



# A systematic review of alcohol interventions for people living with and beyond cancer

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## EXECUTIVE SUMMARY

There is a wealth of evidence pointing to the link between drinking alcohol and the development of cancer. However, there is also evidence suggesting that people diagnosed with cancer continue to live unhealthy lifestyles by drinking more than the recommended intake for alcohol. This has the potential to increase the risk of cancer recurrence, or expedite the development of new cancers. Approximately one in two people diagnosed with cancer will now survive for more than five years. This has led to a growing research interest in delivering healthy lifestyle interventions for cancer patients to reduce their risk of future cancers. However, previous research has been primarily focused around developing interventions for improving diet and physical activity, with limited research focussing specifically on alcohol use.

This study describes a systematic review of the literature outlining the impact of lifestyle interventions on alcohol use following a diagnosis of cancer. Our search strategy consisted of online searches of electronic databases which catalogue the results of published peer-reviewed research, and reports by health organisations, local authorities, and charities. In order to be eligible, an article had to describe a lifestyle, or medical intervention, and report if there were any changes to alcohol use following the intervention. The searches identified 19,579 potentially relevant articles. Initially the title and abstract of each article was screened to ascertain whether they should be included in the review. This reduced the number of potentially relevant articles to 94. Following this, the full texts of each of the 94 articles was obtained and assessed before a final decision was made. This resulted in seven articles being eligible for inclusion in this systematic review.

The results of this review found that no studies specifically focussed on alcohol use, instead they tended to focus on healthy eating and physical activity interventions. Only one article reported a reduction in alcohol intake with participants who received the intervention compared to those who did not. A number of articles described studies where the authors found that alcohol use reduced over time for all participants, whether they received the intervention or not. Furthermore, the vast majority of participants across the studies were white women who had received a diagnosis of breast cancer. This suggests that the results of these studies may lack generalisability across all cancer patients. The mixed impact on alcohol intake, as well as the lack of diversity of included participants suggests that further research is needed to determine whether or not interventions can have an impact on alcohol intake following a cancer diagnosis.

## INTRODUCTION

It has been widely reported that risky drinking causes a significant strain on the National Health Service (NHS) in the United Kingdom (UK), in terms of hospital admissions and treatment costs, with estimations reporting that it costs upwards of £3.5 billion per year to treat alcohol related problems (Williams et al, 2014). In 2013/2014, 71% of NHS hospital admissions were linked to alcohol consumption (Health and Social Care Information Centre, 2015). Risky drinking is generally defined in relation to harmful drinking – levels of consumption that increase the chance of developing health issues; hazardous drinking – levels of consumption that has already caused such problems; and binge drinking – heavy episodic consumption (Wilson et al, 2012).

Forming part of the UK Governments NHS Mandate 2016-2017 is the commitment to improving diagnosis, treatment and outcomes for cancer patients (Department of Health, 2014). There is a further commitment by the NHS to address lifestyle behaviours such as risky drinking (NHS, 2015). Indeed, the NHS Commissioning Board highlights that care for cancer patients falls short, and the Cancer Taskforce calls for a new alcohol strategy given its role in prevention and public health (Independent Cancer Taskforce, 2015). The Cancer Strategy for England 2015-2020 has identified that progress has been made in developing interventions to support people living with and beyond cancer, but that this needs to be taken forward, in part, to reduce costs related to recurrence of cancers (National Cancer Survivorship Initiative, 2013; McMillan Cancer Support, 2014; Independent Cancer Taskforce, 2015). The Five Year Forward Plan (NHS, 2015) identifies one of the six strategic priorities to be around improving public health in order to prevent cancer. Underpinning this is a commitment to encourage public awareness of behavioural causes of cancer.

The association between lifestyle behaviours, such as risky alcohol consumption, and certain cancers are long established (International Agency for Research on Cancer, 1988; Kohl et al, 1988; Block et al, 1992; Proctor, 2012; Stirling University, 2013; Alcohol Health Alliance, 2013; Public Health England, 2014). Despite this, evidence suggests that many cancer patients continue to engage in risky lifestyle behaviours following treatment (Demark-Wahnerfried et al, 2008). With approximately one in two people in the UK surviving cancer for five years or more (Cancer Research UK, 2017) there has been growing interest in delivering healthy lifestyle interventions for those living with and beyond cancer (Blancard et al, 2008) as continuing to engage in such behaviours is associated with increased psychological distress (Kugaya et al, 2000), depression (McCaffrey et al, 2007) and can increase the risk of recurrent or secondary cancers (Independent Cancer Taskforce, 2015), and mortality (Trichopoulou et al, 2003).

