Integrated health behaviour (lifestyle) services: a review of the evidence

NCSCT

Integrated health behaviour (lifestyle) services: a review of the evidence

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The National Centre for Smoking Cessation and Training (NCSCT) is a social enterprise set up to:

- help stop smoking services to provide high quality behavioural support to people who smoke based on the most up-to-date evidence available
- contribute towards the professional identity and development of stop smoking practitioners and ensure that they receive due recognition for their role
- research and disseminate ways of improving the provision of stop smoking support

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1. Executive Summary

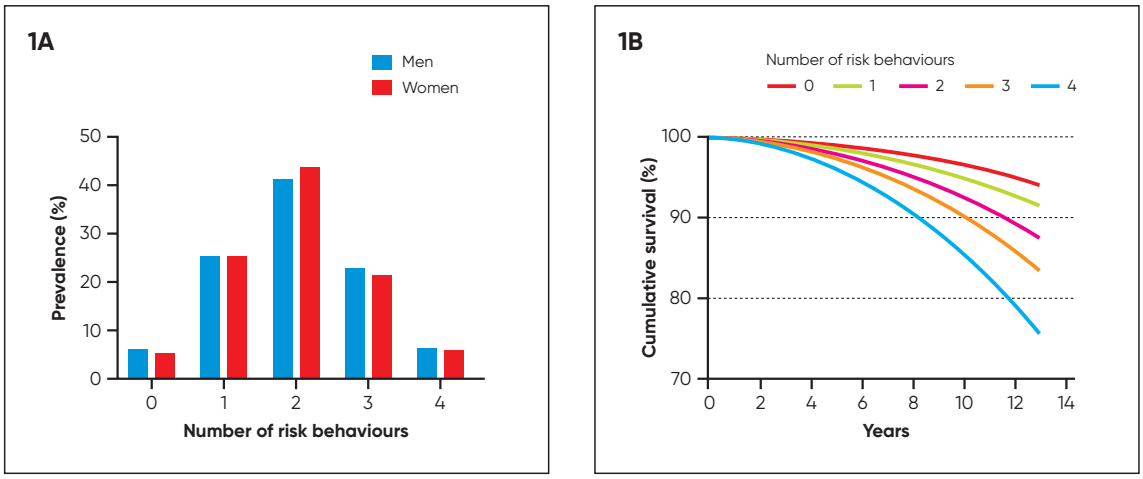
- Health behaviours that put people at risk of increased morbidity and mortality tend to cluster together
- There have been calls for integrated health behaviour services (sometimes called 'lifestyle' services) to target multiple health risk behaviours due to theoretical considerations (i.e. that risk behaviours may be determined by common underlying factors) and practical concerns (e.g. desire to avoid unnecessary duplication of services)
- Based on four risk behaviours studied (tobacco smoking, hazardous alcohol use, poor diet and physical inactivity), this briefing reports that **only specific risk behaviours cluster together**
- We can conclude that a moderate number of risk behaviours (two to three) targeted together result in the biggest improvements in outcome and that the effectiveness and cost-effectiveness of multiple risk behaviour interventions depend on the behaviour targeted
- Changes in diet were found to be associated with weight loss (but no change in physical activity) and positive changes in diet and physical activity reduced the likelihood of smoking cessation
- While there is some evidence to support multiple risk behaviour interventions that target poor diet and physical inactivity, **there is little evidence that targeting tobacco use in this manner is either effective or more cost-effective than single risk behaviour interventions**
- If integrating health behaviour services, commissioners need to consider the available resources, intervention intensity and delivery, and the target population – all of these factors impact the effectiveness, and likely cost-effectiveness, of multiple risk behaviour interventions
- **The evidence reviewed suggests that smoking should be targeted in isolation. In addition, smoking cessation interventions by themselves are more cost-effective than multiple risk behaviour interventions**

2. Evidence review

2.1 Background

The reason for addressing multiple behaviour patterns together arises from the finding that many unhealthy behaviours such as tobacco smoking, poor diet, hazardous alcohol use and physical inactivity tend to cluster.[1–3] As shown in Figure 1A, in England around a quarter of people are engaged in three or more of these health behaviours and only around 6% engage in none of them. As these four health behaviours alone account for nearly half of the burden of diseases in developed countries,[4] and because they likely interact with one another to further increase the risk of premature death (as shown in Figure 1B), there is an urgent need to tackle this problem in a concerted manner.

