005 (-0.001, 0.01)			
Setting of intervention	A&E	-0.10 (-0.19, -0.002)	10 (44)	34%	0.12	-0.12 (-0.22, -0.01)	9 (26)	37%	0.17	-0.001 (-0.14, 0.13)	4 (8)	28%	0.17
	Ambulatory or primary care	-0.20 (-0.27, -0.13)	19 (84)			-0.22 (-0.29, -0.14)	19 (51)			-0.14 (-0.25, -0.03)	7 (18)		
	Hospital inpatient services	-0.14 (-0.29, 0.01)	5 (13)			-0.15 (-0.31, 0.006)	5 (12)			N/A	N/A		
	Non-health settings	-0.03 (-0.16, 0.10)	6 (15)			-0.04 (-0.18, 0.11)	5 (11)			-0.01 (-0.30, 0.29)	1 (4)		
	University	-0.20 (-0.39, -0.09)	10 (112)			-0.21 (-0.23, -0.09)	9 (44)			-0.22 (-0.39, -0.06)	3 (29)		
Provider	Counsellor/mental health clinician	-0.11 (-0.17, -0.05)	24 (163)	34%	0.09	-0.10 (-0.17, -0.04)	22 (79)	32%	0.01	-0.11 (-0.23, 0.01)	8 (41)	43%	0.67
	Different providers	-0.12 (-0.27, 0.03)	4 (10)			-0.12 (-0.25, 0.02)	4 (10)			N/A			

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	Physician	-0.12 (-0.20, -0.04)	17 (65)			-0.14 (-0.22, -0.06)	17 (40)			0.02 (-0.16, 0.21)	6 (10)		
	Nurse	-0.23 (-0.33, -0.13)	13 (41)			-0.28 (-0.38, -0.18)	12 (29)			-0.18 (-0.37, -0.003)	5 (9)		
	Peer intervention	-0.08 (-0.29, 0.13)	2 (10)			-0.05 (-0.28, 0.17)	2 (3)			-0.004 (-0.28, 0.27)	2 (3)		
Content	Brief advice	-0.20 (-0.31, -0.09)	12 (26)	39%	0.54	-0.22 (-0.34, -0.11)	11 (18)	59%	0.31	-0.16 (-0.37, 0.05)	3 (6)	43%	0.89
	Motivational interviewing	-0.13 (-0.19, -0.07)	24 (132)			-0.13 (-0.20, -0.07)	24 (73)			-0.11 (-0.22, 0.004)	9 (28)		
	Motivational interviewing plus	-0.16 (-0.23, -0.09)	20 (110)			-0.19 (-0.27, -0.11)	17 (53)			-0.10 (-0.24, 0.03)	6 (25)		

k=number of studies, *n*=number of effect sizes, *p* is the value from a multiparameter Wald test of coefficients. Models for setting, provider and content include mean-centred time as a covariate, but not in the multiparameter Wald

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Setting

For all quantity outcomes setting of intervention did not appear to fully explain heterogeneity between studies, with residual heterogeneity at 34% and a statistically marginal but non-significant joint test of moderators (p=0.09). Interventions conducted in university settings (d=-0.20, 95% CI [-0.39, -0.09]) and in primary or ambulatory care (-0.20, [-0.27, -0.13]) appeared to be most effective, with a small but statistically significant effect of the intervention. Interventions delivered in community settings (military, criminal justice, research sites and targeted recruitment) did not appear to be effective (-0.03, [-0.16, 0.10]). (Table 4)

For all frequency outcomes, setting of intervention did not explain heterogeneity (residual I^2=25%, Wald p=0.54). Of subgroups with statistically significant pooled effect sizes, interventions delivered in university contexts appeared to be most effective for frequency outcomes (-0.21, [-0.33, -0.08]). Analysis was hampered by small numbers of studies in several categories. (Table 5)

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Table 5 Results of multi-level meta-regression for frequency outcomes

Outcomes	Group name	All quantity outcomes				Quantity of alcohol per unit time				Quantity of alcohol per drinking occasion			
		ES (95% CI)	k (n)	I^2 (%)	*p*	ES (95% CI)	k (n)	I^2 (%)	p	ES (95% CI)	k (n)	I^2 (%)	*p*
Overall	Mean effect	-0.15(-0.20, -0.11)	26 (114)	23%		-0.12 (-0.19, -0.06)	16 (38)	23%		-0.17 (-0.23, -0.11)	15 (76)	20%	
Overall, time-adjusted	Mean effect	-0.16 (-0.20, -0.11)	26 (114)	23%	0.36	-0.12 (-0.19, -0.06)	16 (38)	24%	0.55	-0.18 (-0.24, -0.11)	15 (76)	20%	0.56
	Time (month)	0.002 (-0.002, 0.005)				0.002 (-0.004, 0.007)				0.001 (-0.003, 0.006)			
Setting of intervention	A&E	-0.11 (-0.21, -0.005)	5 (26)	25%	0.54	-0.13 (-0.26, -0.0002)	4 (12)	28%	0.41	-0.11 (-0.22, 0.01)	3 (14)	20%	0.25
	Ambulatory or primary care	-0.18 (-0.26, -0.10)	10 (40)			-0.07 (-0.19, 0.06)	5 (12)			-0.24 (-0.33, -0.15)	6 (28)		
	Hospital inpatient services	-0.21 (-0.47, 0.04)	2 (2)			-0.50 (-0.94, -0.06)	1 (1)			-0.07 (-0.37, 0.23)	1 (1)		
	Non-health settings	-0.08 (-0.22, 0.06)	4 (7)			-0.11 (-0.32, 0.11)	2 (3)			-0.06 (-0.24, 0.13)	2 (4)		
	University	-0.21 (-0.33, -0.08)	5 (39)			-0.18 (-0.36, -0.003)	4 (10)			-0.21 (-0.37, -0.05)	3 (29)		
Provider	Counsellor/mental health clinician	-0.11 (-0.17, -0.04)	14 (73)	23%	0.17	-0.12 (-0.22, -0.02)	9 (25)	32%	0.73	-0.12 (-0.20, -0.05)	9 (48)	18%	0.07
	Different providers	-0.24 (-0.52, 0.03)	1 (1)			-0.25 (-0.56, 0.07)	1 (1)			N/A			
	Physician	-0.13 (-0.22, -0.04)	10 (30)			-0.03 (-0.19, 0.13)	6 (8)			-0.18 (-0.28, -0.07)	5 (22)		
	Nurse	-0.19 (-0.31, -0.07)	7 (22)			-0.20 (-0.31, 0.01)	4 (5)			-0.17 (-0.31, -0.02)	3 (17)		
	Peer intervention	-0.06 (-0.27, 0.13)	2 (3)			-0.08 (-0.31, 0.16)	2 (3)			N/A			
Content	Brief advice	-0.08 (-0.26, 0.09)	3 (7)	29%	0.48	0.17 (-0.11, 0.44)	2 (4)	26%	0.10	-0.23 (-0.44, -0.02)	2 (3)	26%	0.52

