Interventions to prevent and reduce excessive alcohol consumption in older people: a systematic review and meta-analysis

Abstract

Background: Harmful alcohol consumption is reported to be increasing in older people. To intervene and reduce associated risks, evidence currently available needs to be identified.

Methods: Two systematic reviews in older populations (55+ years): (1) Interventions to prevent or reduce excessive alcohol consumption; (2) Interventions as (1) also reporting cognitive and dementia outcomes. Comprehensive database searches from 2000 to November 2016 for studies in English, from OECD countries. Alcohol dependence treatment excluded. Data was synthesised narratively and using meta-analysis. Risk of bias was assessed using NICE methodology. Reviews are reported according to PRISMA.

Results: 13 studies were identified, but none with cognition or dementia outcomes. Three related to primary prevention; 10 targeted harmful or hazardous older drinkers. A complex range of interventions, intensity and delivery was found. There was an overall intervention effect for 3 and 6 month outcomes combined (8 studies; 3591 participants; pooled standard mean difference (SMD) -0·18 (95% CI -0·28, -0·07) and 12 months (6 studies; 2788 participants SMD -0·16 (95% CI -0·32, -0·01) but risk of bias for most studies was unclear with significant heterogeneity. Limited evidence (3 studies) suggested more intensive interventions with personalised feedback, physician advice, educational materials, follow-up could be most effective. However, simple interventions including brief interventions, leaflets, alcohol assessments with advice to reduce drinking could also have a positive effect.

Conclusions: Alcohol interventions in older people may be effective but studies were at unclear or high risk of bias. Evidence gaps include primary prevention, cost-effectiveness, impact on cognitive and dementia outcomes.

Keywords:- alcohol, systematic review, older people, interventions, dementia

Key Points:-

- Interventions to reduce alcohol consumption in at-risk drinkers may be effective in older people.
- However, there are limitations to the evidence as most studies were at unclear or high risk of bias.
- There is some evidence that more intensive interventions could be more effective in older people.
- There is little evidence from interventions relating to primary prevention of excessive

drinking in older people.

- Gaps in the evidence include cost-effectiveness and impact on cognitive and dementia outcomes.

Background

Modifiable lifestyle risk behaviours are the leading cause of major non-communicable diseases (NCDs), such as cardiovascular disease, diabetes, cancer, cognitive decline, and dementia. Due to population ageing, the burden of ill health due to modifiable lifestyle factors is likely to increase. Many older adults, both in the UK and internationally, drink at levels that are hazardous or harmful to health [1, 2]. In England, 19·3% of adults aged 55-64 years, 14·1% of adults aged 65-74 years and 10·5% of adults aged 75 years and older drink at hazardous or harmful levels, compared to 24.2% in the general adult population [1, 3]. Recent reviews and recommendations have linked alcohol consumption with a range of health conditions including dementia [4, 5].

Clear evidence based information is needed on effectiveness, key components of effective interventions and barriers and facilitators to inform the development and implementation of contextualised and tailored programmes for older adults and for public health managers, policy makers and commissioners. The work reported here was part of a comprehensive evidence synthesis of preventive health behaviour interventions to inform policy relating to ageing well and cognitive health, conducted for the NIHR School of Public Health Research Ageing Well Programme.

The specific questions addressed in the two reviews reported here are:

1) What interventions in people in older age (55+ years) are effective for prevention or reduction of excess alcohol consumption?
2) What individual-level interventions targeting alcohol consumption in people in older age (55+ years) are effective for the primary prevention or delay of cognitive decline or dementia?

Methods

Two complementary systematic reviews in older populations to identify: (1) Interventions to prevent or reduce excessive alcohol consumption; (2) Interventions as (1) also reporting cognitive or dementia outcomes. Alcohol dependence treatment was excluded. Protocols were pre-registered on PROSPERO [6-8]. The reviews have been reported according to PRISMA [9].

Search strategy and selection criteria

Multiple databases (MEDLINE, EMBASE, PsycINFO, CINAHL, CENTRAL, Social Sciences Citation Index, York Centre for Reviews and Dissemination, Cochrane database, grey literature,

including relevant websites) were searched from 2000 to November 2016, for studies in English from Organisation for Economic Co-operation and Development (OECD) countries, using MeSH terms and text words for alcohol consumption and behaviour combined with older age terms (Supplement 1). The alcohol searches were part of broader searches for a series of reviews covering a range of health behaviours. Searches were conducted in two stages: 1) for relevant systematic reviews; 2) for primary intervention studies using appropriate search filters [10]. Reference lists of included studies and related reviews were also searched. One pre-2000 study [11], identified from searching reference lists, was also included for completion as it is directly relevant and widely cited.

Types of study design: Primary intervention studies of any design; systematic reviews.

Population: Older people aged 55 and over, living in the community; including healthy participants; with pre-conditions for later ill health such as high blood pressure, high cholesterol, overweight or obese, impaired cognitive function, functional limitations; on medication that did not affect outcomes; disadvantaged and minority groups. Studies primarily focused on populations with previous ill health e.g. stroke, coronary heart disease, mental health conditions were excluded.

Intervention: Interventions that aimed to prevent or reduce excessive alcohol consumption. Treatment of alcohol dependence; prescription drugs; or interventions aimed at national policies, laws and taxation were excluded.

Comparator: Any relevant, including usual care, minimal intervention or no intervention.

Outcomes: Measures of effectiveness or cost-effectiveness including: 1) absolute or risk measures of alcohol consumption; 2) prevalence, incidence or level of dementia or cognition by any appropriate measure, including cognitive tests, scans or imaging, clinical assessment, or dementia biomarkers.

Identification of relevant studies: Titles, abstracts and papers were screened for inclusion by two reviewers. Differences were resolved by discussion with a third reviewer. Studies excluded at the full paper screening stage are listed in Supplement 3.

Data extraction and synthesis: Data was extracted by one reviewer and independently checked by another reviewer. Differences were resolved by discussion. Data was synthesised narratively to describe effective interventions and components and also pooled in meta-analysis. Meta-analysis was conducted using RevMan 5·3 (Cochrane Collaboration) using continuous measures of alcohol consumption in a random effects model. Outcomes at 6 and 12 months were the primary outcomes, but if 6 month data was not reported, 3 month data was used. As outcomes were presented in different ways (e.g. mean drinks/day, week or month; mean drinks/drinking day, different units, country standards), standardised mean difference (SMD) was used as the summary statistic. SMD expresses the size of the intervention effect in each study relative to the variability [12].

Risk of bias

Risk of bias was assessed using NICE methodology by one reviewer and checked for accuracy by a second reviewer [13]. Differences were resolved by discussion. No studies were excluded on the basis of quality. The non-randomised study was assessed as being at high risk of bias.

Results

The study selection process is shown in Figure 1. Thirteen primary intervention studies were identified - 12 RCTs and one before and after intervention study [14]. No studies were identified that targeted alcohol consumption and also reported the impact on cognition or dementia. A summary of included studies and results is shown in Table 1 (further details in Supplement 2).

Description of included studies

Population

Of the 13 included studies, 3 were broadly relevant to primary prevention and recruited people reporting at least one alcoholic drink in the last three months [15]; those that visited their GP for any reason [16]; and from GP lists [17]. The other 10 studies firstly screened for alcohol use and included only at-risk, heavy or hazardous drinkers.

Eleven studies specifically targeted alcohol use and 2 aimed to address a range of health behaviours including alcohol consumption, i.e. multi-domain interventions [16, 17].

Setting

Nine studies were conducted in the US, two in UK, one in Denmark, one in Croatia. Most interventions were conducted in primary care settings, except one that used a mailed screening and intervention [18]. In two studies the setting was unclear [14, 19]. Most studies recruited from people attending regular GP appointments, not specifically relating to alcohol.

Interventions

A complex range of intervention types, intensity and delivery were found (Table 1, Supplement 2). Seven interventions were described as brief interventions, based on the study authors' description, but these included a diverse range of components, delivery and intensity. Three examined combined motivational interviews or motivational enhancement with other educational material [14,19,20]; one a brief web intervention in addition to treatment as usual [21]; one was delivered by mail with personalised feedback on alcohol [18]; one brief physician advice to reduce alcohol with personalised feedback, education and aids for drinking reduction and telephone follow-up [11]. A brief minimal intervention was the control in another study [22].

Three studies combined multiple intervention components, personalised feedback reports, drinking diaries, education and advice and follow-up telephone counselling compared to usual care or minimal intervention [11, 23, 24]. One compared provision of feedback about personal drinking risks and education given to the participant only to feedback given to both the participant and their physician [15]. One compared an integrated care approach to enhanced referral to services in a separate location [25].

Two studies incorporated alcohol counselling and education within broader multi-domain interventions that also targeted other health behaviours such as physical activity, smoking, and preventive care [16, 17].

Comparators

In 4 studies, the comparator was usual care [16, 20, 21, 23]; in 4, it was a minimal intervention such as leaflets, or information sheets [11, 19, 20, 24]; in 2, the comparator received no intervention [17, 18]; in one, the comparator was an enhanced referral [25]; and one used both feedback to patients only and a usual care control [15]; one study had no control group [14].

Cost-effectiveness

Only one study reported cost-effectiveness. For a three-stage stepped care approach compared to a brief minimal intervention there was no significant difference in cost-effectiveness [22]. One study reported costs only (Supplement 2) [23].

Summary of results

Evidence from individual studies

Of the 13 included studies, 3 were broadly aimed at primary prevention. Of these, the 2 multi-domain intervention studies that targeted a range of health behaviours found no effect of intervention for improving alcohol outcomes [16, 17]. The other study found feedback of personalised risks to both participants and their physicians reduced alcohol consumption and drinking risk [15].

Of the other ten studies, in at-risk drinkers: 5 reported positive effects of alcohol interventions in older people, of which 3 found improvements in both alcohol consumption and measures of at-risk drinking [11, 23, 24], compared to controls. All 3 used relatively intensive interventions, including personalised feedback, education and follow-up telephone calls and included physician advice. A brief mailed intervention reported a significant decline in risk score but not absolute numbers of drinks [18]. Another study, reporting a reduction in alcohol problems, used a brief educational and motivational intervention [14].

However, the other 5 included studies reported no statistically significant effect of the intervention versus control [19-22, 25]

All 7 studies described as brief interventions were in at-risk groups. Two based on motivational interviewing [19, 20], a web-delivered intervention [21] and a study that used a brief minimal intervention as the control group found no differences between intervention and control [22]. A brief intervention delivered by mail with personalised feedback on alcohol risks, and a brief educational and motivational intervention reported beneficial effects on risk score and reduction in alcohol problems respectively [18,14]. One study was described as a brief intervention, but included a range and intensity of intervention components including physician counselling, personalised feedback, education and follow-up (so also discussed previously as an intensive intervention), and reported significant effects for all alcohol outcomes [11].

Only 6 (of the 11 individual studies specifically targeted at alcohol) report statistically significant differences in outcomes between the intervention and control at follow-up. However, there is some evidence that the control groups reduced alcohol consumption between baseline and follow-up in many studies (Table 2). This suggests that even the minimal, usual care or no intervention control groups (just receiving an alcohol assessment as part of the research study) may also be motivated to reduce alcohol consumption.

Overall, from individual studies, there is some evidence (3 studies) that more intensive interventions that include personalised feedback reports, physician advice, educational materials, and follow-up may be more effective in older people with reduction in alcohol consumption maintained up to a year. There is some limited evidence (one study) that feedback of risks to both the participant and their physician may be more effective than to the participant alone. The evidence for brief interventions in older people is mixed.

All included studies recruited male and female participants. In the 10 studies that screened for at-risk drinking, most recruited predominantly male populations. One reported outcomes in male and female participants separately and found no significant differences by gender [19]. Another found no significant effect by gender in post hoc analyses controlled for baseline consumption [11]. There is insufficient data to present findings disaggregated by SES or ethnic group (Supplement 2).