Figure 1: A: Distribution of four major health risk behaviours in England, 2008 (data come from [5]); B: Survival rates as a function of engagement in four major risk health behaviours (data come from [6])



If there are common factors underlying these health behaviour patterns, interventions aimed at changing these determinants may lead to multiple health behaviour changes. In addition to the potential for greater health benefits, **it has also been suggested that interventions targeting multiple health risk behaviours at once are likely to reduce health care costs.**[7] Indeed, a briefing by the NHS Confederation argues that integrated wellness services (see 2.4 for further details) would likely result in long-term savings, presenting a more effective approach by moving 'away from silo working on single lifestyle issues'.[8] However, it is also possible that underlying shared factors are too difficult to change and greater benefits can be achieved by focusing on individual behaviour patterns.

From a theoretical perspective, there are several predictions. On the one hand, the systems approach to behaviour would suggest that changes in determinants of one behaviour can lead to changes in associated behaviours.[9] For instance, based on Bandura's social cognitive theory,[10] one would predict that *mastery experience* in one behavioural domain will increase self-efficacy to achieve change in another intractable behavioural domain,[3] or increase problem-solving capacity to deal with other related health behaviours.[11]

On the other hand, targeting several health risk behaviours at the same time may stretch emotional, behavioural and cognitive limits.[12] This may lead to a plateauing, or even decline, in the success rates of interventions when more than a few health behaviours are targeted at once.[13] When people are seeking help to change their behaviour, it is often after they have already had multiple failures in trying to change, resulting in low personal resources for future change.[14,15] It is therefore important to start with small, easy goals and build on success in order to increase confidence in, and techniques for, changing behaviours.[16] Trying to change more than one thing at once may not be a sensible thing to do when resources, skills and confidence are low because this could be overwhelming.[17] Moreover, if an individual feels overwhelmed, they may be less likely to put sufficient effort into changing behaviours.[18]

There is little research in this area, with several questions remaining, including: whether behaviours should be targeted sequentially or concurrently; whether having multiple risk factors affects the dynamics of behaviour change; whether some risks should be prioritised over others; and how cost-effective different approaches are.[19] This briefing summarises work which has focused on targeting multiple health risk behaviours, as would happen in an integrated service, with a particular emphasis on the impact on smoking cessation outcomes. The aim is to enable commissioners to make an informed choice based on existing evidence as to whether integrating smoking cessation treatment into other work streams is likely to be effective and cost-effective.

2.2 Methodology

Given the large amount of literature on interventions targeting multiple risk behaviours, this briefing used two recent meta-analyses covering 55 randomised controlled trials (RCTs)[20] and 150 controlled trials[13] respectively, and one commissioned report covering 50 RCTs,[21] as the starting point to summarise information on effectiveness for multiple health risk behaviour interventions. As data from these reports were restricted to papers published prior to 2013, a mini systematic review was conducted to retrieve primary research published since 2013, with a focus on studies that had an experimental design to evaluate multiple health risk behaviour interventions and which included smoking cessation as one of the target behaviours (see 6.1 for the detailed search strategy). After exclusion of duplicates, observational studies, review articles, protocols and conference presentations, a total of nine papers with information on effectiveness were retrieved to supplement previously published reports and meta-analyses (see 6.2 for PRISMA flowchart).

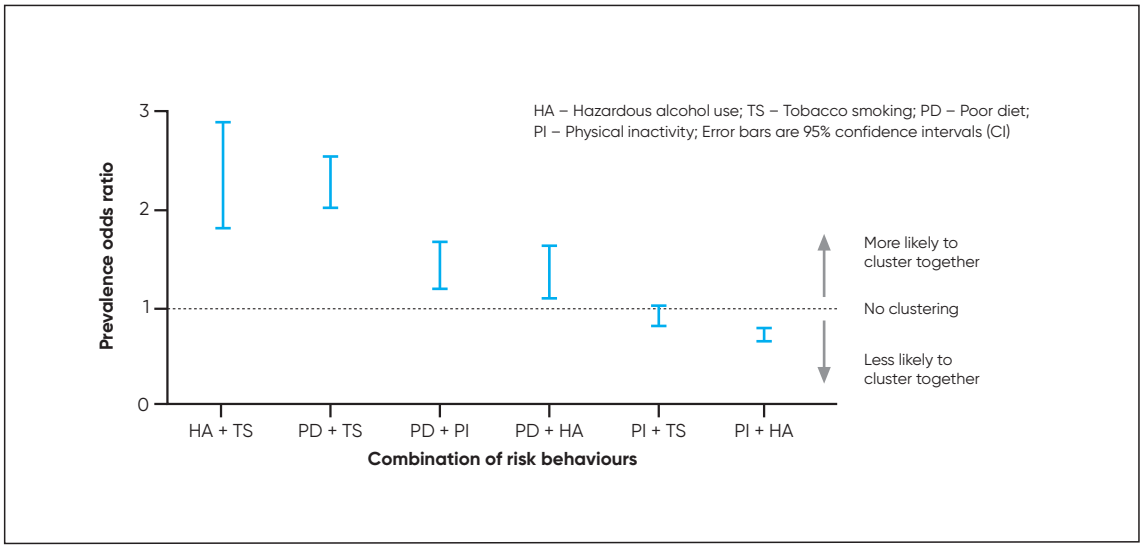
To assess the cost-effectiveness of multiple health behaviour interventions, two economic systematic reviews[22,23] which were conducted to inform a recent update of NICE guidance on Behaviour Change: Individual Approaches [PH49] were also searched for relevant studies and data were extracted for this analysis.