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	Motivational interviewing	-0.15 (-0.21, -0.08)	15 (58)			-0.15 (-0.23, -0.06)	9 (20)			-0.14 (-0.23, -0.06)	9 (38)		
	Motivational interviewing plus	-0.19 (-0.27, -0.11)	11 (49)			-0.13 (-0.24, -0.03)	7 (14)			-0.21 (-0.31, -0.11)	6 (35)		

k=number of studies, *n*=number of effect sizes, *p* is the value from a multiparameter Wald test of coefficients. Models for setting, provider and content include mean-centred time as a covariate, but not in the multiparameter Wald test.

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When limiting the analysis to the sub-set of either quantity or frequency outcomes setting of intervention did not explain heterogeneity (all joint tests of moderators $p>0.10$).

Provider

In the model including all quantity outcomes, provider of intervention did not meaningfully explain heterogeneity, based on I^2 for this model (34%). Interventions delivered at least in part by nurses appeared to have the largest effect by magnitude (d=-0.23, 95% CI [-0.33, -0.13]), though this difference was not supported by a significant joint test of moderators (Wald p=0.09).

Analyses with more specific sets of outcomes revealed a similar picture. Examination of effects at first time point for amount of alcohol per unit time showed that interventions delivered at least in part by nurses (d=-0.30, 95% CI [-0.47, -0.12]) were the most effective, with a significant joint test of moderators (Wald p=0.048) (Online Table 2). Interventions delivered by a range of different providers were least effective and did not yield a statistically significant effect. However, few studies were included in this category of providers. Provider of intervention explained some heterogeneity when the analysis was limited to amount of alcohol per unit time (residual I^2=32%, Wald p=0.01) but not per drinking occasion.

For frequency outcomes, provider of intervention did not explain heterogeneity either combined (Wald p=0.17) or for drinking occasion per unit time (Wald p=0.73*)* but the effect was marginal, but non-significant, for bingeing occasions (Wald p=0.07).

Content

For quantity outcomes, content of intervention did not explain a statistically significant amount of heterogeneity (residual I^2=39%, Wald *p=0.54*), with little apparent reduction in I^2. While all content groups had statistically significant mean effects, brief advice appeared to be most effective (d=-0.20, 95% CI [-0.30, -0.09]) with the impact of motivational interviewing (d=-0.13) and motivational interviewing plus (d=-0.16) also statistically significant.

For frequency outcomes, content of intervention did not explain a significant amount of heterogeneity (residual I^2=29%, Wald p=0.48). Effects by content group for motivational interviewing were similar to those in the analysis of quantity outcomes, though brief advice did not have a statistically significant effect on frequency of alcohol use (-0.08, [-0.26, 0.09]).

Estimates of heterogeneity remained the same when limiting the analysis to the sub-set of either quantity or frequency outcomes.

Sensitivity check: meta-regression on subset of outcomes by first and last time point

Overall effect estimates based on first and last time point were similar to the corresponding value reported in the main analysis, but estimates of heterogeneity (measured through I^2) tend to be higher. Setting of intervention explained some heterogeneity for the alcohol per unit time outcome at first time of marginal significance (residual I^2=49%, Wald *p=0.08*). Findings also suggest that provider explained some heterogeneity (residual I^2=43%, Wald *p=0.05*) with nurses having the biggest effect (d=-30, 95% CI [-0.41, -0.20]) and interventions delivered by different providers the least effect (d=-0.07, 95% CI [-0.12, -0.03]). Content of intervention explained some heterogeneity (residual I^2=43%, Wald *p=0.04*), brief advice was the most effective (d=-0.25, 95% CI [-0.42, -0.07]) and motivational interviewing least effective (d=-0.09, 95% CI [-0.15, -0.04]). (Figures 3-5) With the exception of content, evidence of heterogeneity did not remain significant at the last time point. There was no evidence of heterogeneity for alcohol consumed per drinking occasion or for either subset of frequency outcomes. All findings are summarised in the Online Tables 2-5.

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Discussion

Our findings provide important new evidence on how the effectiveness of brief alcohol interventions differs by setting, provider and content, informing us of optimum modality. Our findings show that provider of intervention may matter. We observed some reductions in heterogeneity in the multi-level analysis of amount of alcohol consumed per unit time, and interventions delivered by nurses having the most effect in reducing quantity of alcohol consumed, but not frequency of consumption. This finding builds on other evidence showing a modest effect of brief interventions delivered by non-physicians (nurses and health care workers) in primary care settings.(24) We found that neither setting nor content appeared to significantly moderate intervention effectiveness: we found little evidence on the effectiveness of brief interventions in community settings or accident and emergency; brief advice was the most effective content in reducing quantity of alcohol consumed but not frequency of drinking and there seemed to be little difference in the effect of motivational interviewing or MI Plus on either quantity or frequency outcomes.