Evidence from meta-analysis
From data from eight studies (9 datasets: one study reported men and women separately; 3591 participants) that report absolute measures of alcohol at three or six months, pooled SMD was -0·18 (95% CI -0·28, -0·07; p=0·001) (Figure 2). However, there was moderate, statistically significant

heterogeneity; I^2=55%. For six of these studies that followed up to 12 months, SMD was -0·16 (95% CI -0·32, -0·01; p=0·04), but there was substantial heterogeneity (I^2=73%) (Supplement 4). All pooled studies were in 'at risk' groups. Two studies in 'at-risk' participants were not pooled. One had no control group [14], the other did not report continuous outcome data [20], and had few participants so would be unlikely to substantially influence the overall analysis. The 3 studies not specifically in 'at risk' populations were not pooled as there was insufficient suitable data. Overall, there is some evidence that alcohol interventions in older at-risk drinkers can be effective.

In post-hoc subgroup analyses, using outcomes at 3 or 6 months, for the 3 intensive interventions [23,11,24] using personalised feedback, education and telephone follow-up: SMD -0·32 (95% CI -0·45, -0·18; p<0·00001), I^2=41%. For studies described as brief interventions, (5 studies; 6 datasets: [21, 11,19, 18, 22]: SMD -0·17 (95% CI -0·30, -0·04), I^2=38%. Without the Fleming 1999 study (intensive 'brief' intervention), a significant effect remained (SMD -0·12 (95% CI -0·22, -0·01; p=0·03, I^2=0%). While these analyses provide some further evidence of the effectiveness of intensive interventions and some support that brief interventions overall also may be effective in older people, they should be interpreted with caution because of the small number of studies and heterogeneity.

Assessment of risk of bias

Most studies were assessed as at unclear risk of bias, and 3 studies at high risk (Supplement 5). All alcohol outcome data was self-reported by participants, although generally using validated instruments. Seven of the 13 included studies reported pre-registration of the trial, 6 did not [11, 14, 15, 18, 20, 21]. National or government funding was reported for most studies, one reported no funding [16].

There is little evidence of publication bias. Several studies reported no intervention effect and preliminary funnel plots (8 studies) suggested little evidence of publication bias. However, funnel plots are not recommended with less than ten studies [12].

Discussion

The focus of this review is to provide evidence to inform local authorities, commissioners and other stakeholders about interventions that may be effective in older people. No evidence from intervention studies in older people was found about the impact of alcohol prevention or reduction strategies on cognition or dementia. This is a key gap in the evidence. We are also not aware of any alcohol prevention or reduction interventions started earlier in life that report cognition or dementia outcomes [26, 27].

Little information is available about primary prevention or health promotion to prevent development

of harmful drinking in older adults. About a third of older people with drinking problems develop them for the first time in later life [31], often linked to bereavement, physical ill-health, lack of mobility, social isolation and depression.

There is, however, evidence about interventions to reduce harmful or hazardous levels of drinking in older people, which is likely to have a beneficial impact on a range of health conditions including dementia [3,4]. There are limitations in the available evidence: most studies were at unclear or high risk of bias; the range of interventions, intensity and delivery makes interpretation complex; in some studies the control group, generally receiving either less intervention or just assessments of alcohol consumption as part of the research study, also reduced their alcohol consumption; searches were limited to studies in English so there is a risk that other relevant studies were not identified.

However, there is some evidence (3 studies) that more intensive interventions involving personalised feedback, physician advice, educational materials, and follow-up could be most effective. Brief interventions in older people may also be effective overall, but there is not yet consistent information about effective components and the range of brief interventions that have been examined had mixed effects. Individual brief interventions that had some positive effects included: a brief 'intensive' intervention; a brief mailed intervention with personalised feedback; provision of advice, education and motivational interviewing. Of note, in some studies, minimal control groups also reduced alcohol consumption, suggesting that simple interventions such as leaflets, and alcohol assessments with advice to reduce drinking, might also have some positive effect.

Previous systematic reviews found few alcohol interventions in older people. A 2007 Cochrane review of brief alcohol interventions in primary care in adults in general found that brief interventions lowered alcohol consumption overall [28]. Only one of the included studies was specifically in older people [11]. A more recent overview of 27 systematic reviews of brief alcohol interventions in primary care in adults [29], also found that brief interventions are effective in reducing alcohol consumption in adults in general but highlighted an evidence gap in older people. This overview included the 2007 Cochrane review and also two other reviews that found studies in older people [30, 32], that between them identified only 2 studies in older people [11, 20]. The VINTAGE project also identified scarce data relating to alcohol interventions in older people [2]. Therefore, this paper fills a clear evidence gap in older people.

Most of the included studies only recruited a small proportion of the at-risk drinkers identified by screening so it is likely those recruited to the trials were motivated to reduce drinking, which may not apply if implemented in practice [33]. Two studies informed participants recruitment was to a healthy

behaviour study, not specifically for alcohol, which may have limited those most motivated to reduce drinking [15,18]. Both trials reported some improvement in alcohol outcomes.

All of the alcohol data was self-reported. People may under-report or not accurately report their drinking, but this is likely to be similar at baseline and follow-up. Little published data relevant to cost-effectiveness of interventions in older people was found but recent work on the general population suggests that brief interventions are likely to be cost-effective [34].

While harmful or hazardous drinking may have started earlier in the lifecourse and alcohol consumption often declines in later life, many older people still drink at levels that are harmful to health [1]. Older people may also have chronic conditions or interactions with medication so the harmful effects of alcohol may manifest at lower levels of consumption [1]. While primary prevention strategies aimed at people earlier in the lifecourse are also important, there is a growing need to address harmful drinking in older people. The current evidence is presented in this review.

The work presented in this paper has contributed to an evidence-based resource for local authority commissioners, clinical commissioning groups and providers of lifestyle behaviour change programmes of interventions to help the uptake and maintenance of healthy behaviours and promote cognitive health among older adults living in the community [35]. This paper provides further details of the methods, analysis and synthesis.

SPHR is a partnership between the Universities of Sheffield, Bristol, Cambridge, Exeter, University College London; The London School for Hygiene and Tropical Medicine; the LiLaC collaboration between the Universities of Liverpool and Lancaster; and Fuse, The Centre for Translational Research in Public Health, a collaboration between Newcastle, Durham, Northumbria, Sunderland and Teesside Universities.

Competing interests: We declare we have no conflicts of interest.

1   Gell L, Meier PS, Goyder E. Alcohol consumption among the over 50s: international comparisons. Alcohol Alcohol 2015; 50: 1–10; doi: 10.1093/alcalc/agu082.

2   Anderson P, Scafato E, Galluzzo L. Alcohol and older people from a public health perspective. Ann Ist Super Sanita 2012; 48: 232–47; doi: 10.4415/ANN_12_03_04.

3   Statistics on alcohol, England. Health and Social Care Information Centre. London. 2015; Available from: http://content.digital.nhs.uk/catalogue/PUB17712/alc-eng-2015-rep.pdf (accessed 12-5-2017).

4   UK Chief Medical Officers' Alcohol Guidelines Review. London. 2016; Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/545937/UK_C MOs__report.pdf (accessed 03 March 2017).

5   National Institute for Health and Care Excellence (NICE). Dementia, disability and frailty in later life: mid-life approaches to delay or prevent onset (NG16). NICE, London, 2015.

6   Lafortune L, Kelly S, Martin S *et al*. Protocol: A systematic review of interventions in older age for increasing the uptake and maintenance of healthy behaviours that may impact on successful ageing. PROSPERO 2014; CRD42014015554.

7   Lafortune L, Kelly S, Martin S, Smailagic N, Cowan A, Brayne C. Protocol: A systematic review of behavioural interventions in older age for the primary prevention, or delay, of dementia and cognitive decline. PROSPERO 2014: CRD42014015584.

8   PROSPERO. www.crd.york.ac.uk/prospero (accessed 03 March 2017).

9   Moher D, Liberati A, Tetzlaff J, Altman DG, Prisma Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 2009; 6:e1000097; doi: 10.1371/journal.pmed.1000097.

10   The InterTASC Information Specialists' Sub-Group Search Filter Resource. Available from:
        https://sites.google.com/a/york.ac.uk/issg-search-filters-resource/home (accessed 03 March
        2017).

11   Fleming MF, Manwell LB, Barry KL, Adams W, Stauffacher EA. Brief physician advice for
        alcohol problems in older adults: a randomized community-based trial. J Fam Pract 1999; 48:
        378–84.

12   Higgins J, Green S. Cochrane Handbook for Systematic Reviews of Interventions Version
        5.1.0. The Cochrane Collaboration; London, 2011.

13   National Institute for Health and Care Excellence (NICE): The Social Care Guidance Manual.
        Process and Methods (PMG10), July 2016. Appendix C.
        https://www.nice.org.uk/process/pmg10/chapter/appendix-c-methodology-checklist-
        randomised-controlled-trials (accessed 12-5-2017).

14   Schonfeld L, King-Kallimanis BL, Duchene DM *et al*. Screening and brief intervention for
        substance misuse among older adults: the Florida BRITE project. Am J Public Health 2010;
        100: 108–14; doi: 10.2105/AJPH.2008.149534.

15   Fink A, Elliott MN, Tsai M, Beck JC. An evaluation of an intervention to assist primary care
        physicians in screening and educating older patients who use alcohol. J Am Geriatr Soc 2005;
        53: 1937–43; doi: 10.1111/j.1532-5415.2005.00476.

16   Vrdoljak D, Markovic BB, Puljak L, Lalic DI, Kranjcevic K, Vučak J. Lifestyle intervention
        in general practice for physical activity, smoking, alcohol consumption and diet in elderly: a
        randomized controlled trial. Arch Gerontol Geriatr 2014; 58: 160–69; doi:
        10.1016/j.archger.2013.08.007.

17   Harari D, Iliffe S, Kharicha K *et al*. Promotion of health in older people: a randomised
        controlled trial of health risk appraisal in British general practice. Age Ageing 2008; 37:
        565–71; doi: 10.1093/ageing/afn150.

18   Kuerbis AN, Yuan SE, Borok J *et al*. Testing the initial efficacy of a mailed screening and
        brief feedback intervention to reduce at-risk drinking in middle-aged and older adults: the
        comorbidity alcohol risk evaluation study. J Am Geriatr Soc 2015; 63: 321–26; doi:
        10.1111/jgs.13237.

19   Hansen AB, Becker U, Nielsen AS, Gronbaek M, Tolstrup JS. Brief alcohol intervention by
        newly trained workers versus leaflets: comparison of effect in older heavy drinkers identified
        in a population health examination survey: a randomized controlled trial. Alcohol Alcohol
        2012; 47: 25–32; doi: 10.1093/alcalc/agr140.

20   Gordon AJ, Conigliaro J, Maisto SA, McNeil M, Kraemer KL, Kelley ME. Comparison of
        consumption effects of brief interventions for hazardous drinking elderly. Subt Use Misuse
        2003; 38: 1017–35; doi: 10.1081/JA-120017649.

21   Cucciare MA, Weingardt KR, Ghaus S, Boden MT, Frayne SM. A randomized controlled trial of a web-delivered brief alcohol intervention in veterans affairs primary care. J Stud Alcohol Drugs 2013; 74: 428–36; doi: 10.15288/jsad.2013.74.428.

22   Watson JM, Crosby H, Dale VM *et al*. AESOPS: a randomised controlled trial of the clinical effectiveness and cost-effectiveness of opportunistic screening and stepped care interventions for older hazardous alcohol users in primary care. Health Techno Assess 2013; 17: 1–158; doi: 10.3310/hta17250.

23   Ettner SL, Xu H, Duru OK *et al*. The effect of an educational intervention on alcohol consumption, at-risk drinking, and health care utilization in older adults: the Project SHARE study. J Stud Alcohol Drugs 2014; 75: 447–57; doi: 10.15288/jsad.2014.75.447.

24   Moore AA, Blow FC, Hoffing M *et al*. Primary care-based intervention to reduce at-risk drinking in older adults: a randomized controlled trial. Addiction 2011; 106: 111–20; doi: 10.1111/j.1360-0443.2010.03229.

25   Oslin DW, Grantham S, Coakley E *et al*. PRISM-E: Comparison of Integrated Care and Enhanced Specialty Referral in Managing At-Risk Alcohol Use. Psychiatr Serv 2006; 57: 954–58.

26   Lafortune L, Martin S, Kelly S. Midlife approaches to prevention of ill health in later life. JAMA Internal Medicine 2017; doi: 10.1001/jamainternmed.2016.8849.

27   Lafortune L, Kelly S, Kuhn I, Cowan A, Brayne C. Disability, dementia and frailty in later life: mid-life approaches to prevent or delay the onset of these conditions. Report to NICE Public Health Guideline Committee. NICE; London, 2014.