However, whilst there is a wealth of research looking at adherence to smoking cessation (Demark-Wahnerfried et al, 2000), physical activity guidelines

(Blanchard et al, 2008) and healthy eating (Robien et al, 2008) amongst those living with and beyond cancer, there is limited research on the prevalence of risky drinking post-cancer diagnosis with estimates of between 18% (Duffy et al, 2002) and 33% (Kugaya et al, 2000) compared to 24% in the general population (Webber, 2012). Where research does exist it often focuses on risky drinking pre-diagnosis (Chow et al, 2001; Barclay et al, 2014), and on quantitative, self-report measures of alcohol use, often failing to consider in-depth personal views of cancer patients and their reasons for using alcohol. Even small decreases in alcohol intake by cancer patients can decrease the risk of further cancer (Kwan et al, 2010; Fazzino et al, 2016) indeed, four in 10 cancers could be prevented by modifying lifestyle behaviours (Parkin et al, 2011). Therefore, encouraging people living with and beyond cancer to consider their levels of alcohol consumption is an important step in reducing the risk of developing recurrent, or secondary cancers, as well as to lower mortality rates (Duffy et al, 2002; Trichopoulou et al, 2003).

Whilst there is little research specifically looking at risky drinking in this population, that research which looks at healthy lifestyle interventions for people living with and beyond cancer may exert a subsequent effect on alcohol use. Therefore, the main aim of this systematic review was to synthesise the evidence from the literature relating to the impact of healthy lifestyle interventions on reducing alcohol consumption for people living with and beyond cancer.

## METHODS

### Literature search design and strategy

This systematic review is reported in line with standard procedures from the Preferred Reporting Items for Systematic Reviews (PRISMA) (Liberati et al, 2009). The following electronic databases of peer reviewed literature were searched: SCOPUS, MEDLINE and ProQuest. In addition, electronic databases of unpublished grey literature were searched including: MEDNAR and Google Scholar. Searches were limited to include human studies that had been published in any language after 1988, the year in which alcohol was categorised as a class one carcinogen (International Agency for Research on Cancer, 1988). The search strategy combined relevant terms for 'cancer' 'alcohol use' and 'intervention', Table 1 outlines an example of the search terms used.

Following screening, the reference list of all articles which met the inclusion criteria for this review were hand searched for further relevant articles.

### Selection criteria

Articles were eligible if they described studies which recruited patients diagnosed with cancer, who were over the age of 16 at the time of the study, included a psycho-social, behavioural, or medical intervention, and reported alcohol use pre- and post-intervention. Articles outlining studies which included both non-cancer patients and cancer patients, or children under the age of 16 as well as those over the age of 16 were eligible, as long as data could be separated. Articles reporting quantitative and qualitative methods were eligible, as was any study design. Editorials, conference abstracts or unpublished theses were excluded as they often lack peer review, and often precede a later publication of the full study, thus increasing risk of duplication.

Articles detailing studies which included palliative care patients, or only family members of cancer patients, were also excluded. The inclusion and exclusion criteria for this review is fully described in Table 2 below.

### Article selection and data collection

After excluding duplicates, the titles and abstracts of all retrieved articles were screened by two independent researchers (GJM & DNB). A double sift was conducted on 20% of eligible titles and abstracts by two researchers (DNB & JF).

The full texts of remaining articles were independently screened by two researchers (GJM & ELG) to identify those meeting the inclusion criteria. A double sift was conducted on 100% of eligible articles by two independent

researchers (JF & GW). Any disagreements between sifters and double sifters was agreed by consensus.