While setting did not explain heterogeneity, findings show that university and ambulatory/ primary care settings were the most effective in terms of magnitude of effect size, which is supported by previous reviews in this area.(14, 15, 17) Prior research has suggested that while ABIs delivered in A&E settings may be effective in reducing alcohol consumption among hazardous and harmful drinkers,(19) it may not provide the most appropriate context for discussion on alcohol use.(89) The brevity of visits, lack of privacy for the delivery of the intervention and severity of injury may hinder the interaction between patient and practitioner reducing effectiveness.(89-92). Other evidence shows that discussion of drinking behaviours is facilitated by a good relationship between practitioner and client.(76) Our finding of increased reduction in alcohol consumption when the intervention is delivered by a nurse is important. The majority of previous research has focussed on physician-led interventions, but there is growing evidence to support the effectiveness of nurse-led interventions in both primary care and other settings.(24, 93, 94) As the largest group of health care workers with repeated patient contact and with a health promotion remit as part of their role, they are well placed to deliver ABIs.(93, 95) Barriers to nurses delivering the interventions include lack of time, worry about losing trust of the patient and inadequate training.(96, 97) Resources and training should be provided to support nurses to undertake this role and embed it within services. The provision of ABIs under the category of different providers was not associated with a reduction in consumption in alcohol. This may be related to problems with training of different providers, but the category was small and included a diverse range of providers, making the finding difficult to interpret. Similarly only a moderate effect was associated with counsellors, but again this definition encompasses a diverse group of practitioners ranging from clinical psychology students(78) to alcohol workers with specialist training in alcohol counselling.(60)

While our categories of intervention content did not meaningfully or statistically explain heterogeneity in either quantity or frequency outcomes in the multi-level analysis, they did in the stratified analysis for both first and last assessment time points. Effect sizes for quantity outcomes for all three classes of content were statistically significant, with brief advice yielding the largest effect. This provides important empirical evidence that brief advice can reduce alcohol intake, where evidence was lacking, and corroborates previous research that demonstrated no difference in effect between brief advice and longer motivational interviewing in reducing harmful levels of drinking in A&E, primary care and criminal justice settings.(12, 60, 98, 99)

Strengths and Limitations

A key strength of this review is the use of a multilevel meta-analysis method to integrate all relevant effect sizes from included studies. This circumvented problems in other systematic reviews around selection of specific effect sizes for meta-analysis. However, we were unable to explicitly model

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correlation between outcomes within studies, though simulation evidence suggests that this may not have a large impact on estimation of intervention effects.(100) We used Cohen's d to standardise outcomes. While this is common across many systematic reviews addressing continuous outcomes, it is uncommon for systematic reviews of alcohol outcomes, where standardisation is often in terms of standard drinks or grams of ethanol consumed. This may somewhat limit comparability between reviews, but it was a critical step in employing the multilevel meta-analysis model we used. As a second sensitivity analysis we compared findings from the multi-level model with a stratified analysis focussing on a sub-set of outcome variables. Findings from the two analyses were comparable. The stratified analysis of quantity of alcohol consumed per unit time suggested stronger effects of setting, provider and content of intervention at first time-point of assessment than indicated in the multi-level models but with comparable effect estimates within each category. Tests for publication bias do not yet exist for multilevel meta-analyses. While our tests using all available effect sizes did not reveal significant publication bias on either quantity or frequency outcomes, it is unlikely that this is the best way to test publication bias in the context of dependent effect sizes. While we used the broadest categories appropriate for setting and provider of interventions, the number of studies included in meta-analysis examining frequency outcomes meant that meta-regressions were likely underpowered. We did not examine the effect of sex, ethnicity or age as a covariate since the sample size would have been too small to conduct a multivariate meta-regression analysis. As the number of trials grows, this meta-analysis should be repeated in order to better estimate differences between categories and examine the effect of other factors.

These findings should also be viewed in context of study-level heterogeneity. In our multilevel meta-analyses, heterogeneity was surprisingly low considering the diversity of settings, providers and modalities included in this body of evidence. One possible reason for this is that because we included all relevant outcomes, we avoided some of the 'random error' that may arise when only selecting one outcome per study. That is, including more information from each study will provide an estimate of statistical heterogeneity that more meaningfully accounts for study-level differences. This is not to say that it was inappropriate to explore this heterogeneity through structured and pre-hypothesised subgroup analyses, as was done here. Rather, the magnitude of difference in effects between studies may not be as pronounced as would be expected in a systematic review with such diverse interventions. While there was a low risk of bias in relation to some aspects of the study design (randomisation, loss to follow-up), there was a high percentage of unclear risk for many criteria, limiting our ability to fully assess the risk of bias. Because of the substantial number of categories for many of our meta-regressions, we were unable to conduct a sensitivity analysis on risk of bias as that would have resulted in underpowered models.

Further research is needed to examine the effectiveness of ABIs in community settings. Our review suggested limited effect but relied on a small number of studies across a wide variety of settings. Our review excluded the use of computer-based interventions, which may be an important approach to reaching populations who do not consider themselves at risk. Some evidence shows that computer-delivered interventions with personalised feedback can effectively reduce alcohol consumption at short-term and long-term follow-up, however the evidence is weaker when comparing direct feedback between face-to-face and computerised feedback.(86) Our findings clearly show the importance of provider in effective delivery of ABIs and it will be important for future research to measure effectiveness of computerised feedback against different providers. Subsequent trials should also comprehensively describe intervention components to enable finer-grained analysis of the relationship between specific aspects of intervention modalities and their effectiveness.

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Findings of this review contribute significantly to the understanding of the key processes involved in the delivery of effective ABIs, and have important policy implications for the design of preventative alcohol strategies both in the UK and internationally. The review provides important new evidence on the effectiveness of brief advice in reducing quantity of alcohol consumed and the role that nurses play in moderating the effectiveness of interventions. Resources should be prioritised to provide further support and training for nurses to deliver ABIs, as well as to undertake research to understand why nurse-led interventions are more effective so appropriate training can be provided to other practitioners.