2.3 Co-occurrence and clustering of specific risk behaviours

Health risk behaviours may co-occur in the population (i.e. reflect concurrent but possibly independent engagement) or cluster within individuals (i.e. reflect a common, underlying association).[24] A systematic review of relevant studies suggests that, due to the high prevalence of the behaviours, **greatest co-occurrence at population level is observed for low fruit and vegetable consumption and low physical activity** at 47 – 54%.[21] By contrast, clustering of behaviours within individuals suggests a different pattern.

As shown in Figure 2, the most commonly clustered risk behaviours were tobacco smoking and hazardous alcohol use, and tobacco smoking and poor diet, whereas there was little clustering for physical inactivity with tobacco smoking or with hazardous alcohol use.

Figure 2: Clustering of four major health risk behaviours (Data come from [21])



While gender and age were not associated with clustering of health risk behaviours, being from a black and minority ethnic group or having a higher socio-economic status was associated with reduced likelihood of engaging in multiple health risk behaviours.[21]

Given the evidence that a number of behaviours do cluster within individuals, and that this may be related to socio-demographic characteristics, integrating services across health behaviours may thus not only reduce wastage by treating common underlying patterns predicted to cross-fertilise to other health risk behaviours, but may also reduce social disparities. At a time of major changes in public health in England and within a difficult financial climate, integrated behavioural 'lifestyle' services have therefore been proposed as a cost-saving alternative to single behaviour change interventions.[8]

2.4 Models of integrated services

The move away from single health behaviour support towards integrated *wellness services* is best exemplified by the model of integrated services shown in Figure 3.[8] In the traditional model, there are independent referral pathways to separate services that deal with specific health behaviours (Figure 4A). An integrated service would attempt to connect primary care providers with local health behaviour service providers via a single point of access, or hub, using a triage system whereby individuals would be assessed 'holistically' and treatment provided. The specific treatment model could then take a clustered approach where health professionals provide treatment for health risk behaviours that have common underlying factors, and which draw on similar expertise in behaviour change (Figure 4B). Alternatively, generalist 'lifestyle' practitioners could provide 'complete care' treatment for any combination of health risk behaviours (Figure 4C). An integrated service would also need to take into consideration wider determinants of health, including social and psychological factors; and engage community support from lay persons and peers, as well as building on other community assets, to go beyond the immediate service as suggested by the wellness model.[19]

Figure 3: Model for integrated health service (Taken from [8])