28   Kaner EF, Beyer F, Dickinson HO *et al*. Effectiveness of brief alcohol interventions in primary care populations. Cochrane Database of Systematic Reviews 2007; CD004148.

29   O'Donnell A, Anderson P, Newbury-Birch D *et al*. The impact of brief alcohol interventions in primary healthcare: a systematic review of reviews. Alcohol Alcohol 2014; 49: 66–78; doi: 10.1093/alcalc/agt170.

30   Whitlock EP, Polen MR, Green CA, Orleans T, Klein J. Behavioral counseling interventions in primary care to reduce risky/harmful alcohol use: a summary of the evidence for the US Preventive Services Task Force. Ann Intern Med 2004*;* 7: 557–68; doi: 10.7326/0003-4819-140-7-200404060-00017.

31   Royal College of Psychiatrists: Alcohol and older people. London. 2012; Available from: http://www.rcpsych.ac.uk/healthadvice/problemsdisorders/alcoholandolderpeople.aspx (accessed 12-5-2017).

32   Jonas DE, Garbutt JC, Amick HR *et al*. Behavioral counseling after screening for alcohol misuse in primary care: a systematic review and meta-analysis for the US Preventive Services Task Force. Ann Intern Med 2012; 9: 645–54; doi: 10.7326/0003-4819-157-9-201211060-00544.

33   McCambridge J, Saitz R. Rethinking brief interventions for alcohol in general practice. BMJ
        2017; 356;j116; doi: 10.1136/bmj.j116.

34   Angus C, Latimer N, Preston L, Li J, Purshouse R. What are the implications for policy
        makers? A systematic review of the cost-effectiveness of screening and brief interventions for
        alcohol misuse in primary care. Front Psychiatry 2014; 5: 114; doi:
        10.3389/fpsyt.2014.00114.

35   Lafortune L, Kelly S, Olanrewaju O, Cowan A, Brayne C. Changing risk behaviours and
        promoting cognitive health in older adults: An evidence based resource for local authorities
        and commissioners. Public Health England, PHE publications gateway number: 2016427,
        Nov 2016. Available from: https://www.gov.uk/government/publications/changing-risk-
        behaviours-and-promoting-cognitive-health-in-older-adults (Accessed 26-6-2017)

Table 1. Intervention studies to prevent or reduce alcohol consumption in older people: summary of study characteristics and results (all studies were conducted in populations identified as at-risk, heavy or hazardous drinking, except those marked * in first column)

Study/design/ country	Mean age, y (SD)	Intervention and comparator	Follow-up/ outcome measure $^{\pm}$	Key results
Cucciare 2013 [21] RCT, US	59 (15)	**Intervention:** (N=78) Brief web-delivered intervention using normative feedback plus treatment as usual; **Comparator:** (N=89) Treatment as usual.	3,6m; TLFB	No significant differences between I and C groups for any alcohol outcome at any of the time points examined.
Ettner 2014 [23] RCT, US	71 (7·3)	**Intervention**: (N=546) Personalised reports, educational materials, drinking diaries, physician advice during office visits, and follow-up telephone counselling; **Comparator:** (N=640) Usual care	3,6,12m ; CARET	**Mean drinks per week:** I: 13·3 (7·9) at baseline to 9·82 at 6 months and 9·45 at 12 months; C: 13·9 (8·0) at baseline to 12·24 at 6months and 11·64 at 12 months (SD nr); p=0·01 between groups; **At risk drinking:** At 6,12 months, significantly greater in the I group compared to C: 6 months (60% vs. 72%; p =0·01); 12 months (56% vs. 67%; p =0·01).
*Fink 2005 [15] RCT, US	76·6 (6·2)	**Combined report intervention**: (N=212) Participants and their GPs received a personalised report of their drinking risks and education; **Patient report intervention:** (N=245) Participants only received a personalised report of their drinking risks and education; **Comparator:** Usual Care (N=238)	12m; CARPS	**Drinks/week:** For combined report compared to usual care, consumption decreased by 1·14 drinks per week (p<0·05) at 12 months; for patient report no significant difference (p<0·05); **Lower-risk drinking:** Both patient report and combined report associated with more lower-risk drinking than usual care (OR 1·59 and 1·23; p<0·05 for each).
Fleming 1999 [11] RCT, US	65+ (most 65-75)	**Intervention:** (N=87). Brief physician advice to reduce alcohol with feedback on their health behaviours, adverse effects of alcohol, drinking cues, diary cards and a drinking agreement/prescription, follow-up telephone interviews; **Comparator:** (N=71). General health booklet.	3 ,6, 12m ; TLFB	**Number of drinks in previous seven days:** I group, decreased from 15·54 (SD 7·65) to 9·31 (6·50) at three months to 10·05 (7·49) at six months and 9·92 (6·97) at 12 months; C: 16·58 (11·49) at baseline, 15·51 (11·37) at three months, 16·09 (12·71) at six months, 16·27 (12·17) at 12 months. Significant between groups at three, six, 12 months (p<0·001 for all)
Gordon 2003 [20] Post hoc analysis of RCT, US	65+	**Brief Motivational Enhancement intervention** (n=18). Verbal, visual techniques, discussion, setting goals; **Brief advice intervention** (n=12). Feedback from the assessment, health/social implications of drinking, advice to stop/reduce alcohol consumption; **Comparator:** Standard Care (n=12)	12m; TLFB	No significant differences between both I groups and C; but all groups decreased drinks/month.
Hansen 2012 [19] RCT, Denmark	60/59 (m/f)	**Intervention:** (N=391) Brief Motivational Interview (BMI) and telephone booster plus leaflets and information sheet; **Comparator**: (N=381) Same leaflets and information sheet as the intervention group.	6, 12m; Internet- Q	**No. of standard drinks in a typical week:** No significant differences between I and C groups or by gender.
Kuerbis 2015 [18] RCT, US	64·7 (8·4)	**Intervention**: (N=44) Brief mailed intervention with personalised mailed feedback outlining their specific risks associated with alcohol, educational booklets; **Comparator:** (N=42) No intervention.	3m; CARET	**Mean drinks per week:** No significant differences between I and C; **At-risk drinkers:** At 3 months, fewer intervention group participants than controls were at-risk drinkers (66% vs 88%; OR 0·32, p=0·05).
Moore 2011 [24] RCT, US	68·4 (6·9)	**Intervention:** (N=310) Personalised report (also given to the primary care provider), booklet on alcohol and aging, drinking diary, oral and written advice, telephone counselling using MI; **Comparator:** (N=321): General health advice booklet	3, 12m; CARET and TLFB	**No. of drinks in the past seven days:** I group consumed significantly fewer drinks at 3 months (RR 0·79 (0·70 to 0·90); p<0·001) and at 12 months (RR 0·86 (0·76 to 0·98; p<0·05).; **At-risk drinkers:** significantly lower proportion in the I group compared to C group at 3 months: 49·6% vs 61·2%; OR 0·45 (95% CI 0·28, 0·81; p<0·01); 12 months, not significant.
Oslin 2006 [25] RCT, US	72·0 (5·3)	**Intervention: Integrated care:** (N=280) Services integrated into primary care (including psychotherapy, case management, brief behavioural alcohol intervention using MI), workbook, drinking agreement. **Comparator: Enhanced referral: (**N=280) Community-based services in a separate location.	6m; Q	No significant between group differences in drinking or binge episodes at 6 months. **No. of drinks per week** : Integrated care: 18·1 (SD 10·6) at baseline to 11·8 (SD 11·8) at 6 months; enhanced referral from 17·5 (SD 11·3) to 11·4 (SD 10·7); p = 0·913 (between groups).
Schonfeld 2010 [14]; Before and after study, US	75.	**Intervention:** (N=102) Brief intervention: advice, education and motivational interviewing; future goals, health habits.	1,3m; AUDIT, SMAST-G.	**Mean SMAST-G score:** Change from baseline significantly diff between I and C: 1.70 +/- 2.52 (95% CI 1.00, 1.92; p<0.001); but from discharge to 30-day follow-up: not significant.
Watson 2013 [22] RCT, UK	63·0 (5·8)	**Intervention:** (N=266) **Stepped care:** behavioural change counselling, with motivational interviewing with referral to step 2(motivational enhancement therapy) and step 3(local specialist alcohol services) if indicated. **Comparator:** (N=263) **Brief minimal intervention:** including feedback of screening results.	6,12m; AUDIT-C, DPI	**Average drinks/day (ADD):** No significant differences in average drinks/day (ADD) between the groups at 6 or12 months :6 months, mean difference: -0·073 (–0·156 to 0·011); p = 0·088; 12 months mean difference: 0·025 (–0·062 to 0·112); p = 0·575.
*Harari 2008 [17] RCT, UK Multidomain	74	**Intervention:** Multi-domain health promotion study targeting a wide range of behaviours using a mailed health risk appraisal followed by computer-generated individualised written feedback to participants and GPs; **Comparator:** No intervention	12m; HRA-O	No significant difference between groups in people reporting 'no or moderate' alcohol use: 80·2% in the I group and 79·7% in the control group (OR: 1·1 (95% CI 0·8, 1·3); p=0·63).
*Vrdoljak 2014 [16]; RCT, Croatia Multidomain	72·3 (5·2)	**Intervention** (N=371): Lifestyle intervention, delivered by GPs, targeting a range of health behaviours: PA, smoking, alcohol; Included educational leaflets for their detected CV risk factors; follow-up appointment; **Comparator** (N=367): GP usual care	18m; Q	No significant difference between groups for alcohol consumption (χ^2 = 0.73, df = 1, p = 0.394) at the end of intervention.

N = number of participants in group; I = intervention; C = comparator; nr = not reported; OR = odds ratio; 95% CI = 95% confidence interval; MI = motivational interviewing; TLFB = Timeline follow back questionnaire; CARET = Comorbidity Alcohol Risk Evaluation Tool; CARPS = Computerised Alcohol-Related Problems Survey; AUDIT = Alcohol Use Disorders Identification Test; SMAST-G = Short Michigan Alcoholism Screening Test, Geriatric Version; DPI = Drinking problems index; HRA-O = Health risk appraisal for older persons questionnaire; Q = questionnaire; $\pm$ = All outcome data was self-reported.

Table 2. Alcohol consumption trends in control groups (for studies that report absolute measures of alcohol)

Study	Control group	Units (alcohol)	Alcohol consumption at baseline and follow-up							
			Baseline	SD / 95% CI	Three months	SD / 95% CI	Six months	SD / 95% CI	12 months	SD / 95% CI
Hansen 2012 (women)	Leaflets and information sheet	Mean drinks per week	21·3	20·2-22·4	NR	NR	15	13·5-16·5	14·9	13·4-16·4
Hansen 2012 (men)	Leaflets and information sheet	Mean drinks per week	32·6	30·9-34·3	NR	NR	24	21·8-26·1	23·4	21·3-25·4
Moore 2011	Booklet on healthy behaviour	Mean drinks in past seven days	15·2	7·4	10·73	8	NR	NR	10·7	8·4
Watson 2013	Brief advice intervention (5 mins)	Mean drinks/day	3·41	2·19	NR	NR	2·81	2·03	2·49	1·93
Fleming 1999	General health booklet	Number of drinks in previous seven days	16·58	11·49	15·51	11·37	16·09	12·71	16·27	12·17
Cucciare 2013	Usual care	Mean drinks per drinking day	4·8	4·1	3·5	2·3	4	3·4	NR	NR
Ettner 2014	Usual care	Mean drinks per week	13·9	8	NR	NR	12·24	NR	11·6	NR
Gordon 2003	Usual care	Mean drinks per month	61·9	NR	51·6	NR	50·1	NR	48·3	NR
Oslin 2006/Arean 2008	Enhanced referral	Number of drinks per week	17·5	11·3	NR	NR	11·4	10·7	NR	NR
Kuerbis 2015	No intervention (but alcohol intake assessed)	Mean drinks per week	14·4	7	13·5	6	NR	NR	NR	NR

Key: NR = not reported. SD = standard deviation. 95% CI = 95% confidence interval