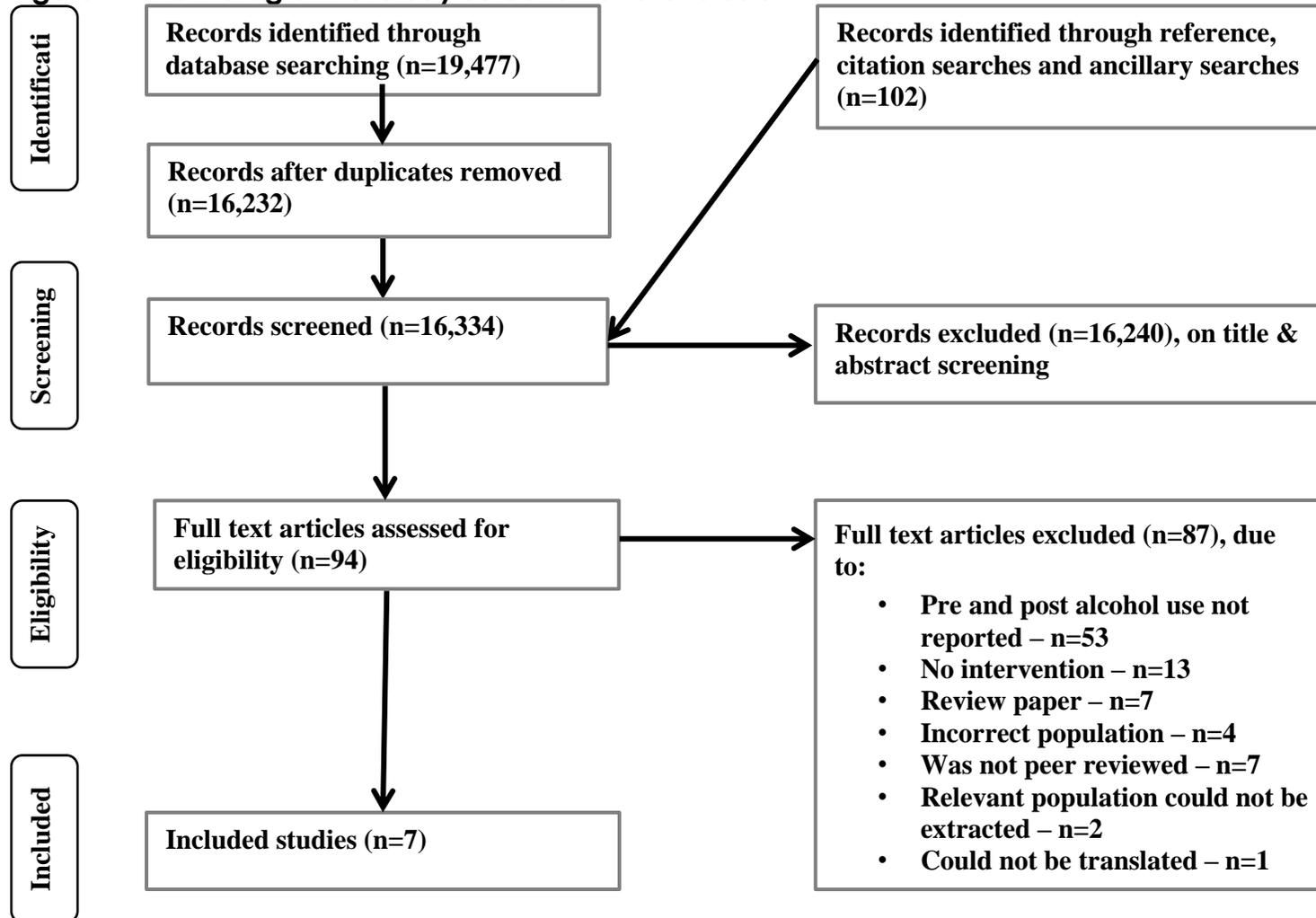
Data was extracted independently by two researchers (GJM & ELG) using a data extraction table designed for this purpose. The information extracted was: bibliographical data; participant characteristics; intervention type; comparator group; primary outcomes; secondary outcomes; study design; and results. Any disagreements were resolved by discussion until consensus was reached. Each article was assessed for quality using the relevant Critical Appraisal Skills Programme (CASP) checklist for randomised controlled trials (RCT's) (CASP, 2017a), or cohort studies (CASP, 2017b). Each article was quality assessed by two independent researchers (either GJM &GW or GJM &ELG) with any discrepancies resolved by a third reviewer (JF).

## RESULTS

### Overview of results

The searches identified a total of 19,579 potentially eligible articles, of which seven met the inclusion criteria and thus are included in this review (see Figure 1 below) (Duffy et al, 2006; Hawkes et al, 2009; Flatt et al 2010; Hawkes et al, 2013; Grimmitt et al, 2015; Fazzino et al, 2016; Greenlee et al 2016). The key characteristics and main findings of all included articles are detailed in Table 3 below, and the quality assessment of these articles is included in Tables 4 and 5. A summary of the main findings is outlined below.

**Figure 1 – Flow diagram of study selection and exclusion.**



**Table 1: Search Terms**

alcohol consumption	Participants	psychosocial	any	alcohol outcomes (see far left column)	any	RCT
alcohol misuse	PATIENTS	psycho-social				randomi* controlled trial
alcohol abuse	STAFF	medical				case control
alcohol intoxication	Cancer	complimentary				Cohort
alcohol drinking	Carcino*	CBT				quasi*
alcohol use disorder	Carcinoma	cognitive behavio*				controlled before and after
alcohol disorder	Cytology	meditation				CBA
alcohol dependence	Hodgkin	therap*				
binge drinking	Leukaemia	lifestyle				
binging near alcohol	Lympho*	counsel*				
occasion drinking	Malignan*	brief advice				
social drinking	Melanoma	Alcohol screening and brief advice				
risky drinking	metasta*	Alcohol screening and brief intervention				
drinking near occasion	Neoplasm	ASBI				
intoxicate*	Oncology	early intervention				

alcoholism	Sarcoma	brief intervention				
alcoholic	Tumo*	alcohol therapy				
drunk		lifestyle intervention				
booze						
alcoholic beverage						
beverage						
drunk*						
pissed						
wrecked						
smashed						