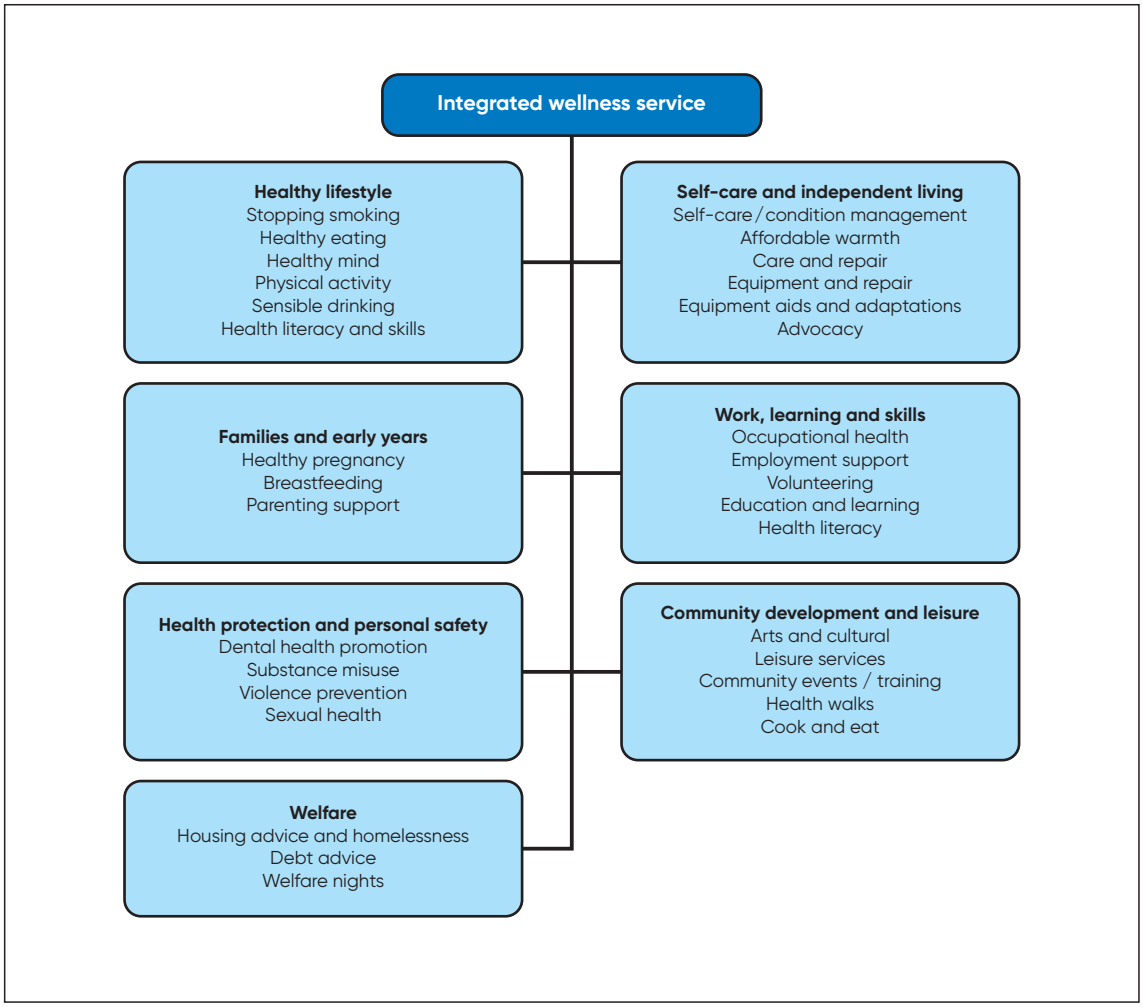
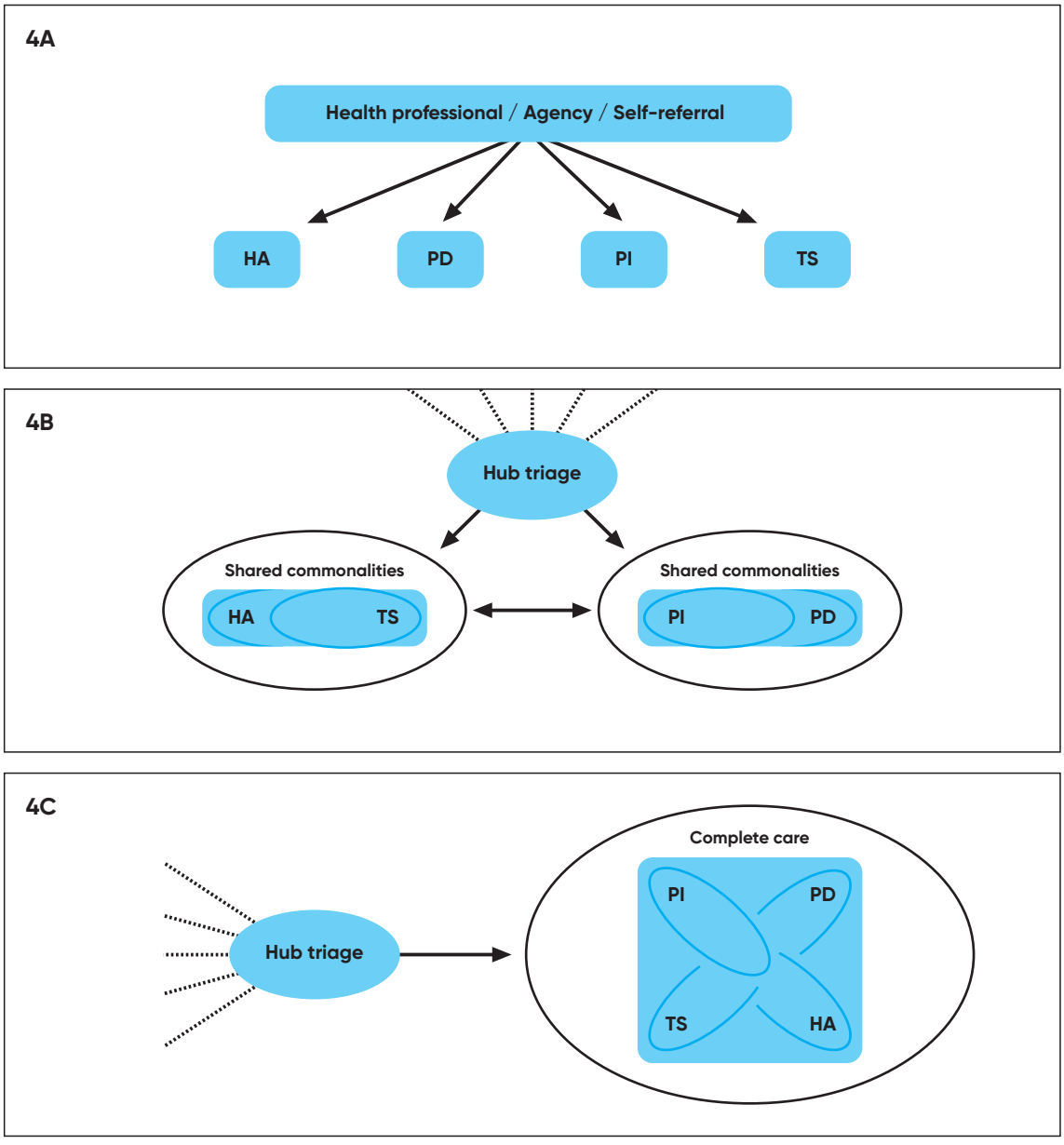