Figure 1: PRISMA flow diagram for searches for primary studies and systematic reviews

```
┌─────────────────────────┐   ┌─────────────────────────┐
│   Database searches     │   │     Other sources       │
│   SRs 37799 records     │   │ (grey lit and cross-check│
│ Primary studies 82298   │   │     of reviews)         │
│      records            │   │    SRs 70 records       │
│                         │   │ Primary studies 1629    │
│                         │   │      records            │
└─────────────────────────┘   └─────────────────────────┘
             │                           │
             │                           │
             ▼                           ▼
        ┌──────────────────────────────────────┐
        │       After duplicates removed        │
        │        SRs 28434 records              │
        │   Primary studies 57142 records       │
        │        Total: 85576                   │
        └──────────────────────────────────────┘
                        │
                        ▼
   ┌──────────────────────────┐      ┌──────────────────────────────┐
   │     Records screened     │      │      Records excluded        │
   │    SRs 28434 records     │─────▶│  82503 SRs/primary studies   │
   │ Primary studies 57142    │      │                              │
   │      records             │      │ (most studies excluded as not│
   │     Total: 85576         │      │ relevant to alcohol; other   │
   │                          │      │ reasons for exclusion were:  │
   │                          │      │ not intervention studies; not│
   │                          │      │ older people)                │
   └──────────────────────────┘      └──────────────────────────────┘
                        │
                        ▼
   ┌──────────────────────────┐      ┌──────────────────────────────┐
   │ Full-text assessed for   │      │      Records excluded        │
   │      eligibility         │─────▶│  3060 SRs/primary studies    │
   │       SRs 1513           │      │                              │
   │   Primary studies 1560   │      │                              │
   │       Total: 3073        │      │                              │
   └──────────────────────────┘      └──────────────────────────────┘
                        │
                        ▼
   ┌──────────────────────────────────────────────────────────┐
   │  Included primary intervention studies (alcohol)          │
   │                                                            │
   │    Question 1 = 13 (prevention or reduction)              │
   │ Question 2 = 0 (prevention or reduction *with* cognitive/ │
   │                 dementia outcomes)                         │
   │                                                            │
   │          Included systematic reviews (alcohol)            │
   │                                                            │
   │       Q1 = 0 (prevention or reduction)                    │
   │  Q2 = 0 (prevention or reduction with cognitive/dementia  │
   │          outcomes)                                         │
   └──────────────────────────────────────────────────────────┘
                        │
                        ▼
   ┌──────────────────────────────────────────────────────────┐
   │   Primary studies included in meta-analysis               │
   │                                                            │
   │       Question 1 = 8 studies (9 datasets)                 │
   │                                                            │
   └──────────────────────────────────────────────────────────┘
```
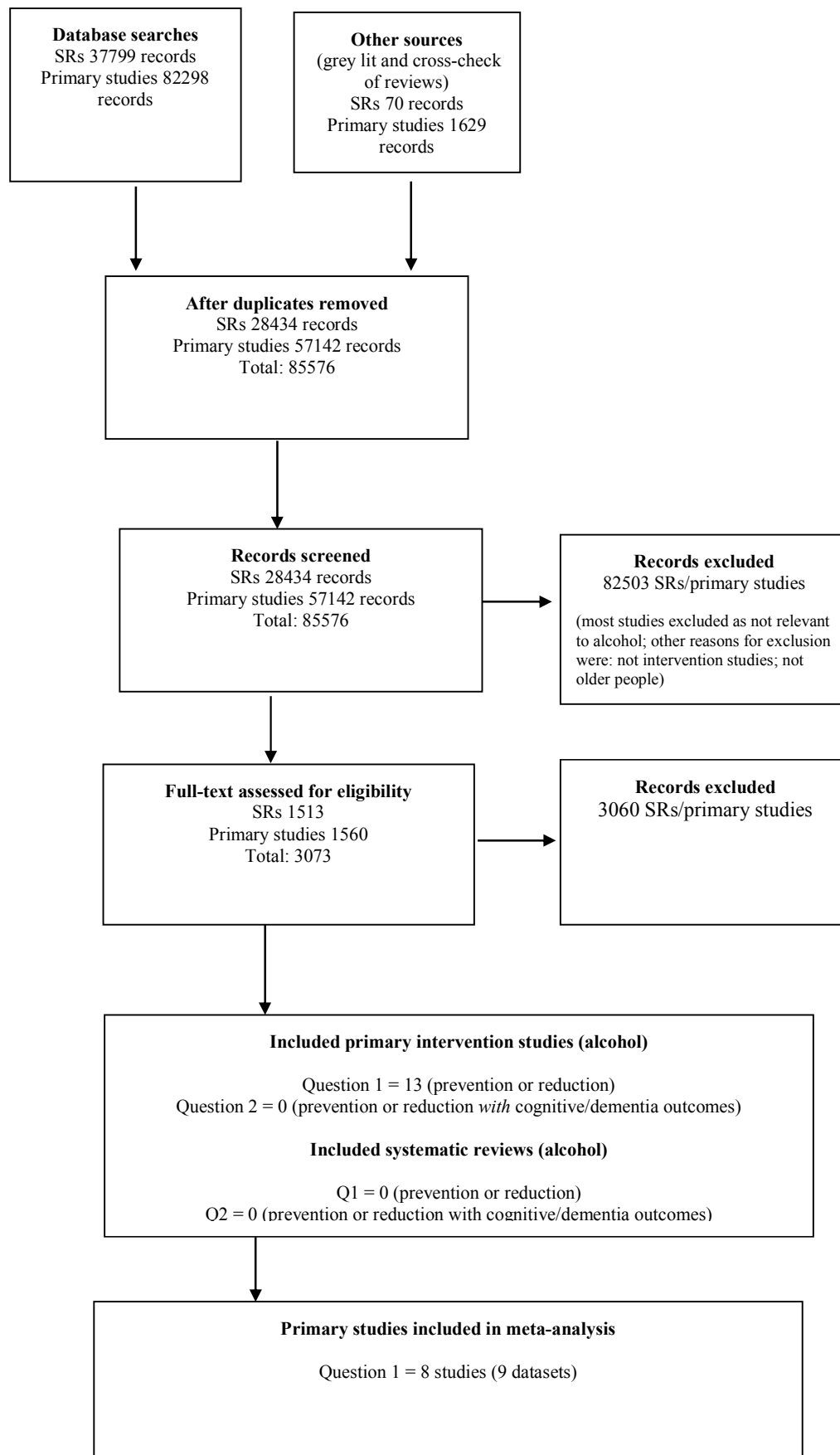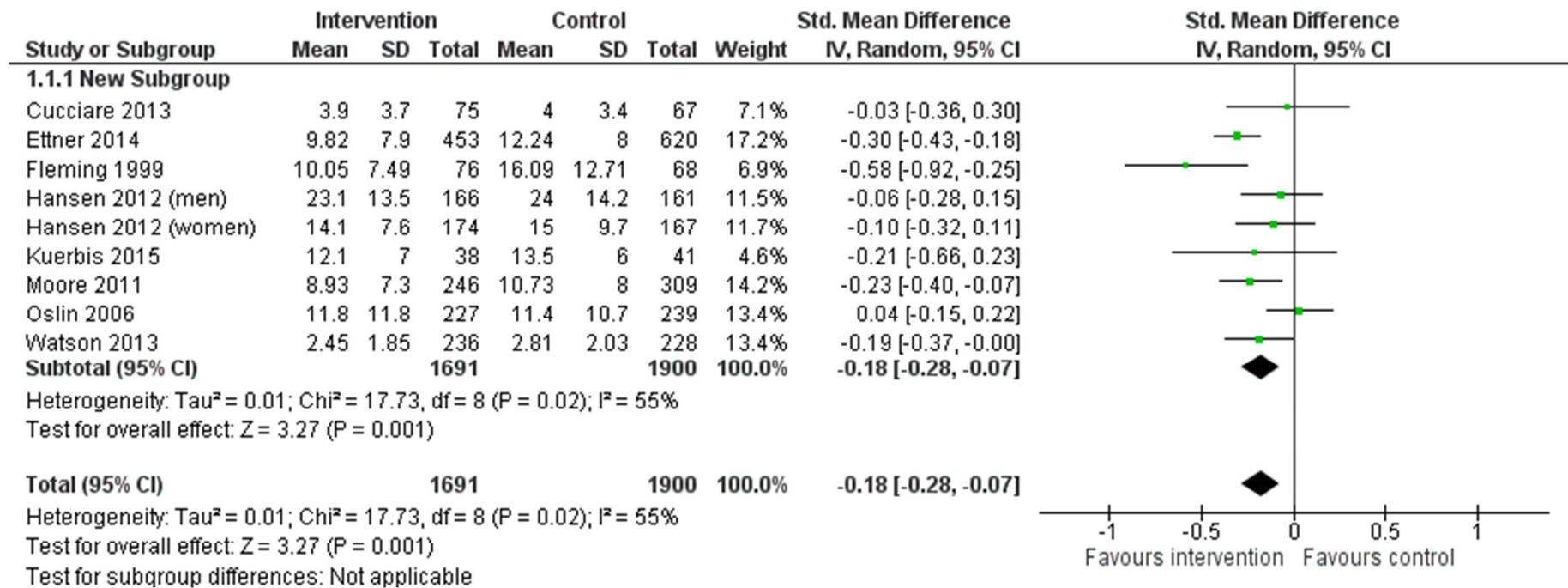
Figure 2. Forest plot[1,2,3] for alcohol consumption in intervention groups versus control groups at three[5] or six months[4] follow-up, in 'at-risk' populations

	Intervention			Control				Std. Mean Difference	Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
1.1.1 New Subgroup									
Cucciare 2013	3.9	3.7	75	4	3.4	67	7.1%	-0.03 [-0.36, 0.30]	
Ettner 2014	9.82	7.9	453	12.24	8	620	17.2%	-0.30 [-0.43, -0.18]	
Fleming 1999	10.05	7.49	76	16.09	12.71	68	6.9%	-0.58 [-0.92, -0.25]	
Hansen 2012 (men)	23.1	13.5	166	24	14.2	161	11.5%	-0.06 [-0.28, 0.15]	
Hansen 2012 (women)	14.1	7.6	174	15	9.7	167	11.7%	-0.10 [-0.32, 0.11]	
Kuerbis 2015	12.1	7	38	13.5	6	41	4.6%	-0.21 [-0.66, 0.23]	
Moore 2011	8.93	7.3	246	10.73	8	309	14.2%	-0.23 [-0.40, -0.07]	
Oslin 2006	11.8	11.8	227	11.4	10.7	239	13.4%	0.04 [-0.15, 0.22]	
Watson 2013	2.45	1.85	236	2.81	2.03	228	13.4%	-0.19 [-0.37, -0.00]	
Subtotal (95% CI)			**1691**			**1900**	**100.0%**	**-0.18 [-0.28, -0.07]**	

Heterogeneity: Tau² = 0.01; Chi² = 17.73, df = 8 (P = 0.02); I² = 55%
Test for overall effect: Z = 3.27 (P = 0.001)

Total (95% CI)			**1691**			**1900**	**100.0%**	**-0.18 [-0.28, -0.07]**	

Heterogeneity: Tau² = 0.01; Chi² = 17.73, df = 8 (P = 0.02); I² = 55%
Test for overall effect: Z = 3.27 (P = 0.001)
Test for subgroup differences: Not applicable

-1 -0.5 0 0.5 1
Favours intervention Favours control

[1]Summary statistic is standardised mean difference (SMD)

[2]Data presented for eight studies (nine datasets) that reported alcohol consumption as continuous outcome

[3]All 8 studies (9 datasets) included in the Forest plot were assessed as at 'Unclear' risk of bias.

[4] 6 month outcome data available for: Cucciare 2013, Ettner 2014, Fleming 1999, Hansen 2012, Oslin 2006, Watson 2013.

[5]Only 3 month outcome data available for: Kuerbis 2015, Moore 2011.

Supplement 1 - Example search strategies and grey literature sources

The alcohol searches were part of broader searches for a series of reviews covering a range of health behaviours. Searches were conducted in two stages 1) for relevant systematic reviews 2) for primary intervention studies using appropriate search filters (The InterTASC Information Specialists' Sub-Group Search Filter Resource **(**ISSG). https://sites.google.com/a/york.ac.uk/issg-search-filters-resource/. For intervention studies searches were conducted using the BMJ Clinical Evidence Filter and a filter for programme evaluation and intervention studies (University of Texas School of Public Health). For systematic reviews the SIGN filter was used.