**Table 2: Inclusion and Exclusion Criteria**

INCLUSION	EXCLUSION
Patients who have cancer OR patients who are recovering from cancer	Pre and post alcohol use not reported
Any intervention: including alcohol specific interventions and psycho-social, behavioural or drug interventions	Palliative care patients
Drug treatment (for alcohol – such as naltrexone)	Intervention with family or caregivers of cancer patients only
Setting: Any	Books or book chapters
If part of a larger study where alcohol is a secondary outcome for example an exercise and diet intervention where pre and post alcohol use is reported	Conference proceedings
Include studies with a mixed group (cancer and non-cancer patients) if data on alcohol use for those with cancer can be separated.	Published before 1988
Dissertations	Protocols
	Cancer Patients under 18 at the time of the study

**Table 3: Characteristics and results from included studies**

Author (Year) [Country]	Study Type	Number of participants (% randomised)	Mean Age (Range)	Site	%female	%white	Intervention	Outcome Measure	Results
Duffy et al (2006) [USA]	RCT	184 (50.5%)	57 (not reported)	Head and Neck	16%	90%	Telephone based Cognitive Behavioural Therapy and pharmacological management	AUDIT	32% of drinkers in the intervention group reduced alcohol consumption compared with 30% in the control group (p>0.05).
Fazzino et al (2016) [USA]	Non RCT	210 (not reported)	57.8 (not reported)	Breast	100%	100%	Telephone group based counselling	24-h dietary recall	For the whole cohort there was a significant reduction from 19.6 g per day of alcohol at baseline to 2.28 g per day at 6-month follow-up (p>0.01). No between group differences observed.
Flatt et al (2010) [USA]	RCT	3088 (49.7%)	52 (18-70)	Breast	100%	85%	Dietary intervention	Arizona Food Frequency Questionnaire and 24-hour recall	For the whole cohort there was a significant 0.9 grams per month reduction in consumption between baseline and 12-month follow up (p<0.05). No between group differences observed.
Greenlee et al (2016) [USA]	RCT	141 (not reported)	54 (not reported)	Breast	100%	59%	Multiple lifestyle guidance	Single item on questionnaire	At three month follow up the intervention group reported significantly lower frequency of alcohol drinking (mean weekly frequency 0.9) when compared to controls (1.6) p =0.03.

Grimmett et al (2015) [UK]	Cohort	29 (n/a)	65 (44-79)	Colorectal	62%	78%	Multiple lifestyle guidance	Not reported	Non-significant change in alcohol consumption reducing from seven units per week (SD = 10.8) to four units (SD = 9.1) $p>0.05$ .
Hawkes et al (2009) [Australia]	Pilot	20 (n/a)	66 (20-80)	Colorectal	50%	Not reported	Psychosocial and lifestyle support	Average number of units consumed	Non-significant increase in the proportion of non-drinkers (15.0% to 27.8% and high risk drinkers 10.0% to 16.7%).
Hawkes et al (2013) [Australia]	RCT	510 (50%)	Intervention - 64.9 Control - 67.8 (not reported)	Colorectal	46%	Not reported	Psychosocial and lifestyle support	Cancer Council Victoria Food Frequency Questionnaire	For the whole cohort there was a significant decrease in alcohol consumption between baseline and 6-months ( $p<0.01$ ) and a significant increase between 6-months and 12-months ( $p<0.01$ ). No between group differences observed.

**Table 4: Quality Assessment of Included studies (RCTs)**

	Duffy et al (2006)	Fazzino et al (2016)	Flatt et al (2010)	Greenlee et al (2016)	Hawkes et al (2013)
Did the trial address a clearly focused issue?	Yes	Yes	Yes	Yes	Yes
Was the assignment of treatment to participants randomised?	Yes	No – placed in intervention group based on weight loss	Yes	Yes	Yes
Were all of the patients who entered the trial properly accounted for at its conclusion?	Yes	Yes	No	No	Yes
Were patients, health workers and study personnel 'blind' to treatment?	No	No	Can't Tell	Yes	Yes
Were the groups similar at the start of the trial?	Yes	Yes	Can't Tell	Yes	Yes
Aside from the experimental intervention were the groups treated equally?	Yes	Yes	Yes	Yes	Yes
How large was the treatment effect?	No significant change in alcohol use	Significant reduction in alcohol consumption between baseline and follow-up (non-randomised phase). No differences observed during randomised phase.	No between group differences in alcohol intake observed.	Significant difference in alcohol intake at 3-month follow up.	Significant reduction in alcohol use at 6-months for both groups, However, not between group differences were observed.
How precise was the estimate of the treatment effect?	Can't Tell	CI -5.45 – 2.05 impact of intervention group on alcohol use	CI 0.49-0.97 reduced risk of mortality for moderate/heave drinkers	Can't Tell	CI at 6-month = -3.7 to 1.0 and 12 months = -3.0 to 1.8.
Can the results be applied in your context? (or to the local population?)	Yes	Yes	Yes	Can't Tell	Yes
Were all clinically important outcomes considered?	Yes	No – all participants received the intervention before randomisation which may have impacted on results.	Yes	Yes	Yes
Are the benefits worth the harms and costs?	No	Yes	Yes	No	Yes