*Figure 4: A: Traditional single service model; B: Integrated healthy lifestyle services (shared factors)^; C: Healthy lifestyle services (complete care)^*

^ Hub connects to other services outlined in Figure 3 and health behaviours addressed as an example are: HA – Hazardous alcohol use; TS – Tobacco smoking; PD – Poor diet; PI – Physical inactivity.



2.5 Effectiveness of multiple risk behaviour change interventions

A comprehensive report[21] commissioned by the Department of Health Policy Research Programme found **beneficial effects of multiple risk behaviour interventions on reducing poor diet and physical inactivity, but no evidence for an effect on reducing tobacco smoking and insufficient evidence for an effect on reducing hazardous alcohol use** (Figure 5). Further analyses were conducted to assess how changes in one risk behaviour affect other risk behaviours. This found that changes in diet were associated with weight loss (but no change in physical activity) and that **positive changes in diet and physical activity reduced the likelihood of smoking cessation.** One study investigated whether sequential or simultaneous behaviour change is more effective, which produced an inconclusive result, suggesting that either are equally effective or ineffective.[25,26]

A Cochrane review[20] of multiple risk factor interventions for the primary prevention of coronary heart disease (CHD), which included counselling on diet, exercise, weight loss, salt intake, alcohol use, stress management, smoking cessation, medication adherence found no evidence of overall improvement in actual health outcomes, including CHD mortality. The only risk behaviour which was reported in sufficient studies to include in the meta-analysis was smoking cessation, and as shown in Figure 6 there was evidence of a non-significant reduction in smoking rates. However, this effect is likely to be overstated due to lack of biochemical validation (effects were reduced when self-report was compared with validated smoking rates[27]) and more recent rigorous studies conducted after 2000 found no effect (Figure 6). A narrative, rather than meta-analytic, review of comprehensive work-site interventions that targeted other health risk behaviours in addition to tobacco smoking also failed to find an effect.[28]

Figure 5: Effectiveness of multiple health risk behaviour intervention by targeted behaviour

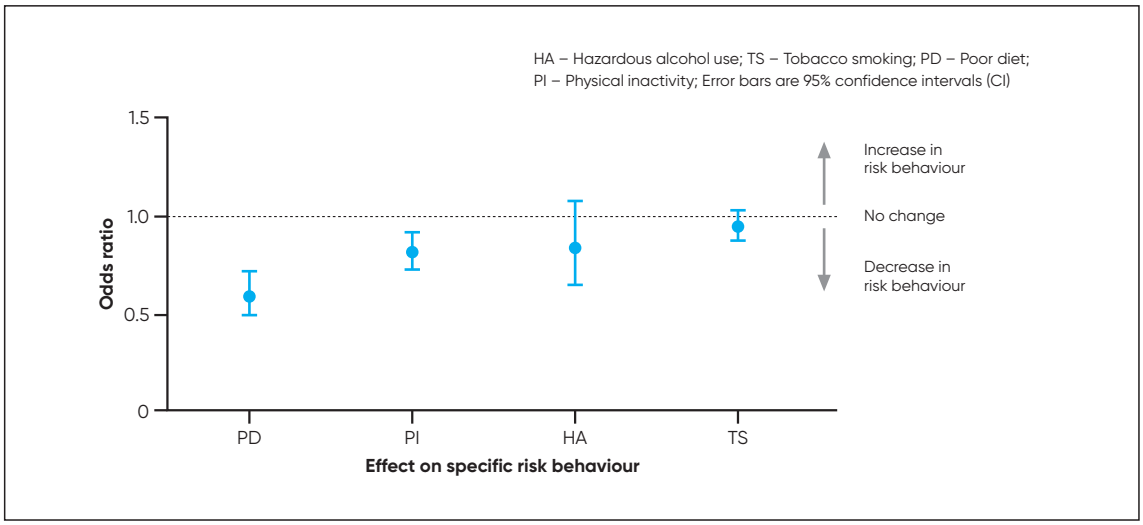


Figure 6: Impact on smoking cessation of multiple health risk behaviour interventions for prevention of coronary heart disease