Searches were conducted for 1) any existing systematic reviews 2) primary studies (primary intervention studies and primary qualitative studies – qualitative findings will be reported separately). Original searches were conducted in July-Nov 2015 and updated to November 2016.

1. Search dates

Database (source)	Search dates (systematic reviews)	Search dates (primary intervention and qualitative studies)
MEDLINE (Ovid SP)	21-11-2016	28-11-2016
EMBASE (Ovid SP)	21-11-2016	28-11-2016
PsycINFO (EBSCO host)	21-11-2016	28-11-2016
CINAHL (Cumulative Index to Nursing and Allied Health Literature) EBSCO host	21-11-2016	28-11-2016
CENTRAL (Cochrane Central Register of Controlled Trials) http://www.cochranelibrary.com/about/central-landing-page.html	21-11-2016	29-11-2016
Social Sciences Citation Index (Web of Science)	21-11-2016	29-11-2016
Cochrane Library http://www.cochranelibrary.com/	21-11-2016	N/A
York Centre for Reviews and Dissemination Health Technology Assessment (HTA); NHS Economic Evaluation Database (NHS-EED); Database of Abstracts of Reviews of Effectiveness (DARE) (Note: NHS-EED and DARE records only available up to 31-3-2015)	21-11-2016	N/A
Grey literature (searched for SRs and primary studies)	21-02-2017	

2. Example search strategy for MEDLINE for randomized controlled studies (for a range of health behaviour interventions including alcohol)

1. exp Health Behavior/

2. exp Risk Reduction Behavior/

3. exp Health Promotion/

4. exp Primary Prevention/

5. exp Preventive Medicine/

6. ((health$ adj3 behavior$) or behaviour$).ab,ti.

7. ((behavio?r$ or lifestyle or "lifestyle") adj3 (change$ or changing or modification or modify or modifying or therapy or therapies or program$ or intervention$ or counsel$)).ab,ti.

8. ((ageing or aging) adj3 (well or success$ or positive$ or active$ or healthy)).ab,ti.

9. ("health check" or "check up" or "check-up").ab,ti.

10. "health MOT".ab,ti.

11. "NHS check".ab,ti.

12. or/1-11

13. exp Diet/

14. *Food/

15. (diet or diets or dietary).ab,ti.

16. (dietary adj3 fat$).ab,ti.

17. salt$.ab,ti.

18. sugar$.ab,ti.

19. fruit$.ab,ti.

20. vegetable$.ab,ti.

21. (wholegrain or whole-grain or "whole grain" or "glyc?emic index").ab,ti.

22. (fish or "omega-3" or "omega-6" or "omega 3" or "omega 6" or (fish adj2 oil$)).ab,ti.

23. ("five a day" or "5 a day").ab,ti.

24. (fat$ adj3 (intake$ or diet$ or consum$)).ab,ti.

25. ((protein or carbohydrate$ or fibre or fiber) adj2 (intake$ or consum$ or diet$)).ab,ti.

26. ((energy or calorie$) adj2 (intake$ or consum$ or diet$)).ab,ti.

27. (vitamin$ adj3 (intake$ or consum$ or diet$)).ab,ti.

28. ((micronutrient or micro-nutrient or "micro nutrient") adj3 (intake$ or consum$ or diet$)).ab,ti.

29. nutrition.ab,ti.

30. *Food Habits/

31. *Food Preferences/

32. exp Nutrition Therapy/

33. or/13-32

34. eat$.ab,ti.

35. (over eat or "over eat" or overeat).ab,ti.

36. *Malnutrition/

37. malnutrition.ab,ti.

38. (undernutrition$ or undernourish$ or under-nutrition$ or under-nourish$).ab,ti.

39. (weight adj2 (gain$ or loss$ or cycling or reduc$ or maint$ or decrease$ or increas$ or watch$ or control$ or change$)).ab,ti.

40. ((bmi or "body mass index") adj2 (gain$ or los$ or cycling or reduc$ or maint$ or decrease$ or increas$ or watch$ or control$ or changes$)).ab,ti.

41. (obesity adj2 "related behaviour").ab,ti.

42. or/34-41

43. exp Exercise/

44. exp Sports/

45. *Exercise Therapy/

46. exp Physical Exertion/

47. exp "Physical Education and Training"/ or exp Physical Fitness/

48. exp running/ or exp swimming/ or exp walking/

49. exp Bicycling/

50. exp Dancing/

51. "tai chi".ab,ti.

52. tai ji/ or yoga/

53. "tai ji".ab,ti.

54. yoga.ab,ti.

55. ((center$ or centre$ or program$ or site$ or setting$ or venue$ or event$) adj3 (sport$ or exercise$ or fitness or training$ or activ$)).ab,ti.

56. exp Life Style/

57. exp Sedentary Lifestyle/

58. sedentary.ab,ti.

59. (exercis$ or sport$ or danc$ or run$ or walk$ or jog$ or garden$ or leisure or recreation$ or golf$ or tennis$ or badminton$ or bowl$ or curl$).ab,ti.

60. (bicycl$ or training or trainer$ or bik$ or wellness).ab,ti.

61. balanc$.ab,ti.

62. ((resistance or conditioning) adj2 training).ab,ti.

63. ((cardio$ or aerobic$) adj2 (sport$ or exercise$ or fitness or training$ or activ$)).ab,ti.

64. or/43-63

65. Smoking/

66. exp Smoking Cessation/

67. exp "Tobacco Use Cessation Products"/

68. (smok$ adj3 (cessation or cease$ or quit$ or stop$ or reduce$ or reduction)).ab,ti.

69. or/65-67

70. exp Drinking Behavior/

71. exp Alcohol Deterrents/

72. exp Temperance/

73. ((alcohol or drunk$ or drink$) adj3 (consum$ or misus$ or abuse$ or intoxicat$ or harmful or excess$ or binge$ or hazardous$ or heavy or temperance or abstinence)).ab,ti.

74. (temperan$ or teetotal$).ab,ti.

75. or/70-74

76. (cognit$ adj2 stimulat$).ab,ti.

77. cognit$ exercis$.ab,ti.

78. (cognit$ adj2 (stimulat$ or train$ or exercis$)).ab,ti.

79. (brain adj2 (stimulat$ or train$ or exercis$)).ab,ti.

80. puzzle$.ab,ti.

81. crossword$.ab,ti.

82. reading.ab,ti.

83. (intellect$ adj2 activit$).ab,ti.

84. or/76-83

85. (socialis$ or socializ$).ab,ti.

86. (social$ adj2 (activit$ or stimulat$)).ab,ti.

87. (social adj3 (isolat$ or network$ or contact$ or alienat$)).ab,ti.

88. lonel$.ab,ti.

89. exp Loneliness/

90. or/85-89

91. 12 or 33 or 42 or 64 or 69 or 75 or 84 or 90

92. vision tests/

93. Eyeglasses/

94. vision disorders/

95. computer terminals/

96. Asthenopia/

97. ((sight or eyesight or vision or eye$) adj2 (protect$ or maintain$ or maintenance)).ti,ab.

98. or/92-97

99. hearing tests/

100. hearing loss/

101. hearing aids/

102. ((hearing or noise$) adj2 (protect$ or maintain$ or maintenance)).ti,ab.

103. or/99-102

104. 91 or 98 or 103

105. "sun burn".ab,ti.

106. Sunburn/

107. Sunscreening agents/

108. (sun adj (light or exposure or overexposure or screen* or protect* or tan$)).ab,ti.

109. vitamin D.ab,ti.

110. Vitamin D/

111. or/105-110

112. 104 or 111

113. *Aged/

114. Retirement/

115. *Aging/

116. Geriatrics/

117. older.ab,ti.

118. elder$.ab,ti.

119. senior$.ab,ti.

120. geriatr$.ab,ti.

121. retir$.ab,ti.

122. ag?ing.ab,ti.

123. longevity.ab,ti.

124. "later life".ab,ti.

125. "randomized controlled trial".pt.

126. (random$ or placebo$ or "single blind$" or "double blind$" or triple blind$).ab,ti.

127. (retraction of publication or retracted publication).pt.

128. ((comment or editorial or meta-analysis or practice-guideline or review or letter or journal correspondence) not "randomized controlled trial").pt.

129. (random sampl$ or random digit$ or random effect$ or random survey$ or random regression).ab,ti.

130. controlled trial.pt.

131. 129 not 130

132. 125 or 126 or 127

133. 128 or 131

134. 132 not 133

135. or/113-124

136. 112 and 134 and 135

137. limit 136 to yr="2000 -Current"

138. Animals/

139. Humans/

140. 138 and 139

141. 138 not 140

142. 137 not 141

143. limit 142 to english language

3. For non-randomised studies, searches were as above to line 124 then the following filter for non-randomised studies was used:-

evaluation studies/ or evaluation studies as topic/ or program evaluation/ or validation studies as topic/ or ((pre-adj5 post-) or (pretest adj5 posttest) or (program* adj6 evaluat*)).ti,ab. or (effectiveness or intervention).ti,ab.

4. Grey literature sources searched and dates

Sites	Date	Refs	Date	Refs	TOTAL
Action on Hearing Loss	06.10.14	2	21.02.17	2	4
Alzheimer's Society	06.10.14	6	21.02.17	22	28

Beth Johnson Foundation	06.10.14	7	21.02.17	1	8
British Library	06.10.14	130	21.02.17	25	155
Campbell Collaboration	08.10.14	4	21.02.17	0	4
Cochrane	07.10.14	68	21.02.17	3	71
Department of Health	07.10.14	9	21.02.17	0	9
E-Print Network	21.10.14	42	21.02.17	3	45
Fight For Sight	07.10.14	0	21.02.17	0	0
Google Scholar	07.10.14, 08.10.14	360	21.02.17	52	412
Grey Literature Report	20.10.14	49	21.02.17	27	76
Health Evidence Canada	21.10.14	112	21.02.17	23	135
Lenus	21.10.14	58	21.02.17	17	75
NHS Evidence	21.10.14 22.10.14	208	21.02.17	14	232
NYAM	22.10.14	31	21.02.17	3	34
OAister	22.10.14	116	21.02.17	10	126
Open Grey	22.10.14, 27.10.14	67	21.02.17	0	67
Public Health Obs	27.10.14	12	21.02.17	0	12
Public Health Europe	27.10.14	44	21.02.17	2	46
RAND	27.10.14	159	21.02.17	5	164
RNIB	27.10.14	14	21.02.17	0	14
Science Direct	27.10.14, 28.10.14	156	21.02.17	42	198
WHO	28.10.14	26	21.02.17	4	30

Supplement 2. Alcohol intervention studies in older people: Further details of study characteristics and results