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Data sharing agreement

No additional data are available

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Contributors

LP and CA developed the study protocol with advice from EK. LP conducted the search with assistance from DNB. LP and DNB checked the eligibility criteria of all manuscripts with help from AO. AO and JB conducted the data extraction and validation of extraction. GJM developed the statistical approach and conducted all statistical analyses in collaboration with LP. All authors commented on the manuscript.

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Figure 1 Categories and definitions of Interventions by Content, Provider and Setting

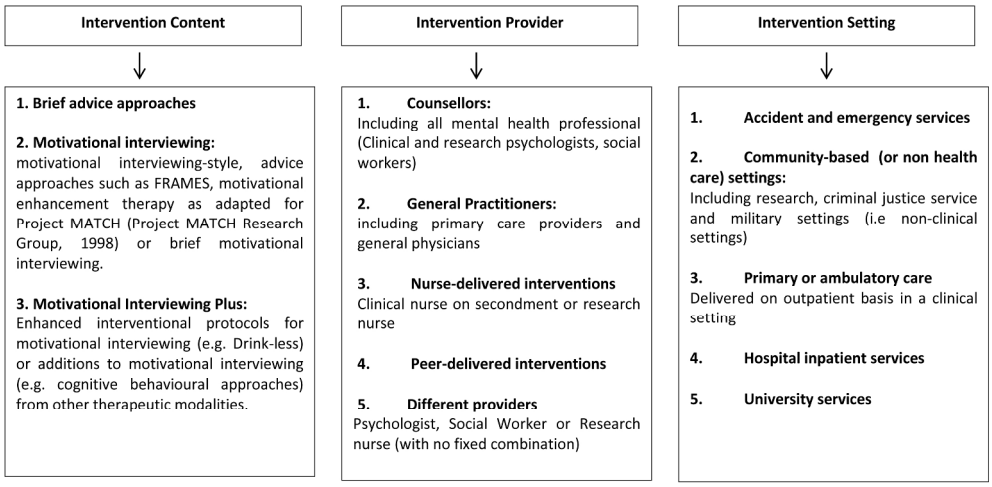

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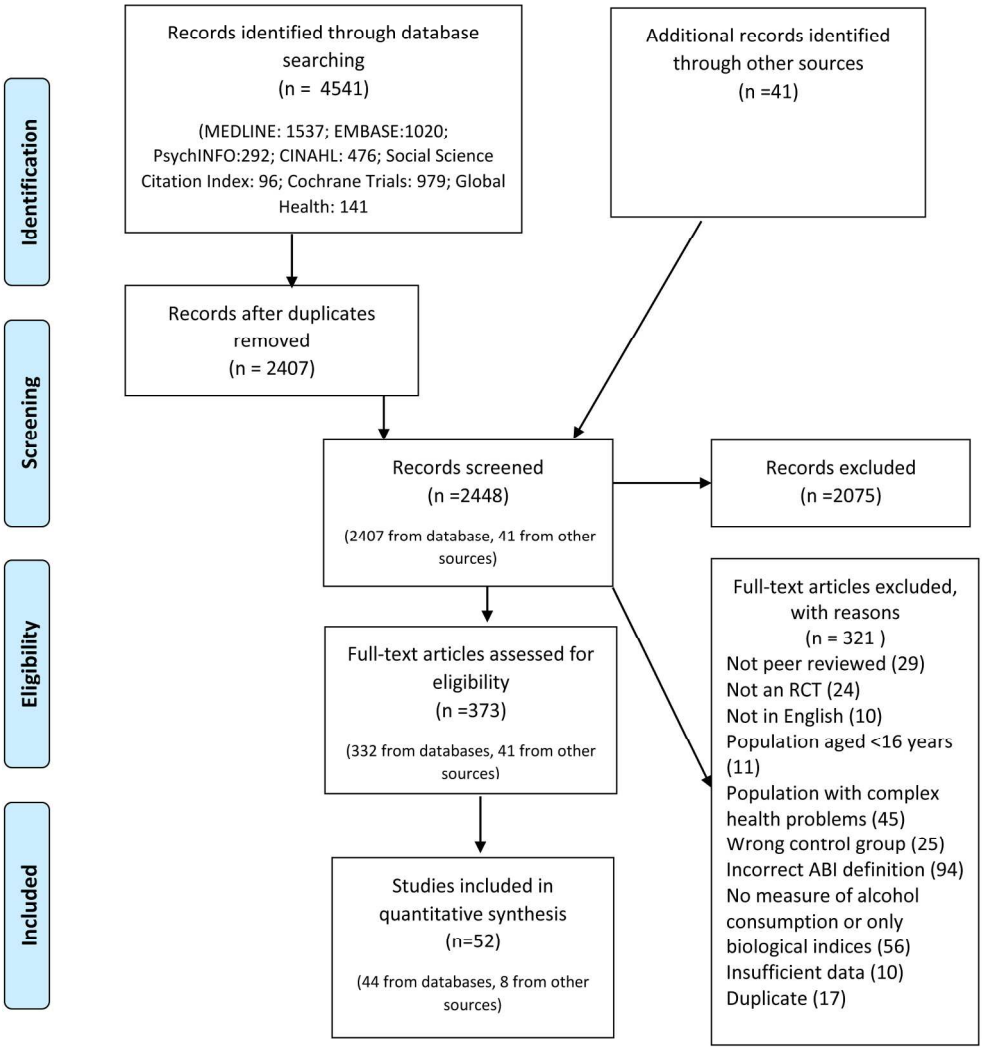
Figure 2: Flow chart of systematic review and study selection