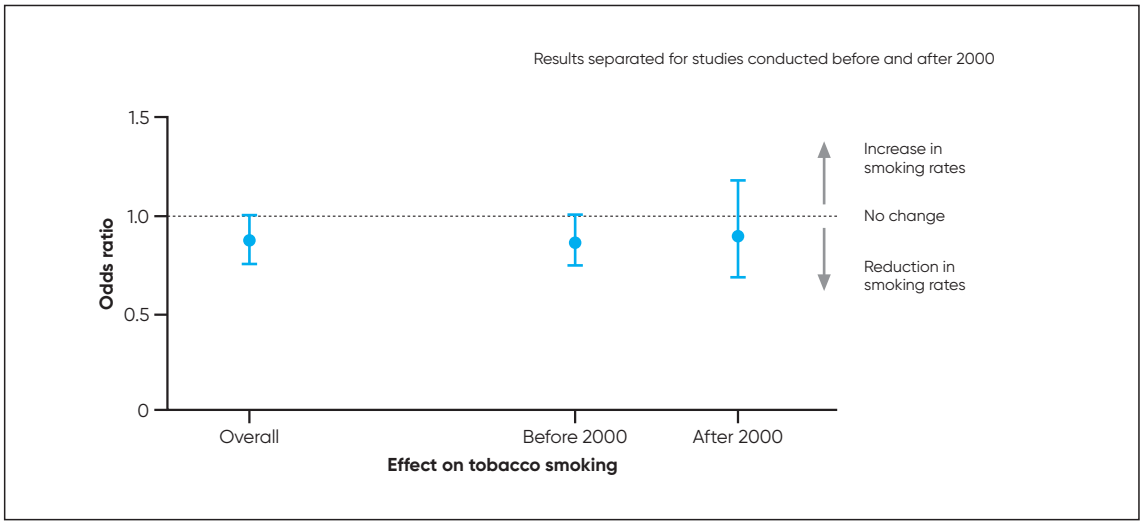


Figure 7: Effectiveness of health risk behaviour interventions stratified by the number of targeted behaviours and intervention length