Study	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Key results	Risk of Bias
Cucciare 2013 [21] RCT	US	mean: 59 (SD15) (aimed to recruit a 'considerably older' sample)	Older US Military veterans who screened positive for alcohol misuse (AUDIT-C) at a routine primary care visit. **Setting:** Primary care **Gender:** 88% male **Ethnicity:** 58% white; 10% black; 7% Hispanic; 4% Asian Pacific Islander; 1% Native American. **SES:** Annual income: TAU: $57520; TAU +BAI: 61,643 (2007).	Brief web-delivered intervention using normative feedback plus treatment as usual (TAU+BAI) versus Treatment as Usual (TAU). **Intervention:** (N=78) Brief web-delivered intervention using normative feedback plus treatment as usual (TAU+BAI): 10-15 mins in length and included personalised feedback on: weekly use of alcohol and other substances; gender and age matched typical alcohol use from the general population; financial, social and health consequences of misusing alcohol; education on peak blood alcohol limit and tolerance; risk factors for unsafe drinking; self-reported motivation to change substance use. **Comparator:** (N=89) Treatment as usual (TAU).	**Follow-up:** three and six months **Loss to follow-up:** 0% (outcome data based on all those randomised). **Outcome measurement:** Self-reported (30 day Timeline Follow Back (TLFB)).	There were no significant differences between the groups for any alcohol outcome at any of the time points examined. However, within each group there was a significant reduction (p<0·05) in all alcohol outcomes reported (total number of drinking days, mean drinks per drinking day, % of heavy drinking days, severity of alcohol problems) from baseline to follow-up at three and six months. Mean drinks per drinking day in the TAU group reduced from 4.8 (SD 4.1) at baseline to 3.5 (SD 2.3) and 4.0 (SD 3.4) at three and six months respectively. In the TAU+BAI group, mean drinks/day reduced from 4.9 (4.9) to 4.1 (3.8) at three months and 3.9 (3.7) at six months.	Unclear
Ettner 2014[23] RCT (cluster randomised trial of 31 primary care providers and their patients at a community-based practice with seven clinics) Project SHARE – Senior Health and Alcohol Risk Education (Secondary analysis Duru 2015)	US	60+ mean 71 (SD 7·3)	At-risk older drinkers living in the community (identified by telephone and a baseline mailed survey). **Setting:** Primary care/community **Gender:** 65·7% male **Ethnicity:** 5·9% Latino; 94·1% non-Latino **SES:** Education: 3·2% less than high school; 10·5% high school graduate; 27·0% some college; 24·8% college graduate; 34·6% graduate degree.	**Intervention:** (N=546) Personalised reports, educational materials, drinking diaries, physician advice during office visits, and follow-up telephone counselling delivered by a health educator at two weeks, three and six months. **Comparator:** (N=640) Usual care (specific details varied but could include alcohol counselling).	**Follow-up:** three, six, and 12 months after baseline **Loss to follow-up** (12 months): Intervention: 19·6% Control: 4·7% **Outcome measurement:** Self-reported, Comorbidity Alcohol Risk Evaluation Tool (CARET).	**Mean drinks per week:** In the intervention group declined from 13·3 (7·9) at baseline to 9·82 at 6 months and 9·45 at 12 months. In the control group declined from 13·9 (8·0) at baseline to 12·24 at six months and 11·64 at 12 months (SD not reported for follow-up). **At risk drinking:** At six and 12 months, there were significantly greater reductions in at-risk drinking in the intervention groups compared to control: six months (60% vs. 72%; _p_ </= 0·01); 12 months (56% vs. 67%; _p_ </=·01). **Usual drinks per week:** The effects of the intervention on usual number of drinks per week reported by patients were significant at both six and 12 months (-2·42 and -2·19, respectively, p </=0·01). **Costs:** Average variable costs per patient were $31 for screening and $79 for intervention (2007).	Unclear
Fink 2005 [15] (RCT conducted in three primary care sites randomised by site)	US	65+ mean 76·6 SD 6·2	Older primary care patients who reported at least one alcoholic drink in the last three months. At baseline, 21% were harmful drinkers, and 26% were	Three arms of trial - Combined report versus Patient report versus Usual care. **Combined report intervention:** (N=212) participants and their GPs received a personalised report of their	**Follow-up:** 12 months **Loss to follow-up:** Usual care 6·7%; Patient report 6·1%; Combined report 6·6%.	**Drinks/week** In the combined report group compared to usual care, alcohol consumption decreased by 1·14 drinks per week (p<0·05) at 12 months. There was no statistically significant difference (p<0·05) between the	Unclear

Study	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Key results	Risk of Bias
			hazardous drinkers; 53% were non-hazardous drinkers. N=711 randomised, N=665 completed. **Setting:** Primary care **Gender:** 54% female (completers) **Ethnicity:** 88% non-Hispanic white; 4% Hispanic; 7% Asian American; 1% African American (completers). **SES:** Education: 9% no high school degree; 49% high school degree but no college degree; 42% with college degree.	drinking risks and education. **Patient report intervention:** (N=245) participants only received a personalised report of their drinking risks and education, but their physicians did not receive reports. **Comparator:** Usual care N=238: Neither the 12 participating physicians nor their patients received reports, and the patients did not receive any education during the study.	**Outcome measurement:** Computerised Alcohol-Related Problems Survey (CARPS).	patient report intervention and usual care in their changes in drinking from baseline to follow-up. **Lower-risk drinking** The patient report and combined report interventions were each associated with greater odds of lower-risk drinking at follow- up than usual care (OR 1·59 and 1·23, respectively, p<0·05 for each). Similar results were obtained when intention to treat analysis was used.	
Fleming 1999 [11] RCT Project GOAL - Guiding Older Adult Lifestyles	US	65+ (most aged 65-75)	Older adult problem drinkers identified by screening using modified Health Screening Survey, recruited from people with regularly scheduled appointments. **Setting:** Community based primary care practices (n=24) **Gender:** 66·5% male; 33·5% female **Ethnicity:** Not reported **SES:** 'Relatively well educated': '20% of women and 30% of men completed four or more years of college and higher proportions had some schooling beyond high school'.	**Intervention:** (n=87). Brief physician advice to reduce alcohol use plus same booklet as control group. Received two 10-15 minute physician delivered counselling sessions that included: a workbook with feedback on their health behaviours, information on prevalence of problem drinking, reasons for drinking and adverse effects of alcohol, drinking cues, diary cards and a drinking agreement in the form of a prescription. Follow-up telephone interviews at three, six, 12 months. Participants were paid $70 for completing the study procedures. **Comparator:** (n=71). Received a general health booklet. Note: control group were assessed for a range of health behaviours, not just alcohol.	**Follow-up:** three, six, 12 months **Loss to follow up:** intervention: 9·2%; control 5·7% **Outcome measurement:** Self-reported, interview using TLFB procedures. Family members contacted at 12 months to verify self-reports.	Analysis conducted only on those who completed. **Number of drinks in previous seven days:** intervention group, decreased from 15·54 (SD 7·65) to 9·31 (6.50) at three months to 10·05 (7·49) at six months and 9·92 (6·97) at 12 months; control: 16·58 (11·49) at baseline, 15·51 (11.37) at three months, 16·09 (12·71) at six months, 16·27 (12·17) at 12 months. Difference between groups was significant at three, six, 12 months (p<0·001 for all) **Binge drinking episodes in previous 30 days:** significant difference between groups at three, six, 12 months. **% binge drinking in previous 30 days:** significant difference between groups at three and 12 months. **% drinking excessively in previous seven days:** significant difference between groups at three, six, and 12 months.	Unclear
Gordon 2003 [20] (post hoc analysis by age of the Early Lifestyle Modification (ELM) programme RCT, Maisto 2001).	US	65+	Hazardous alcohol drinking elderly n=45; (analysis also compared with younger hazardous drinkers, n=256) **Setting:** Primary care. **Gender:** 87% male (elderly); 67% male (non-elderly)	Both intervention groups described as brief interventions. **ME Intervention:** Motivational Enhancement (n=18). Verbal and visual techniques were used and considerable time was given to discussing and setting goals. Each initial session was 45-60 mins, with two ten-15 min booster sessions at two and six weeks after the initial session. **BA Intervention:** Brief advice (n=12).	**Follow-up:** One year **Loss to follow up:** 0% (from baseline assessment to follow-up) **Outcome measurement:** Self-reported, Timeline Follow Back (TLFB) questionnaire	All three groups decreased the number of drinks per month, increased the number of days abstained, and reduced the number of days per month they drank. However, there were no significant differences between the intervention groups and standard care. The ME group decreased drinks/month from 60·7 at baseline to 29·6 at six months to 34·4 at 12 months. The BA group	High

Study	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Key results	Risk of Bias
			Ethnicity: 69% white, 29% African-American, 2% other. **SES:** 69% high school graduate.	One ten to 15 min session, focusing on feedback from the assessment questionnaire, health and social implications of patients drinking, and advice to stop or reduce alcohol consumption. Both brief interventions (ME and BA) were delivered by extensively trained researchers. The ME intervention was more intense, longer and more frequent than the BA. **Comparator:** Standard Care (n=12) (may have included the usual range of services in primary care or no discussion of alcohol use problems).		decreased drinks/month from 126·9 at baseline to 66·9 at six months to 58·6 at 12 months. The standard care group decreased drinks/month from 61·9 at baseline to 50·1 at six months to 48·3 at 12 months. (No SD data reported) There were no significant differences between the elderly group and a younger group for all three interventions.	
Hansen 2012 [19] RCT	Denmark	mean: 60 (men); 59 (women); range 48 to 65	Heavy drinkers (identified from a population survey). **Setting:** Community **Gender**: 49% men/51 % women in BMI group; 54% men/46 % women in control group. **Ethnicity:** Not reported **SES:** years of education: men: <10 yrs 5%; 10-12 yrs 28%; 13-14 yrs 24%; 15+ yrs 43%: women: <10 yrs 12%; 10-12 yrs 18%; 13-14 yrs 24%; 15+ yrs 46%.	**Intervention:** N=391. Brief Motivational Interview (BMI) (mean duration 11 mins) followed up by telephone booster (five mins) plus leaflets and information sheet about local alcohol treatment delivered by BMI trained research team. (Authors reported quality of BMI delivered was sub-optimal). **Comparator**: N=381. Control group received the same leaflets and information sheet as the intervention group.	**Follow-up:** Six and 12 months **Loss to follow-up:** (six months): Intervention: 12·5%; control 13·9%. (12 months): Intervention: 19·2%; control 21·3%. **Outcome measurement:** Self-reported, internet-based questionnaire.	**Mean drinks per week** **Women:** In the intervention group, drinks/week decreased from 19·9 (95% CI 19·1, 20·7) at baseline to 14·1 (12·9, 15·2) at 6 months to 14·5 (13.3, 15·8) at 12 months. In the control group, decreased from 21·3 (20·2, 22·4) at baseline to 15·0 (13·5, 16·5) at six months to 14·9 (13.4, 16·4) at 12 months. **Men:** In the intervention group drinks/week decreased from a mean baseline level of 31·1 (95% CI 29·6, 32·5) to 23·1 (95% CI 21·1, 25·1) at six months to 23·2 (21·2, 25·1) at 12 months. In the control group decreased from 32·6 (30·9, 34·3) at baseline to 24·0 (21·8, 26·1) at six months and 23·4 (21·2, 25·4) at 12 months. No significant differences between intervention and control based on intention to treat analysis. The intervention effect of the BMI was −1·0 drinks/week (95% CI: −2·15 to 0·23), but there were no significant differences between groups or by gender.	Unclear
Kuerbis 2015 [18] RCT (pilot) Co-morbidity Alcohol Risk Evaluation Study	US	50+ mean 64·7 (8·4)	Individuals aged 50 and older who were identified as at-risk drinkers according to the Comorbidity Alcohol Risk Evaluation Tool (CARET) **Setting**: Primary care **Gender:** 66% male **Ethnicity:** 88% white (non-Hispanic); 9% Hispanic; 2% other	**Intervention**: (N=44) Brief mailed intervention with personalised mailed feedback outlining their specific risks associated with alcohol use, educational booklets about alcohol, a $5 gift card (were told the study was testing whether giving information on healthy behaviours would help them reduce risks associated with alcohol use). **Control group:** (N=42) No intervention, received $5 gift card.	**Follow-up:** three months **Loss to follow-up:** Intervention: 13·6%; Control: 2·4% **Outcome measurement:** Self-reported, Comorbidity Alcohol Risk Evaluation Tool (CARET).	**Mean drinks per week:** decreased in the intervention group from 15·6 (8·8) to 12·1 (7·0); in the control group from 14·4 (7·0) to 13·5 (6·0) at three months. Between group difference was not significant. **CARET risk score**: declined in both groups. In the intervention group it declined from 2·6 (1·6) to 1·6 (1·7) and from 2·3 (1·3) to 2·1 (1·4) in the control group at three months but the intervention	Unclear