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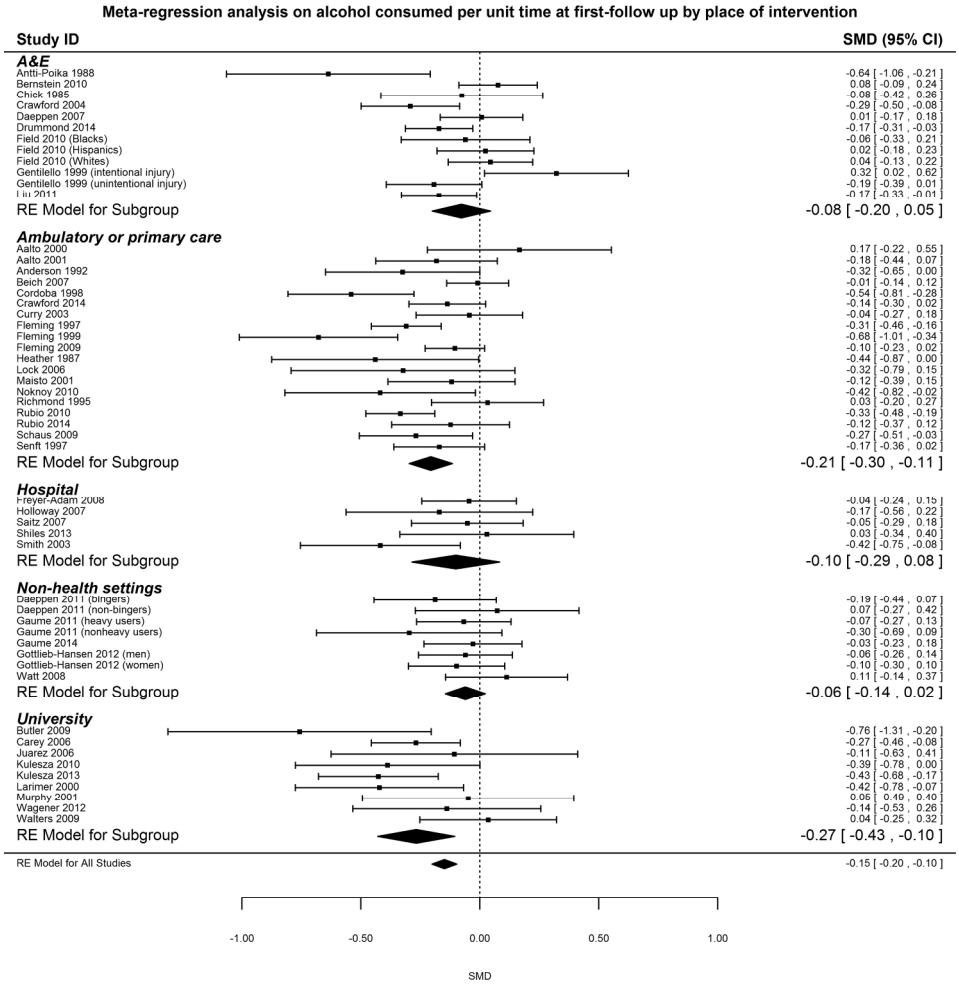

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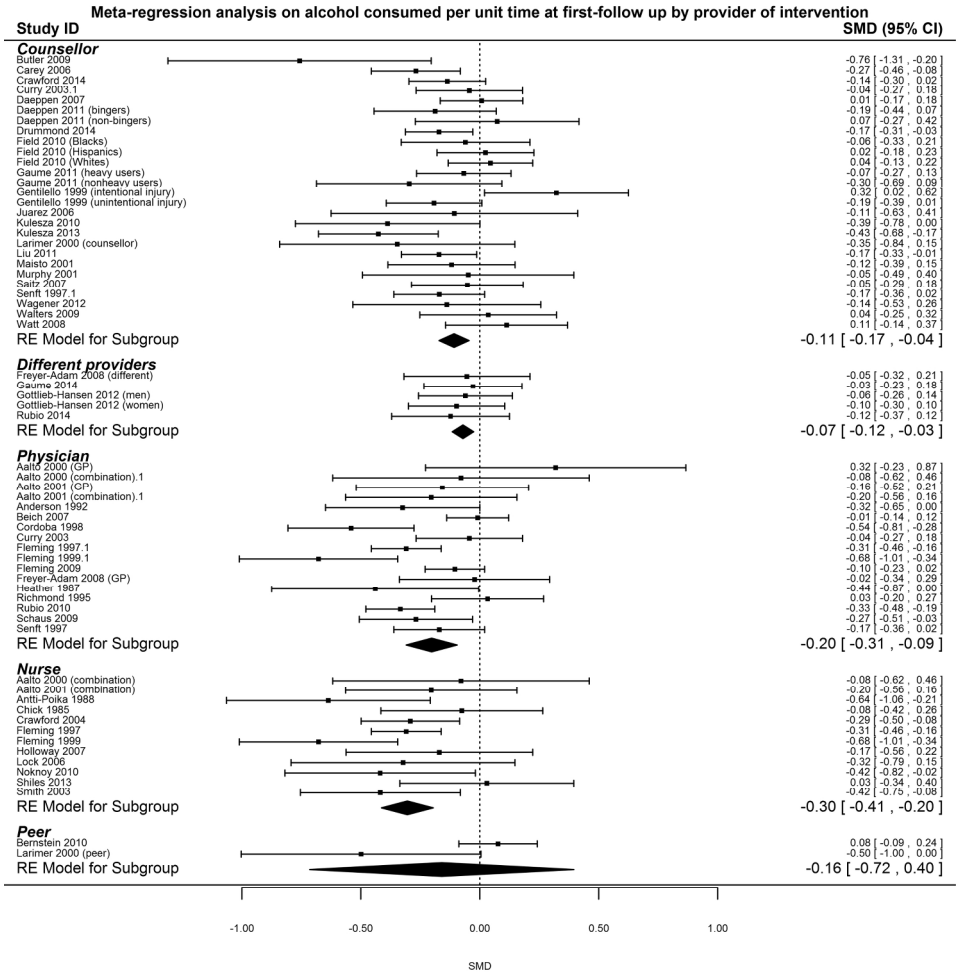