**Table 5: Quality Assessment of Included studies (Cohort)**

	Grimmett et al (2015)	Hawkes et al (2009)
Did the study address a clearly focused issue?	Yes	Yes
Was the cohort recruited in an acceptable way?	Yes	Yes
Was the exposure accurately measured to minimise bias?	Can't Tell	Yes
Was the outcome accurately measured to minimise bias?	Yes	Yes
Have the authors identified all important compounding factors?	Yes	Yes
Have they taken into account compounding factors in the design and/or analysis	Yes	Yes
Was the follow-up of subjects complete enough?	Yes	Yes
Was the follow-up of subjects long enough?	Yes	Yes
What are the results of this study?	No significant reduction in alcohol consumption	No significant reduction in alcohol consumption
How precise are the results	Not very	Not very
Do you believe the results?	Yes	Yes
Can the results be applied to the local population?	Yes	Yes
Do the results of this study fit with other available evidence?	Yes	Yes
What are the implications of this study for practice?	More work needed to develop effective alcohol interventions for cancer survivors	Dietary intervention can have an impact on alcohol use for cancer survivors

## STUDY CHARACTERISTICS

All papers were published between 2006 and 2016. The seven included articles described six unique studies; two publications by Hawkes et al described a pilot study and a randomised controlled trial (RCT) of the same intervention (Hawkes et al, 2009; Hawkes et al, 2013). Four of the included studies were RCTs (Duffy et al, 2006; Flatt et al, 2010; Hawkes et al, 2013; Greenlee et al, 2016), with the remaining studies being a non-randomised trial (Fazzino et al, 2016), a cohort study (Grimmett et al, 2015), and a pilot study (Hawkes et al, 2009). Four studies were conducted in the United States of America (USA) (Duffy et al, 2006; Flatt et al, 2010; Fazzino et al, 2016; Greenlee et al, 2016), two were conducted in Australia (Hawkes et al, 2009; Hawkes et al, 2013), and one was conducted in the United Kingdom (UK) (Grimmett et al, 2015). Baseline sample sizes varied between 20 (Hawkes et al, 2009) and 3088 (Flatt et al, 2010).

For RCTs, on average, 51.5% of participants were randomised to the intervention, whilst in the non-randomised trial 100% of participants received a weight loss intervention for six months and those who lost  $\geq 5\%$  of their baseline body weight received a 12 month weight maintenance intervention, with remaining participants in the control group. Of the seven included studies, two focused on reducing alcohol consumption as a primary outcome (Duffy et al, 2006; Fazzino et al, 2016), for the remaining five studies alcohol consumption was a secondary outcome measure (Hawkes et al, 2009; Flatt et al, 2010; Hawkes et al, 2013; Grimmett et al, 2015; Greenlee et al, 2016). Four studies aimed to improve adherence to lifestyle recommendations (Hawkes et al, 2009; Hawkes et al, 2013; Grimmett et al, 2015; Greenlee et al, 2016); one looked at improving adherence to dietary guidance (Flatt et al, 2010), one focussed on weight loss and weight maintenance (Fazzino et al, 2016), and one focussed on reducing tobacco and alcohol consumption and symptoms of depression (Duffy et al, 2006).

### Participant Characteristics

Of the seven included studies, three focussed on patients with colorectal cancer (Hawkes et al, 2009; Hawkes et al, 2013; Grimmett et al, 2015), three on patients with breast cancer (Flatt et al, 2010; Greenlee et al, 2016; Fazzino et al, 2016), and one looked at patients with various head and neck cancers (Duffy et al, 2006). For all studies the pooled mean age of participants at baseline was 54.3, four studies did not report the age range of participants (Duffy et al, 2006; Hawkes et al 2013; Fazzino et al, 2016; Greenlee et al, 2016). The pooled mean percentage of women participants across all six studies was 89.8% with three studies including only women (Flatt et al, 2010; Fazzino et al, 2016; Greenlee et al, 2016) and no studies including only men. Five studies reported the ethnicity of participants, with two studies not reporting the ethnicity of participants (Hawkes et al, 2009; Hawkes et al, 2013). The pooled mean percentage of white participants was 84.4%.