Study	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Key results	Risk of Bias
			SES: Education: high school or less 7%; technical or trade school 3%; some college 14%; college degree or higher 77%.			group had a statistically significantly greater decline than the control group (p<0·01). At three months, fewer intervention group participants than controls were at-risk drinkers (66% vs 88%; OR 0·32, p=0·05), binge drinking (45% vs 68%; OR 0·33, p=0·03), using alcohol with a medical or psychiatric condition (3% vs 17%; OR 0·28, p=0·12), or having symptoms of such a condition (29% vs 49%; OR 0·38, p=0·07).	
Moore 2011 Addiction [24] RCT Healthy Living as you Age study (HLAYA) (Secondary analyses: Lin 2010; Borok 2013)	US	55+ mean 68·4 (6·9); range 55-89	Older at-risk drinkers in primary care identified by the Comorbidity Alcohol Risk Evaluation Tool (CARET). N=631 randomised **Setting:** Primary care/community **Gender:** 71% male **Ethnicity:** 87% white (non-Hispanic); 8% Hispanic/Latino; 3% other. **SES: Education:** high school or less 23%; some college 31%; college degree or more 46%.	**Intervention (n=310)** Received a personalised report (also given to the primary care provider), booklet on alcohol and aging, drinking diary, oral and written advice from the primary care provider and telephone counseling from a health educator at two, four and eight weeks using motivational interviewing. **Control (n=321)** Received a booklet on with advice on recommended behaviours for alcohol, nutrition, exercise, medication use and smoking during an office appointment.	**Follow-up:** three and 12 months **Loss to follow-up:** (three months) Intervention: 21%; Control: 4%; (six months) Intervention: 28%; Control 7%. **Outcome measurement:** Self-reported, Comorbidity Alcohol Risk Evaluation Tool (CARET) and Timeline Follow Back (TLFB) questionnaire.	**The number of drinks in the past seven days** decreased from 15·1 (SD 7·2) in the intervention group to 8·9 (7·3) at three months and was 9·4 (8·0) at 12 months. In the control group it decreased from 15·2 (7·4) at baseline to 10·7 (8·0) at three months and was 10·7 (8·4) at 12 months. The intervention group consumed fewer drinks (in the past seven days) at three months (RR 0·79 (0·70 to 0·90; p<0·001) and at 12 months (RR 0·86 (0·76 to 0·98; p<0·05). **At-risk drinkers:** lower proportion of at-risk drinkers in the intervention group compared to the control group at three months: 49·6% vs 61·2%, odds ratio 0·45 (95% CI 0·28, 0·81; p<0·01). At 12 months the proportion of at-risk drinkers in the intervention group compared to control was 54·1% vs 59·9%, but the difference was not statistically significant: odds ratio 0·75 (95% CI (0·42 to 1·36). Similarly, at three months, there was less heavy drinking in the intervention group: odds ratio 0·45 (0·21 to 0·96; p<0·05) but this was not significant at 12 months.	Unclear
Oslin 2006 [25] RCT (multisite RCT in ten primary care clinics) PRISM-E study (Secondary analyses: Arean 2008; Bartels 2004; Zanjani 2006, 2008; Lee 2009; Gallo 2004)	US	65+ mean: 72·0 (SD 5·3)	Older primary care patients with at-risk drinking (assessed by questionnaire), identified from people who had a primary care appointment for any reason. **Setting:** Primary care **Gender:** 92% male **Ethnicity:** 70% white; 23·8% black; 3·5% Hispanic or Latino; 0·7% Asian	**Integrated care versus enhanced referral** **Intervention: Integrated care:** (N=280) Assigned to mental health services integrated into primary care clinic (services on site including psychotherapy, case management and a brief behavioural alcohol intervention based on harm reduction and MI), structured workbook on drinking and a drinking agreement. Trained staff delivered the intervention. **Comparator: Enhanced referral:** (N=280) Referred by primary care to a	**Follow-up:** Six months (post-randomisation) **Loss to follow-up:** (Six months): Integrated care: 18·1%; Enhanced referral: 14·6% **Outcome measurement:** self-reported questionnaire	Drinking declined in both intervention groups between baseline and 6 months. However, there were no statistically significant between group differences in drinking or binge episodes at 6 months. Number of drinks per week declined from 18·1 (SD 10·6) at baseline in integrated care to 11·8 (SD 11·8) at six months and from 17·5 (SD 11·3) at baseline in enhanced referral to 11·4 (SD 10·7) at 6 months; p = 0·913 (between groups).	Unclear

Study	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Key results	Risk of Bias
			SES: 78% had less than high school education level; 21% had 'limited finances'.	nurse or medical social worker model that linked patients to community-based services in a separate location (medication management, psychotherapy and alcoholics anonymous model treatment for heavy drinking).			
Schonfeld 2010 [14] Before and after intervention study Florida Brief Intervention and Treatment for Elders (BRITE) project	US	Mean age: 75.	**Population:** Older people who screened positive for alcohol misuse (screened for a range of substance misuse) **Setting:** Screening conducted at health fairs, retirement communities and senior housing sites. Interventions conducted at home, ageing services sites or medical settings. **Gender:** 69·5% female **Ethnicity:** 76·2% white; 17·1% black; 5·7% multiracial; 0·3% Asian **SES:** Education: less than high school diploma 28·9%; high school diploma 37·3%; some college 19·7%; undergraduate degree 14·1%.	**Intervention:** (N=102) Brief intervention (one-five x one-hour sessions): advice, education and motivational interviewing; future goals, health habits (exercise and use of tobacco, alcohol, medications, and drugs), education about older adults and alcohol, medication interactions and management; delivered by trained counsellors.	**Follow-up**: time from baseline to intervention discharge not reported; then optional 30 day and 90 day follow-up **Loss to follow-up:** 53·3% of those who received intervention did not complete intervention discharge. **Outcome measurement:** self-reported, telephone or in-person interviews, 3 questions from the AUDIT test and the ten-item Short Michigan Alcoholism Screening Test, Geriatric Version (SMAST-G).	Scores on the SMAST-G significantly decreased (t108=6·09; P<0·001) from initial screen to discharge. Means (SMAST-G) between I baseline and discharge were significantly different: 1.70 +/- 2.52 (95% CI 1.00, 1.92; p<0.001) but the means from discharge to 30-day follow-up were not significantly different. Among those who screened positive for alcohol problems on the baseline SMAST-G screen, only 18·9% were still positive at discharge and follow-up.	High
Watson 2013 [22] RCT (multi-centre) AESOPS trial	UK (England and Scotland)	55+ Mean age 63·0 (SD 5·8)	Older hazardous alcohol users in primary care scoring >8 on the Alcohol Use Disorders Identification Test (10-item) (AUDIT). N=529 randomised **Setting:** Primary care **Gender:** 80·3% male **Ethnicity:** Not reported **SES:** Education: 63·3% had post-school education; 44·4% had degree or professional qualification. Accommodation: 79·4% owner-occupied; 14·8% local authority/housing association; 5·4% private rented; 0·4% temporary.	Brief, minimal intervention vs stepped care. **Intervention:** (N=266) Stepped care: Received a 20-minute session of behavioural change counselling, with motivational interviewing with referral to step two (motivational enhancement therapy, three x 40 min sessions delivered by a trained therapist) and step three (local specialist alcohol services) if indicated (no limit on intensity or duration). Sessions were recorded and rated to ensure treatment fidelity. Delivered by nurses or other therapists. **Comparator:** (N=263) Brief minimal intervention: Received a five-minute brief advice intervention with the practice or research nurse involving feedback of the screening results and discussion regarding the health consequences of continued hazardous alcohol consumption.	**Follow-up:** Six, 12 months Minimal intervention: 11% at 6 months; 11·8% at 12 months. Stepped care intervention: 9·8% at six months; 13·2% at 12 months. **Outcome measurement:** Self-reported, AUDIT-Consumption (AUDIT-C), DPI (Drinking Problems Index); Quality-adjusted life-years (QALYs) (for cost–utility analysis derived from European Quality of Life-5 Dimensions); and health and social care resource use.	Both groups reduced alcohol consumption between baseline and 12 months. There were no significant differences in average drinks/day (ADD) between the groups at 12 months. **Average drinks/day (ADD)** In the stepped care group drinks/d decreased from 3·38 (SD 2·14) at baseline to 2·45 (SD 1·83) at six months to 2·56 (SD 2·09) at 12 months. In the minimal intervention group drinks/d decreased from 3·41 (SD 2·19) at baseline to 2·81 (SD 2·03) at 6 months to 2·49 (SD 1·93) at 12 months. At 6 months the mean difference between the groups (drinks/d) was -0·073 (–0·156 to 0·011); p = 0·088 At 12 months the mean difference between the groups (drinks/d) was 0·025 (–0·062 to 0·112); p = 0·575. **Screening costs:** Mean screening cost for every participant recruited into the trial was £5·52 (2010 costs). **Intervention costs:** No statistically significant difference in costs between	Unclear

Study	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Key results	Risk of Bias
						groups at six and 12 months. At 12 months, participants in the stepped care group incurred fewer costs, with a mean difference of –£194 (95% CI –£585 to £198), and had gained 0.0117 more QALYs (95% CI –0·0084 to 0·0318) than the control group.	

Multi-domain interventions that target a range of health behaviours, including alcohol (with separate alcohol outcomes)

Study	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Key results	Risk of Bias
Harari 2008 [17] RCT	UK	65+ (mean age 74)	Functionally independent community dwelling older people. **Setting**: Primary care/community **Gender:** 56·0 % female in intervention group and 52·9% female in control. **Ethnicity:** Not reported **SES:** Townsend score: intervention: 1·00 ± 2·93; control 0·86 ± 2·88 (higher score denotes higher social deprivation on scale of one-five)	**Intervention:** Multi-domain health promotion study targeting a wide range of behaviours using a mailed health risk appraisal followed by computer-generated individualised written feedback to participants and GPs. Health behaviours addressed: PA, diet, smoking, alcohol, seat belts when driving. Preventive care: BP, cholesterol, blood glucose, faecal occult blood test, influenza or pneumococcal vaccinations, dental, vision, hearing, mammography checks. **Comparator:** No intervention	**Follow-up:** One year **Loss to follow-up:** 0% (numbers analysed at baseline and follow-up the same) **Outcome measurement:** Self-reported, health risk appraisal for older persons (HRA-O) questionnaire.	Over the range of health behaviours or preventative health care measures in older people examined, there was minimal improvement in any health behaviour or uptake (except pneumococcal vaccination). At one year follow-up, there was no significant difference between groups in people reporting 'no or moderate' alcohol use - 80·2% of those in the intervention group and 79·7% of those in the control group (OR: 1·1 (95% CI 0·8, 1·3), p=0·63).	Unclear
Vrdoljak 2014 [16] RCT (multicentre, conducted in 59 general practices)	Croatia	65+ (Mean 72·3 (SD 5·2)	Croatian citizens aged 65+ years who visited their GP for any reason (those with life expectancy <6 months, severe dementia, severe mental illness, communication disability excluded). **Setting:** Primary care (General practice) **Gender:** 61% female **Ethnicity:** Not reported **SES:** 83·1% retired; 21·0 % average income; 31% somewhat below average; 30·7% considerably below average; 17.3% above average.	Lifestyle intervention that targeted a range of health behaviours: PA, smoking, alcohol, diet. **Intervention** (N=371): Intensified intervention delivered by GPs. Intervention participants were counselled and given a tailored life plan for adopting healthier behaviour. Each patient received educational leaflets for their detected CV risk factors and a specific appointment was given for the next follow-up visit. **Comparator** (N=367): Usual care of a GP: GPs were not instructed to give any specific intervention.	**Follow-up:** 18 months **Loss to follow-up:** Of those completing the baseline survey for alcohol (n=104), 97·1% completed the follow-up survey. However, only 29% of participants at baseline completed the alcohol questions. **Outcome measurement:** Self-reported, questionnaire	Outcomes reported separately for each health behaviour, including alcohol. There was no significant difference between groups for alcohol consumption (chi-squared = 0·73, df = 1, p = 0·394) at the end of intervention. Note: it may not have been the same people who completed alcohol questions at baseline and follow-up. (Also no significant differences between the intervention and control groups for physical activity (chi-squared = 0·84, df = 1, p = 0·36), smoking (chi-squared = 0·85, df = 2, p = 0·65) at the end of the study). The number of participants who drank excessively or moderately was not significantly reduced at 18-month follow-up in control and intervention group (chi-squared = 1, p = 0·25).	High