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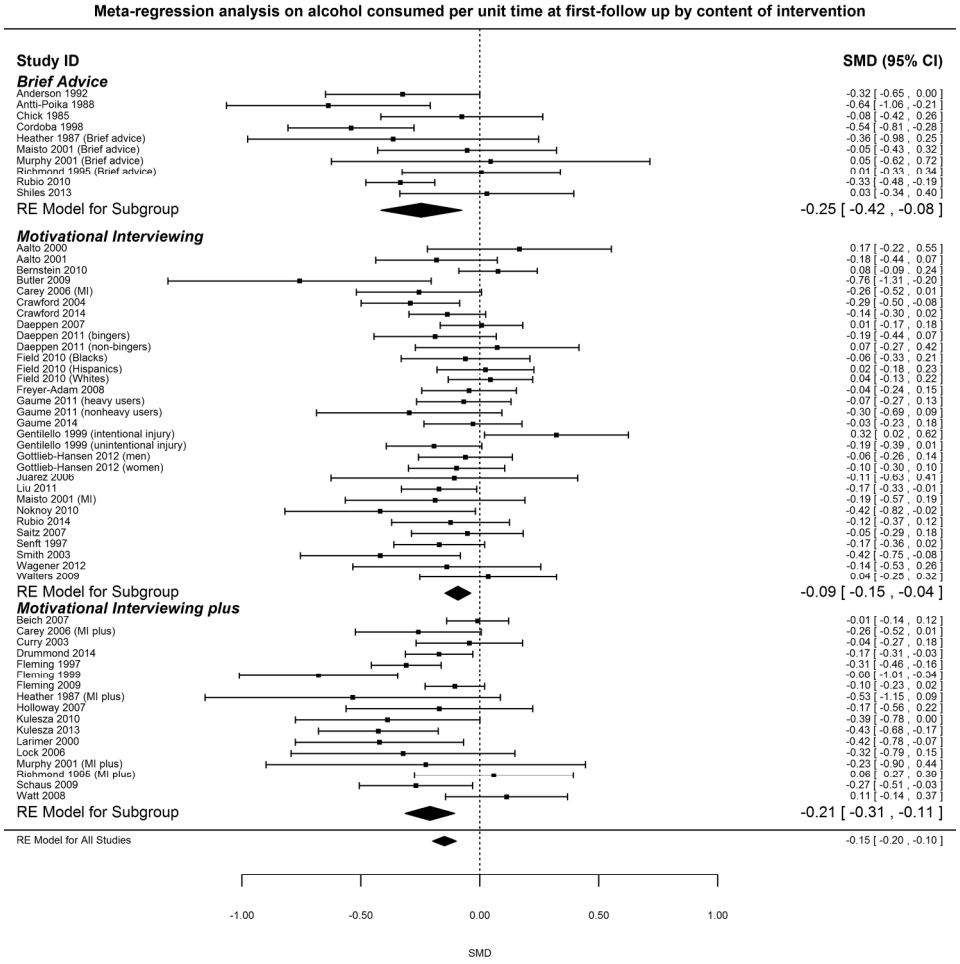

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Web Appendices

The medline search strategy is summarised below:

1 Randomized Controlled Trial/ (366634)
2 Random Allocation/ (79124)
3 Double-Blind Method/ (125165)
4 Clinical Trial/ (490650)
5 Clinical trial, phase i.pt. (14574)
6 Clinical trial, phase ii.pt. (24041)
7 clinical trial, phase iii.pt. (9034)
8 clinical trial, phase iv.pt. (898)
9 controlled clinical trial.pt. (87662)
10 randomized controlled trial.pt. (366634)
11 multicenter study.pt. (167388)
12 clinical trial.pt. (490650)
13 exp Clinical Trials as topic/ (277707)
14 Randomized Controlled Trials as Topic/ (90747)
15 Single Blind Method/ (18370)
16 or/1-15 (1009657)
17 case report.tw. (178692)
18 letter/ (782419)
19 historical article/ (294857)
20 case-control studies/ (172380)
21 cohort studies/ (158274)
22 cross-sectional studies/ (165889)
23 or/17-22 (1707664)
24 16 not 23 (937394)
25 Motivational Interviewing/ (93)
26 (Brief intervention or minimal intervention or early intervention or cognitive behav* or screen* or counsel* or brief advice or structured advice or identification or managed care or motivational interview).ab,ti. (856434) 27 25 or 26 (856487)
28 (((alcohol* or beer or wine or lager or spirit* or drink) adj3 (consum* or unit or use* or intake or binge or abuse* or misuse*)) or drink* rate* or drunk*).ab,ti. (76049)
29 Alcohol Drinking/ (50093)
30 Binge Drinking/ (124)
31 Ethanol/ (71297)
32 28 or 29 or 30 or 31 (157841)
33 24 and 27 and 32 (1331)
34 animals/ (5263469)
35 33 not 34 (1328)

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Online Table 1: Study Level risk of bias assessment

Study	Risk of bias indicator				
	Allocation	Blinding	Loss to follow up	Outcome	Intention to Treat Analysis
Aalto 2000	Adequate	C	A	C	
Aalto 2001	Adequate	C	A	C	
Anderson 1992	Unclear	C	A	C	
Antti-Poika 1988	Unclear	C	A	C	
Baer 2001	Unclear	C	B	C	
Beich, 2007	Adequate	D	A	B	
Bernstein 2010	Adequate	B	A	C	
Butler 2009	Adequate	C	A	C	
Carey 2006	Unclear	D	A	C	
Cherpitel 2010	Adequate	B	A	A	
Chick 1985	Inadequate	D	A	A	
Cordoba 1998	Adequate	D	B	C	
Crawford 2004	Adequate	B	B	B	
Crawford 2014	Adequate	B	A	A	
Curry 2003	Unclear	C	A	A	
Daeppen 2007	Adequate	C	A	A	
Daeppen 2011	Adequate	B	A	A	
Drummond 2014	Adequate	B	A	A	
Field 2010	Adequate	B	B	A	
Fleming 1997; Manwell 2000, Grossberg 2004	Adequate	B	A	A	
Fleming 1999	Unclear	B	A	C	
Fleming 2009	Adequate	A	A	A	
Freyer-Adam 2008	Adequate	B	A	B	
Gaume 2011	Adequate	C	A	C	
Gaume 2014	Unclear	C	A	A	
Gentilello 1999	Adequate	C	A	C	
Gottlieb-Hansen 2012	Adequate	D	A	B	
Heather 1987	Unclear	C	A	A	
Holloway 2007	Adequate	C	A	A	