## Intervention Characteristics

There was great variation in the level of detail provided about the intervention and control groups. Five studies reported secondary analysis of previously published studies where the original article had not reported results of alcohol measures and thus detail on the intervention and control conditions was limited (Duffy et al, 2006; Hawkes et al, 2009; Flatt et al, 2010; Hawkes et al, 2013; Greenlee et al, 2016). There was also heterogeneity in the content, duration, frequency, and method of delivery for the intervention sessions. The number of intervention sessions delivered to patients ranged from two (Greenlee et al, 2016) to 52 (Fazzino et al, 2016) (median = 10), with one study not reporting how many sessions were delivered to patients (Flatt et al, 2010).

In four of the included articles the intervention was delivered via telephone consultations (Duffy et al, 2006; Hawkes et al, 2009; Grimmatt et al, 2015; Hawkes et al, 2013), one study used a mixture of telephone and face to face consultations (Flatt et al, 2010), one used a group based teleconference (Fazzino et al, 2016), and one study used face to face consultations (Greenlee et al, 2016).

Despite variation in the content of the intervention sessions there were a number of commonalities. Five articles outlined the delivery of lifestyle recommendations on healthy eating and nutrition (Hawkes et al, 2009; Flatt et al, 2010; Hawkes et al, 2013; Grimmatt et al, 2015; Greenlee et al 2016), four studies also provided guidance on recommended levels of physical activity (Hawkes et al, 2009; Hawkes et al, 2013; Grimmatt et al, 2015; Greenlee et al, 2016). Five studies included recommendations for alcohol use (Duffy et al, 2006; Hawkes et al, 2009; Hawkes et al, 2013; Grimmatt et al, 2015, Fazzino et al, 2016), two studies discussed smoking (Duffy et al, 2006; Hawkes et al, 2009), and one discussed management of depressive symptoms (Duffy et al, 2006).

Included studies used different methods to deliver interventions to patients living with and beyond cancer. For the cohort study, telephone consultations were conducted by the researcher to provide lifestyle guidance on physical activity, alcohol use, fruit and vegetable, and red meat consumption (Grimmatt et al, 2015). Participants were also sent information on the benefits of a healthy lifestyle for colorectal cancer survivors. However, this study used two separate phases of recruitment and advice on alcohol use was only given to those participants recruited in phase two. No details were provided on how many participants were recruited in each phase.

For the non-randomised trial all participants initially received a weekly group based teleconference intervention facilitated by either a dietician or a psychologist (Fazzino et al, 2016). Participants were given advice on healthy eating, physical activity and received advice on the risks of breast cancer recurrence associated with alcohol use. Participants who had lost  $\geq 5\%$  of their

baseline body weight at the end of the intervention went on to receive a bi-weekly weight maintenance intervention receiving further group telephone consultations. Those who did not, went into a control group who received the same advice in written form.

Of the four RCTs one utilised telephone consultations to deliver a cognitive behavioural therapy (CBT) counselling intervention to patients who screened positive for alcohol and/or smoking problems and/or symptoms of depression. Participants in the control group were given enhanced usual care which involved referral to outside agencies where appropriate (Duffy et al, 2006). One study used healthcare professionals to deliver one one-hour session which provided guidance on lifestyle recommendations based on the American Society of Clinical Oncology guidelines, and one one-hour session with a nutritionist to provide guidance on healthy eating and exercise (Greenlee et al, 2016). All intervention and control participants were also given a copy of 'Facing Forward: Life after Cancer Treatment' (National Cancer Institute, 2014) which summarises key issues of interest to cancer survivors. One study did not provide any details on the intervention other than it was a dietary intervention as details had been previously reported elsewhere (Flatt et al, 2010).

The remaining two studies described a pilot study (Hawkes et al, 2009) and an RCT (Hawkes et al, 2013) of the same intervention. Participants received bi-weekly psycho-social and lifestyle support session via telephone consultations delivered by a health coach. Advice focused on physical activity, healthy eating and alcohol consumption. Participants who were randomised to the control group as part of the RCT received usual care plus four educational brochures on understanding colorectal cancer and cutting risk, as well as a quarterly newsletter from the research team.

## Outcome Measures

A variety of methods were used to assess pre- and post-intervention alcohol use with no two studies using the same measure. In one article the authors used the 10-item Alcohol Use Disorders Identification Toolkit AUDIT (Barbor et al, 1989; Duffy et al, 2006) which is a validated measure of risky and hazardous drinking (Rubio et al, 1998). One article measured grams of alcohol consumed using the Arizona Food Frequency questionnaire and 24-hour recall (Flatt et al, 2010). The Arizona Food Frequency Questionnaire has been validated for dietary recall for patients living with and beyond cancer but has been shown to be a poor predictor of alcohol use (Martínez et al, 1999). In one article the authors used 24-hour dietary recall only (Fazzino et al, 2016); one used a self-report questionnaire (Greenlee et al, 2016); and in one the authors asked participants to report the average number of units of alcohol consumed per day and the average number of days per week that alcohol was consumed (Hawkes et al, 2009). In one article the authors used the Cancer Council Victoria Food Frequency Questionnaire (Hawkes et al, 2013) which has been validated for dietary recall in patients living with and beyond cancer but has poor reliability

for measuring alcohol intake in women (Hebden et al, 2013). One study did not report how alcohol consumption was measured (Grimmett et al, 2015).