Supplement 3. Excluded studies and reason for exclusion

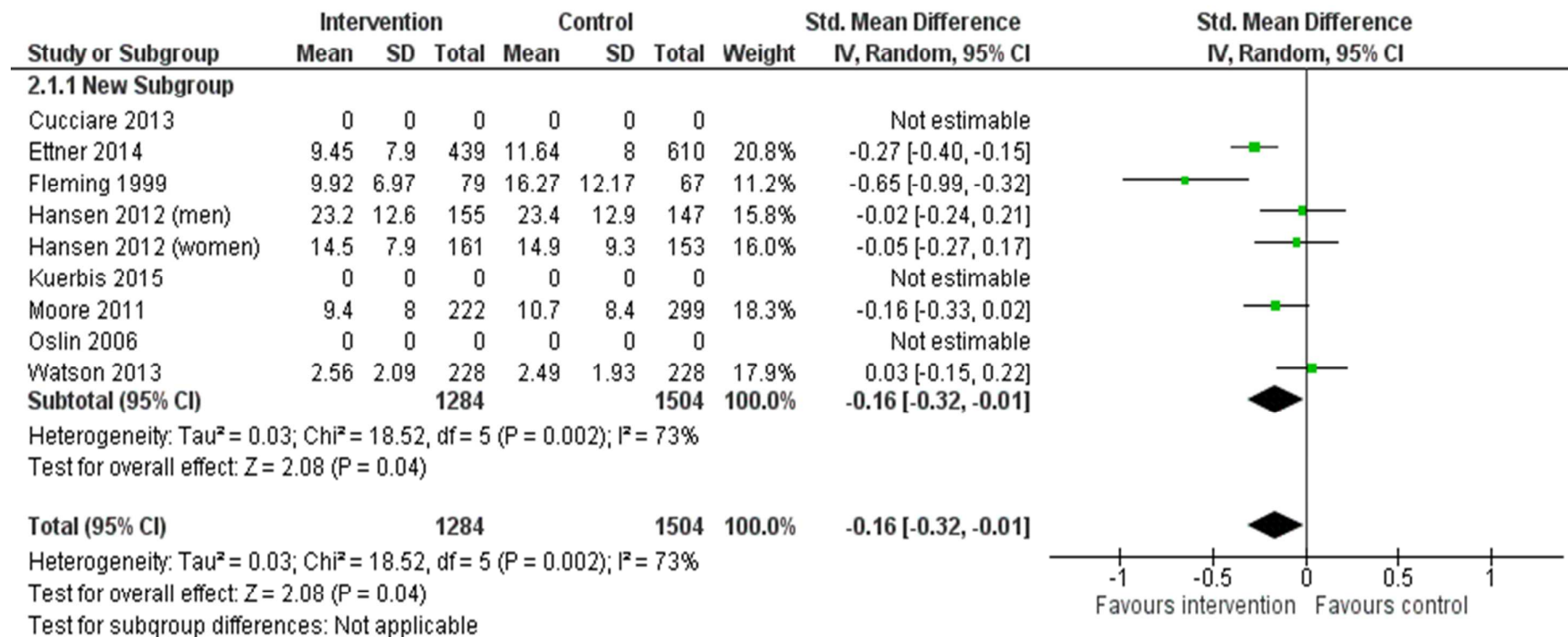Only excluded studies relevant to alcohol reported below: searches included a range of health behaviours.

Systematic Reviews

Study	Reason excluded
Anderson P, Scafato E, Galluzzo L.Alcohol and older people from a public health perspective. *Annali dell'Istituto Superiore di Sanità* 2012; **48**:232–47.	Most studies referenced are observational studies. Checked for relevant primary intervention study references. Included in discussion section of paper.
Jonas DE, Garbutt JC, Amick HR, et al. Behavioral counseling after screening for alcohol misuse in primary care: a systematic review and meta-analysis for the US Preventive Services Task Force. *Annals of Internal Medicine* 2012; **9**:645–54.	No specific analysis for older people. Checked for relevant primary studies. Included in discussion section of paper
Kaner EF, Beyer F, Dickinson HO, et al. Effectiveness of brief alcohol interventions in primary care populations. *Cochrane Database of Systematic Reviews* 2007; CD004148.	No specific analysis for older people. Reports lack of studies for older adults. Checked for relevant primary studies. Included in discussion section of paper
O'Donnell A, Anderson P, Newbury-Birch D, et al. The impact of brief alcohol interventions in primary healthcare: a systematic review of reviews. *Alcohol and Alcoholism* 2014; **49**:66–78.	Review is not specifically in older population (but reports separately for different population groups). Reports lack of studies in older adults. Checked for relevant studies. Included in discussion section of paper.
Whitlock EP, Polen MR, Green CA, Orleans T, Klein J. Behavioral counseling interventions in primary care to reduce risky/harmful alcohol use: a summary of the evidence for the US Preventive Services Task Force. *Annals of Internal Medicine* 2004*;* **7**:557–68	No specific analysis for older people. Checked for relevant primary studies. Included in discussion section of paper

Primary Studies

Study	Reason excluded
Barnes AJ, Xu H, Tseng CH, et al. The Effect of a Patient-Provider Educational Intervention to Reduce At-Risk Drinking on Changes in Health and Health-Related Quality of Life Among Older Adults: The Project SHARE Study. *Journal of Substance Abuse Treatment* 2016; **60**:14–20.	No alcohol outcomes. Further paper from the included study Ettner 2014 - Project SHARE.
Boissoneault J, Lincoln L, Prather R, Nixon SJ. Acute moderate alcohol effects on working memory function in older and younger social drinkers. *Alcoholism: Clinical and Experimental Research* 2013; **37**:272A.	Acute effects only
Boissoneault J, Sklar A, Prather R, Nixon SJ Acute effects of moderate alcohol on psychomotor, set shifting, and working memory function in older and younger social drinkers. Journal of Studies on Alcohol and Drugs 2014;**75**:870.	Acute effects only
Coogle CL, Owens MG. Screening and brief intervention for alcohol misuse in older adults: Training outcomes among physicians and other healthcare practitioners in community-based settings. *Community Mental Health Journal* 2015; **51**:546–53.	Intervention not in older adults – aimed at healthcare practitioners
Copeland A, Blow C, Barry KL. Health Care Utilization by Older Alcohol-Using Veterans: Effects of a Brief Intervention to Reduce At-Risk Drinking. *Health Education & Behavior* 2003; **30**:305.	Not alcohol outcomes
Dhital R, Norman I, Whittlesea C, Murrells T, McCambridge J. The effectiveness of brief alcohol interventions delivered by community pharmacists: randomized controlled trial. *Addiction* 2015; **110**:1586–94.	Intervention not specifically older people – general population
D'Onofrio G, Pantalon MV, Degutis LC, et al. Brief Intervention for Hazardous and Harmful Drinkers in the Emergency Department. *Annals of Emergency Medicine* 2008; **51**:742–50.	Not older people
Enggasser JL, Hermos JA, Rubin A, et al. Drinking goal choice and outcomes in a Web-based alcohol intervention: results from VetChange. *Addictive Behaviors* 2015; **42**:63–8.	Not older people
Gavens L, Goyder E, Hock ES, Harris J, Meier PS. Alcohol consumption after health deterioration in older adults: a mixed-methods study. *Public Health* 2016; **139**:79–87.	Not intervention study
Hilbink M, Voerman G, Van Beurden I, Penninx B, Laurant M. A randomized controlled trial of a tailored primary care program to reverse excessive alcohol consumption. *Journal of the American Board of Family Medicine* 2012; **25**:712–22.	Not older people
Boissoneault J, Sklar A, Prather R, Nixon SJ Acute effects of moderate alcohol on psychomotor, set shifting, and working memory function in older and younger social drinkers. Journal of Studies on Alcohol and Drugs 2014;**75**: 870.	Acute effects only

Supplement 4. Forest plot[1,2,3] for alcohol consumption in intervention groups versus control groups at 12 months follow-up in 'at-risk' populations

Study or Subgroup	Intervention Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
2.1.1 New Subgroup								
Cucciare 2013	0	0	0	0	0	0		Not estimable
Ettner 2014	9.45	7.9	439	11.64	8	610	20.8%	-0.27 [-0.40, -0.15]
Fleming 1999	9.92	6.97	79	16.27	12.17	67	11.2%	-0.65 [-0.99, -0.32]
Hansen 2012 (men)	23.2	12.6	155	23.4	12.9	147	15.8%	-0.02 [-0.24, 0.21]
Hansen 2012 (women)	14.5	7.9	161	14.9	9.3	153	16.0%	-0.05 [-0.27, 0.17]
Kuerbis 2015	0	0	0	0	0	0		Not estimable
Moore 2011	9.4	8	222	10.7	8.4	299	18.3%	-0.16 [-0.33, 0.02]
Oslin 2006	0	0	0	0	0	0		Not estimable
Watson 2013	2.56	2.09	228	2.49	1.93	228	17.9%	0.03 [-0.15, 0.22]
Subtotal (95% CI)			1284			1504	100.0%	-0.16 [-0.32, -0.01]

Heterogeneity: Tau² = 0.03; Chi² = 18.52, df = 5 (P = 0.002); I² = 73%
Test for overall effect: Z = 2.08 (P = 0.04)

Total (95% CI)			1284			1504	100.0%	-0.16 [-0.32, -0.01]

Heterogeneity: Tau² = 0.03; Chi² = 18.52, df = 5 (P = 0.002); I² = 73%
Test for overall effect: Z = 2.08 (P = 0.04)
Test for subgroup differences: Not applicable

[1]Summary statistic is standardised mean difference (SMD)

[2]Data presented for five studies (six datasets) that reported alcohol consumption as continuous outcome

[3]All 5 studies (6 datasets) included in the Forest plot were assessed as at 'Unclear' risk of bias.

Supplement 5. Risk of bias assessment for included studies

	Selection bias				Performance bias				Attrition bias				Detection bias						Summary Risk of Bias
	A1	A2	A3	Overall	B1	B2	B3	Overall	C1	C2	C3	Overall	D1	D2	D3	D4	D5	Overall	
RCTs																			
Oslin 2006/ Arean 2008	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	Yes	Low	Yes	Yes	Unclear[1]	No	No	Unclear	**Unclear**
Cucciare 2013	Yes	Unclear	Yes	Unclear	Yes	No	N/A	Unclear	Yes	Yes	Yes	Low	Yes	Yes	Unclear[1]	Yes	Unclear	Unclear	**Unclear**
Ettner 2014	Yes	Unclear	Yes	Unclear	Yes	No	Unclear	Unclear	Yes	Unclear	Unclear	Unclear	Yes	Yes	Unclear[1]	Yes	Unclear	Unclear	**Unclear**
Hansen 2012	Yes	Yes	Yes	Low	Yes	No	No	Unclear	Yes	Yes	Yes	Low	Yes	Yes	Unclear[1]	No	Unclear	Unclear	**Unclear**
Kuerbis 2015	Yes	Unclear	Yes	Low	Yes	Unclear	Unclear	Unclear	Yes	Unclear	Unclear	Unclear	Yes	Yes	Unclear[1]	Unclear	Unclear	Unclear	**Unclear**
Moore 2011	Yes	Yes	Yes	Low	Yes	Yes	Unclear	Low	Yes	Unclear	Unclear	Unclear	Yes	Yes	Unclear[1]	Yes	Unclear	Unclear	**Unclear**
Watson 2013	Yes	Yes	Yes	Low	Yes	No	No	Unclear	Yes	Yes	Yes	Low	Yes	Yes	Unclear[1]	Unclear	Unclear	Unclear	**Unclear**
Fink 2005	Unclear	Unclear	Yes	Unclear	Yes	Yes	Unclear	Unclear	Yes	Yes	Yes	Low	Yes	Yes	Unclear[1]	Unclear	Unclear	Unclear	**Unclear**
Fleming 1999	Unclear	Unclear	Yes	Unclear	Yes	Unclear	Yes	Low	Yes	Yes	Yes	Low	Yes	Yes	Unclear[1]	Yes	Unclear	Unclear	**Unclear**
Gordon 2003	Yes	Unclear	Unclear	Unclear	Yes	No	No	Unclear	Yes	Yes	Yes	Low	Yes	Yes	Unclear[1]	Unclear	Unclear	Unclear	**Unclear**
Vrdoljak 2014	Yes	Unclear	Unclear	Unclear	Unclear	Yes	Yes	Unclear	Yes	Unclear	Unclear	Unclear	Yes	No	No	Unclear	Unclear	High	**High**
Harari 2008	Yes	Unclear	Yes	Unclear	Yes	No	Unclear	Unclear	Yes	Yes	Yes	Low	Yes	Unclear	Unclear[1]	Unclear	Unclear	Unclear	**Unclear**
Non-randomised studies																			
Schonfield 2010 (before and after study)	No	No	N/A	High	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Unclear	Yes	Unclear[1]	N/A	N/A	Unclear	**High**

[1] = Self-reported outcomes; N/A = Not applicable