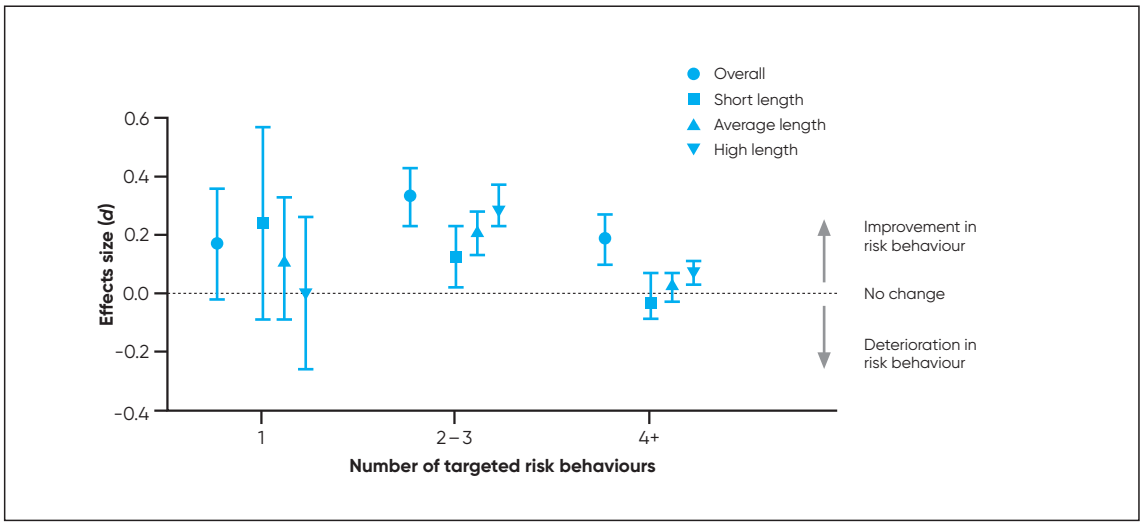
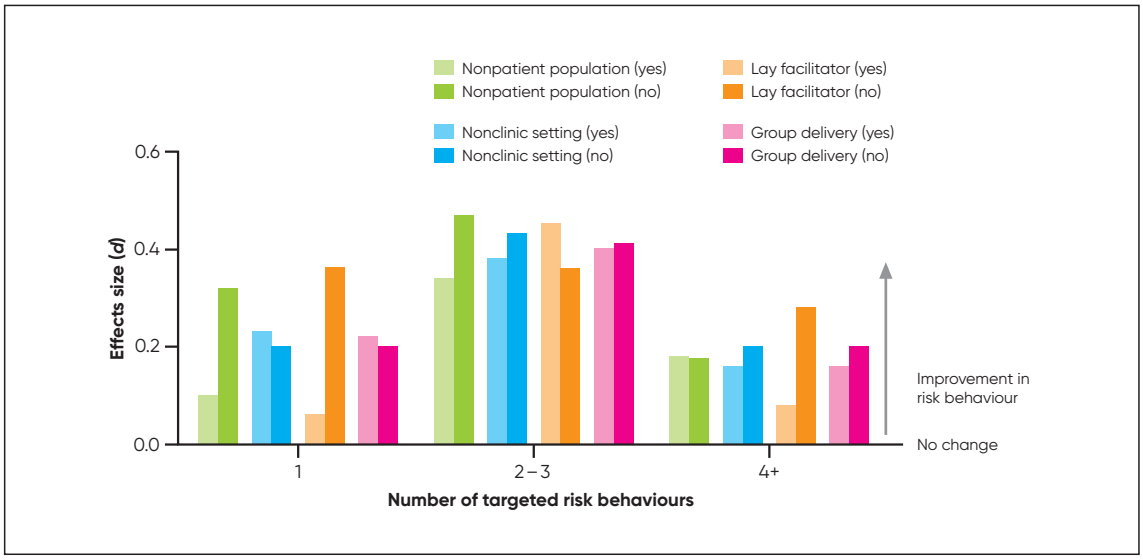


Figure 8: Effect modifiers for health risk behaviour interventions stratified by the number of targeted behaviours



Error bars are 95% confidence intervals (CI)

A final systematic review and meta-analysis[13] attempted to disentangle the relationship between the number of health risk behaviours targeted and the effectiveness of the interventions, independent of the specific risk behaviours that were assessed. **The results suggest that interventions targeting a moderate number of health risk behaviours (two to three) are more effective than those targeting only one or more than three behaviours.** However, the effectiveness of interventions was dependent on available resources, with **short interventions favouring a single behavioural target, but average length and more intensive interventions favouring two to three intervention targets** (Figure 7). In addition, the setting of interventions also affected outcomes: **single-health behaviour interventions were particularly effective for patient populations led by specialist facilitators, whereas interventions targeting two or three risk behaviours were more effective if led by lay facilitators** (Figure 8). Neither clinic vs non-clinic setting nor group vs non-group delivery affected effect sizes. Further exploratory analyses indicated that interventions making multiple recommendations were more effective when they were opportunistic and passive (i.e. with minimal involvement from intervention recipients) and conducted face-to-face.[13]

As the three recent meta-analyses discussed above only covered literature up to 2013, a further meta-analysis was conducted for the purposes of this briefing (see section 6 for details). Nine additional studies investigating multiple risk behaviour interventions, which also provided information on smoking outcomes, were identified in the literature since 2013. Details of these studies are provided in Table 1. Of these, a number could not be included in a meta-analysis due to their study design or data presentation and are summarised narratively first.

Table 1: Characteristics of studies evaluating multiple risk behaviour interventions published since 2013

Study and design	Sample and setting	Intervention	Control	Behaviours targeted	Behaviour outcomes
An et al[29]* Randomised controlled trial (RCT)	Young adults aged 18–30; recruited online; USA; N=1,698	Online, avatar-hosted tailored intervention, peer support	Non-tailored, health-unrelated web content	Tobacco smoking, alcohol use, exercise and eating breakfast	12-week follow up: 30-day self-reported abstinence; number of days of alcohol use; eating breakfast; number of days with exercise over last 30 days
Baumann et al[30] RCT	RCT; population-based study; all people aged 30 – 60 in Copenhagen county, Denmark N=3,444	Individual lifestyle counselling based on cardiovascular risk score + group-based counselling over 6 months	One-time generic lifestyle counselling	Tobacco smoking, alcohol use, physical activity and diet	10-year follow up: self-reported point-prevalence smoking status; weekly alcohol consumption over past year; adjusted for various covariates
Emmons et al[31] Cluster RCT	Adults attending primary care (internal medicine practices) in Boston, USA N=2,440	Self-guided intervention delivered via print or online + two coaching calls	Usual care	Tobacco smoking, multi-vitamin use, physical activity and diet (red meat consumption, fruit and vegetable intake)	18-months follow up: Multiple risk behaviour score
Epton et al[32]* RCT	University students, UK; N=1,445	Online programme + app providing tailored theory-based messages, self-affirmation task, a planner and detailed info	Measurement only	Tobacco smoking, alcohol use, physical activity and diet	6-month follow-up: portions of fruit and vegetable a day; physical activity and alcohol consumption in last week; point-prevalence smoking
Gibson et al[33] Pre-post study	Patients at increased risk of CVD, Ireland N=375	16-week programme delivered by specialists	N/A	Tobacco smoking, physical activity, and diet	1-year follow-up: fruit and vegetable, fish consumption; physical activity per week; current smoking status