## Trial Outcomes

Of the seven articles included in this review, one reported a significant difference in alcohol consumption at three-month follow-up for the intervention group when compared to the control group. Greenlee et al (2016) reported that participants in the intervention group consumed on average 0.9 grams of alcohol per day compared to 1.6 grams per day in the control group ( $p < 0.03$ ).

Three articles reported significant reductions in alcohol consumption for both the intervention and control groups, with no between group differences observed (Flatt et al, 2010; Hawkes et al, 2013; Fazzino et al, 2016). Flatt et al (2010) reported a significant 0.9 gram per month reduction in alcohol consumption for both the intervention and control groups between baseline and 12-month follow-up ( $p < 0.05$ ). Hawkes et al (2013) found that there was a 1.0 gram per day reduction in alcohol consumption between baseline and six-month follow-up for the intervention group ( $p < 0.01$ ) and a 1.3 gram per day reduction in alcohol use for the control group ( $p < 0.01$ ). However, they found that between six-month follow-up and 12-month follow up there was a significant 0.8 gram per day increase in alcohol consumption for the intervention group ( $p < 0.01$ ), and a significant 0.2 gram per day increase in alcohol consumption for the control group ( $p < 0.01$ ) (37). Fazzino et al (2016) reported that for the whole cohort there was a significant reduction from 19.6 g per day of alcohol at baseline to 2.28 g per day at six-month follow-up  $p > 0.01$ . No difference was observed during the weight maintenance phase. No between group differences for alcohol consumption were observed at any stage. At six-month follow-up the average consumption for intervention group was 1.3 g per day compared to 2.7 g per day for the control group. At the end of the study (18-month follow-up) the average alcohol consumption for the intervention group was 3.52 g per day compared to 5.1 g per day for the control group.

In the pilot study, Hawkes et al (2009) found an increase in the proportion of non-drinkers from 15.0% at baseline to 27.8% at follow-up (no significance testing). Duffy et al (2006) found that 32% of participants in the intervention group reduced alcohol consumption between baseline and six-month follow-up, compared to 30% in the control group however this was not significant. Finally, Grimmett et al (2015) recorded a small, non-significant reduction in the average number of units of alcohol consumed per week for the cohort, reducing from seven units per week at baseline, to four units per week at the end of the intervention.

## Assessment of Methodological Quality

The reviewers agreed on 58 of the 83 methodological ratings (70%). The remaining disagreements were resolved by an independent reviewer. One article met all of the criteria on the CASP checklist for randomised controlled trials (CASP, 2017a) and was rated as high quality. It had a large number of participants all of whom were accounted for at the conclusion of the study, reported the effect size, and could be applied to local contexts. The remaining six articles met eight out of the 11 CASP criteria and were rated as medium quality. None of the articles met all of the criteria on the CASP checklist for cohort studies (CASP, 2017b). One article met 13 out of the 14 CASP criteria, and the other met 12 out of the 14 criteria. Both articles were therefore rated as high quality as they assessed a clearly defined issue, had taken all compounding factors into account and the results could be applied to local populations.

## DISCUSSION

This systematic review summarises the results and assesses the methodological quality of seven reports of six unique studies of lifestyle interventions designed for patients following a diagnosis for cancer.

This review has highlighted that there is a lack of lifestyle interventions with a specific focus on reducing alcohol consumption following a diagnosis of cancer. Furthermore, it has highlighted that interventions focussing on multiple lifestyle factors may have limited impact on alcohol use.

Only one study reported a significant change in alcohol use at three-month follow-up for the intervention group when compared to the control group (Greenlee et al, 2016). Interestingly this article did not describe the provision of advice on risky drinking as being part of the intervention. However, this article reported the secondary analysis of a study which had previously been published with limited detail on the intervention being provided. Therefore, the nutritional advice component of the intervention may have included advice on risky drinking. Furthermore, this was the only intervention in which all intervention sessions were delivered face-to-face. Those articles describing interventions which were conducted over the telephone, or had a combination of telephone and face-to-face sessions did not report significant differences in alcohol use between the intervention and control participants. This suggests that for this population face-to-face interventions may have more of an impact. Whilst the above article (Greenlee et al, 2016) reported between group differences, a number of other articles in this review found significant reductions in alcohol use over time, however this was observed in both the intervention group and the control group, with no between group differences (Flatt et al, 2010; Hawkes et al, 2013; Fazzino et al, 2016). This suggests that alcohol use would have declined for participants over time regardless of whether they received an intervention or not.