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Study	Risk of bias indicator				
	Allocation	Blinding	Loss to follow up	Outcome	Intention to Treat Analysis
Ingersoll 2013	Adequate	C	A	A	C
Juarez 2006	Unclear	C	B	C	C
Kulesza 2010	Unclear	C	A	C	C
Kulesza 2013	Unclear	C	A	C	C
Larimer 2000	Unclear	C	B	C	C
Liu 2011	Adequate	C	A	A	C
Lock 2006	Adequate	C	A	A	C
Maisto 2001	Adequate	C	B	C	C
Murphy 2001	Adequate	C	B	C	C
Noknoy 2010	Adequate	C	A	A	C
Richmond 1995	Adequate	C	A	C	C
Rubio 2010	Adequate	C	B	A	C
Rubio 2014	Adequate	C	A	A	C
Saitz 2007	Adequate	D	A	B	C
Schaus 2009	Adequate	C	A	C	C
Senft 1997	Unclear	B	A	A	C
Shiles 2014	Adequate	C	A	A	C
Smith 2003	Adequate	B	A	C	C
Wagener 2012	Adequate	C	B	C	C
Walters 2009	Adequate	A	A	C	C
Watt 2008	Adequate	B	A	C	C

Allocation concealment: Adequate allocation concealment (e.g. allocation by a central office unaware of subject characteristics; serially numbered, opaque, sealed envelopes; on-site computer system combined with allocations kept in a locked unreadable computer file that can be accessed only after the characteristic of an enrolled participant have been entered; or other description that contained elements convincing of concealment); Unclear allocation concealment (authors either did not report an allocation concealment approach at all or report an approach that did not fall in the category A or C); inadequate allocation concealment (alternation or reference to case numbers, dates of birth, day of the week; any procedure that is entirely transparent before allocation, such as an open list of random numbers or other description that contained elements convincing of none concealment)

Blinding of participants: A= double blind; B= single blind (blinding of participants); C= unclear D= not done

Loss to follow up: A= Loss to follow up completely recorded for each group; B= Loss to follow-up incompletely recorded (data reported only for one group or for the overall sample); C= Unclear or not done

Outcome assessment: A= Blind to treatment allocation at outcome assessment; B= Not blind to treatment allocation at outcome assessment; C= Unclear

Intention to Treat Analysis: A= Intention to Treat Analysis conducted; B= Not conducted; C=Not clear

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Online table 2: Quantity of alcohol per unit time

Outcomes	Group name	First time point				Last time point			
		ES (95% CI)	k	I^2 (%)	*p*	ES (95% CI)	k	I^2 (%)	*p*
Overall	Mean effect	-0.15 (-0.20, -0.10)	53	53%		-0.15 (-0.19, -0.10)	53	43%	
Setting of intervention	A&E	-0.08 (-0.20, 0.05)	12	49%	0.08	-0.12 (-0.23, -0.02)	12	43%	0.29
	Ambulatory or primary care	-0.21 (-0.30, -0.11)	19			-0.18 (-0.28, -0.09)	19		
	Hospital inpatient services	-0.10 (-0.29, 0.08)	5			-0.10 (-0.28, 0.07)	5		
	Non-health settings	-0.06 (-0.14, 0.02)	8			-0.05 (-0.15, 0.05)	8		
	University	-0.27 (-0.43, -0.10)	9			-0.24 (-0.42, -0.06)	9		
Provider	Counsellor/mental health clinician	-0.11 (-0.17, -0.04)	27	43%	0.048	-0.13 (-0.18, -0.07)	27	36%	0.12
	Different providers	-0.07 (-0.12, -0.03)	5			-0.04 (-0.18, 0.10)	5		
	Physician	-0.20 (-0.31, -0.09)	17			-0.18 (-0.28, -0.07)	17		
	Nurse	-0.30 (-0.41, -0.20)	12			-0.27 (-0.38, -0.16)	12		
	Peer intervention	-0.16 (-3.76, 3.44)*	2			-0.19 (-3.20, 2.81)	2		
Content	Brief advice	-0.25 (-0.42, -0.07)	10	43%	0.04	-0.24 (-0.43, -0.06)	10	40%	0.07
	Motivational interviewing	-0.09 (-0.15, -0.04)	31			-0.10 (-0.15, -0.06)	31		
	Motivational interviewing plus	-0.21 (-0.31, -0.11)	17			-0.16 (-0.27, -0.07)	17		

k=number of effect sizes, *p* is the value from a multiparameter Wald test of coefficients.*This estimate was sensitive to type of maximum likelihood estimator used. We present this estimate without the Knapp-Hartung modification in the forest plot for interpretability.