There was great variation in the methods used for recording alcohol use in the seven articles described in this review. Only one study (Duffy et al, 2006) used the AUDIT tool (Barbor et al, 1989) which is validated for measuring risky and hazardous drinking. Whilst two other studies used tools validated for use with cancer patients, one using the Arizona Food Frequency Questionnaire (Flatt et al, 2010) and one using the Cancer Council Victoria Food Frequency Questionnaire (Hawkes et al, 2013), they are not reliable measures of alcohol use. The remaining articles described the use of self report or non-validated tools (Hawkes et al, 2009; Grimmer et al, 2015; Fazzino et al, 2016; Greenlee et al, 2016). This highlights the need for consistency in measuring alcohol use in studies looking at reducing risky drinking. Two of the authors of this review are involved in a project looking at developing a core outcome set for alcohol brief interventions which should help achieve this consistency of reporting in future studies (Shorter et al, 2017).

There is a wealth of evidence pointing to the effectiveness of alcohol specific interventions at reducing risky drinking in other populations such as adolescents (Patton et al, 2013); people in prisons (Stein et al, 2010) and those attending primary care (Kaner et al, 2009; O'Donnell et al, 2013). However, there is mixed evidence for the impact that multiple health behaviour change interventions can have on alcohol use. Evidence suggests that these types of interventions can impact on alcohol use, but only if lifestyle advice is delivered sequentially (advice on one lifestyle behaviour at a time) as opposed to simultaneously (all advice at once) (James et al, 2016). However, the five articles outlined in this systematic review which delivered advice on risky drinking did so simultaneously with other lifestyle advice, rather than sequentially which evidence suggests could be more effective. The remaining two articles provided little information on the intervention. We were therefore unable to determine whether advice had been delivered simultaneously or sequentially, and whether advice on risky drinking had formed part of the intervention.

Whilst the articles included in this review described little impact on reducing alcohol consumption following a cancer diagnosis a wide range of other benefits were reported. Consistent with previous reviews detailing multiple health behaviour change interventions (James et al, 2016), a number of articles included in this review reported significant increases in participation in physical activity (Hawkes et al, 2013; Greenlee et al, 2016), a significant impact on healthy eating (Hawkes et al, 2009; Hawkes et al, 2013; Grimmett et al, 2015), and significant reductions in smoking prevalence (Duffy et al, 2006). Therefore, these interventions may be beneficial for overall health following a cancer diagnosis but may have less of an impact on alcohol use.

The results of this systematic review are important as research has shown that patients living with and beyond cancer continue to engage in risk taking behaviour such as risky drinking which can increase the chance of secondary or recurrent cancers (Independent Cancer Taskforce, 2015). Therefore, there is a need for interventions which include a specific component outlining advice for risky drinking either as a stand alone intervention or as part of a sequential multiple behaviour change intervention. This will allow for a more robust assessment of whether or not interventions can be effective with cancer populations to reduce the risk of secondary or recurrent cancers.

## Strengths and Limitations

To the best of our knowledge this is the first systematic review which has attempted to synthesise evidence for the impact of lifestyle interventions on alcohol use following a cancer diagnosis. This review followed a rigorous search strategy and adhered to explicit inclusion/exclusion criteria and quality assessment of included studies.

Our search identified only a small number of eligible articles, the vast majority of which were conducted in the USA and Australia, with only one cohort study being conducted in the UK. Across all seven articles the vast majority of

participants were white women living with and beyond breast cancer. Therefore, the results of this systematic review cannot be generalised to all patients living with and beyond cancer. Furthermore, due to the number of studies which were secondary analysis of previously published work the level of detail reported meant that only three study was rated as high quality. Finally, a limitation of this review is that one identified study which may have been eligible for inclusion was excluded because it could not be translated despite all efforts to have the article translated into English. This may have limited our study as the article may have included relevant information which could have impacted on the results and conclusions of this systematic review.

## CONCLUSION

The association between risky drinking and the development of cancer is well-established and evidence suggests that patients diagnosed with cancer continue to engage in risk taking behaviour following treatment. Whilst interest in behaviour change interventions for patients living with and beyond cancer has increased in recent years these tend to focus on improving diet and physical activity with limited focus on alcohol use. This systematic review has found limited evidence for the impact of multiple behaviour change interventions, with alcohol use as likely to decline in the control group as it is in the intervention group. Future studies are needed with a more specific focus on risky drinking, and with a more diverse range of cancer patients to ascertain whether or not interventions can have a positive impact on alcohol use following a diagnosis of cancer.

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