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Online table 3: Quantity of alcohol per occasion

Outcomes	Group name	First time point				Last time point			
		ES (95% CI)	k	I^2 (%)	*p*	ES (95% CI)	k	I^2 (%)	*p*
Overall	Mean effect	-0.09 (-0.18, -0.001)	15	51%		-0.06 (-0.15, 0.02)	15	39%	
Setting of intervention	A&E	0.005 (-0.29, 0.29)	4	44%	0.39	-0.01 (-0.23, 0.21)	4	43%	0.65
	Ambulatory or primary care	-0.14 (-0.28, 0.003)	7			-0.06 (-0.26, 0.13)	7		
	Hospital inpatient services	N/A				N/A			
	Non-health settings	-0.08 (-0.38, 0.23)	1			-0.02 (-0.35, 0.31)	1		
	University	-0.18 (-0.47, 0.10)	3			-0.16 (-0.46, 0.14)	3		
Provider	Counsellor/mental health clinician	-0.11 (-0.23, 0.002)	8	50%	0.75	-0.07 (-0.19, 0.06)	8	36%	0.47
	Different providers	N/A				N/A			
	Physician	-0.07 (-0.26, 0.12)	6			0.05 (-0.12, 0.22)	6		
	Nurse	-0.12 (-0.44, 0.20)	5			-0.11 (-0.43, 0.21)	5		
	Peer intervention	0.01 (-2.03, 2.06)	2			-0.02 (-1.04, 0.99)	2		
Content	Brief advice	-0.23 (-0.60, 0.14)	3	42%	0.48	-0.17 (-0.54, 0.19)	3	30%	0.57
	Motivational interviewing	-0.07 (-0.24, 0.09)	9			-0.05 (-0.20, 0.10)	9		
	Motivational interviewing plus	-0.11 (-0.25, 0.03)	6			-0.06 (-0.21, 0.09)	6		

k=number of effect sizes, *p* is the value from a multiparameter Wald test of coefficients.

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Online table 4: Frequency of drinking occasions per unit time

Outcomes	Group name	First time point				Last time point			
		ES (95% CI)	k	I^2 (%)	p	ES (95% CI)	k	I^2 (%)	p
Overall	Mean effect	-0.12 (-0.20, -0.05)	16	34%		-0.14 (-0.22, -0.05)	16	45%	
Setting of intervention	A&E	-0.11 (-0.29, 0.08)	4	36%	0.42	-0.14 (-0.39, 0.12)	4	50%	0.53
	Ambulatory or primary care	-0.08 (-0.21, 0.04)	5			-0.08 (-0.20, 0.04)	5		
	Hospital inpatient services	-0.51 (-0.89, -0.12)	1			-0.51 (-0.89, -0.12)	1		
	Non-health settings	-0.14 (-1.85, 1.58)	2			-0.14 (-1.84, 1.56)	2		
	University	-0.25 (-0.75, 0.25)	4			-0.23 (-0.83, 0.37)	4		
Provider	Counsellor/mental health clinician	-0.12 (-0.26, 0.01)	9	38%	0.89	-0.14 (-0.30, 0.02)	9	47%	0.83
	Different providers	-0.26 (-0.47, -0.05)	1			-0.26 (-0.47, -0.05)	1		
	Physician	-0.10 (-0.23, 0.02)	6			-0.09 (-0.21, 0.04)	6		
	Nurse	-0.21 (-0.55, 0.13)	4			-0.21 (-0.55, 0.13)	4		
	Peer intervention	-0.07 (-1.08, 0.95)	2			-0.07 (-1.08, 0.95)	2		
Content	Brief advice	0.17 (-1.96, 2.30)	2	28%	0.32	0.13 (-2.00, 2.26)	2	41%	0.36
	Motivational interviewing	-0.14 (-0.27, -0.01)	9			-0.16 (-0.30, -0.01)	9		
	Motivational interviewing plus	-0.12 (-0.23, -0.01)	7			-0.11 (-0.22, -0.002)	7		

k=number of effect sizes, *p* is the value from a multiparameter Wald test of coefficients.

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Online table 5: Frequency of binge drinking occasions per unit time

Outcomes	Group name	First time point				Last time point			
		ES (95% CI)	k	I^2 (%)	*p*	ES (95% CI)	k	I^2 (%)	*p*
Overall	Mean effect	-0.15 (-0.22, -0.08)	19	38%		-0.14 (-0.22, 0.06)	20	50%	
Setting of intervention	A&E	-0.09 (-0.29, 0.10)	5	24%	0.18	-0.11 (-0.35, 0.13)	5	57%	0.70
	Ambulatory or primary care	-0.20 (-0.30, 0.10)	6			-0.21 (-0.36, 0.06)	7		
	Hospital inpatient services	-0.06 (-0.30, 0.17)	1			-0.06 (-0.30, 0.17)	1		
	Non-health settings	-0.06 (-0.28, 0.16)	4			-0.06 (-0.28, 0.16)	4		
	University	-0.31 (-0.73, 0.11)	3			-0.21 (-1.17, 0.74)	3		
Provider	Counsellor/mental health clinician	-0.12 (-0.22, -0.02)	13	36%	0.36	-0.09 (-0.20, 0.01)	13	21%	0.11
	Different providers	N/A				N/A			
	Physician	-0.20 (-0.30, -0.09)	5			-0.20 (-0.27, 0.03)	6		
	Nurse	-0.24 (-0.52, 0.04)	3			-0.32 (-0.57, 0.08)	4		
	Peer intervention	N/A				N/A			
Content	Brief advice	-0.26 (-1.17, 0.65)	2	24%	0.25	-0.26 (-1.17, 0.65)	2	46%	0.71
	Motivational interviewing	-0.11 (-0.21, -0.02)	13			-0.12 (-0.23, 0.01)	13		
	Motivational interviewing plus	-0.18 (-0.29, -0.08)	6			-0.14 (-0.31, 0.03)	7		

k=number of effect sizes, *p* is the value from a multiparameter Wald test of coefficients. N/A= Not Available

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PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3 and 4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	4 and 5
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	6
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	4 and 5
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	5
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	4 and 5
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	5
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	5 and 6
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	6

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Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	5
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	6
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	6 &12
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	13-16
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	18 & Online Table 1
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	24-26
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	20-23
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	7
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	8 & online tables 3-6
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	8-9
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	9
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	8-9
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	11

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From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

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