Study and design	Sample and setting	Intervention	Control	Behaviours targeted	Behaviour outcomes
Griffin et al[34] RCT	General practice patients, aged 40 – 69 with Type 2 diabetes, UK N = 478	Facilitator-led, tailored behaviour change intervention + enhanced usual care	Enhanced usual care	Tobacco smoking, physical activity, medication adherence and diet	1-year follow-up: comprehensive diet, medication adherence and physical activity assessment; current smoking status
Kadda et al[35]* RCT	Patients who had open heart surgery, Greece N = 500	Individual extensive lifestyle counselling delivered by nurses + booklet	Usual care	Tobacco smoking, physical activity, and diet	1-year follow-up: smoking abstinence; dietary habits following Mediterranean diet; physical activity (aerobic activity)
Lakerveld et al[36]* RCT	General practice patients, aged 30+ increased risk of Type 2 diabetes or CVD, Netherlands N = 622	Theory-based lifestyle intervention delivered by nurses combining motivational interviewing and problem solving	Health brochures	Tobacco smoking, physical activity, and diet	1-year follow-up: comprehensive fruit intake and physical activity assessment; current smoking status
Parekh et al[37] RCT	General practice patients, aged 18 – 70, Australia N = 4,676	Computer-tailored intervention + health promotion information sheets	Computer tailored intervention for non-targeted behaviours + health promotion information sheets for these	Tobacco smoking, physical activity, alcohol intake, and diet	12-months follow-up: adherence to health behaviours

* Included in meta-analysis

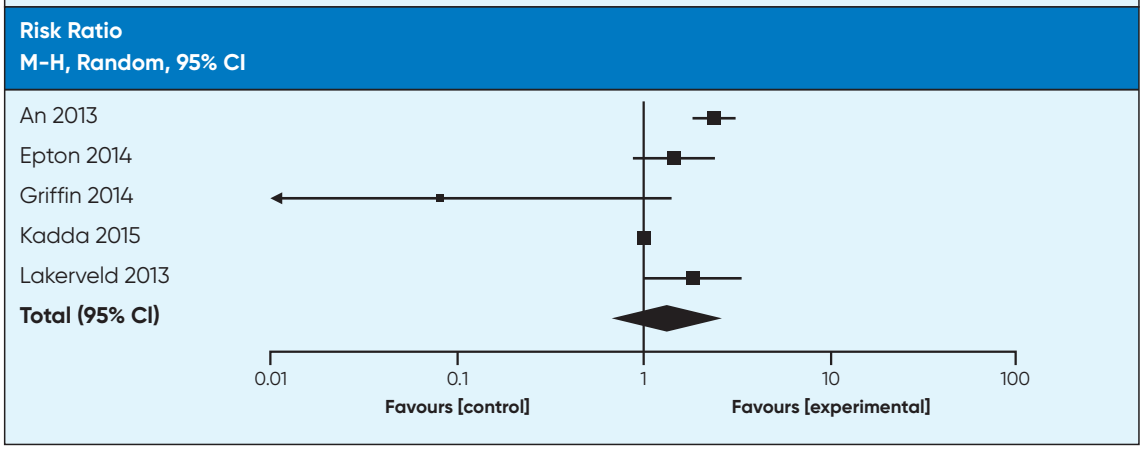
Results from the Inter99 study[30] **suggest that a positive impact on smoking (and alcohol consumption) can be maintained up to 5 years after intervention delivery; however, results showed only a marginal improvement** (OR 1.84, 95%CI 1.02 – 3.33, p = 0.043). Results of the Health Directions trial[31] suggest improvements in an aggregate risk behaviour score; however, it is unclear which of the targeted behaviours improved. An observational study[33] of a comprehensive intervention delivered by specialists found **some improvements from baseline to follow-up across a range of health risk behaviours, but results were confounded by drop-outs and by lack of a control group and biochemical verification.** A final RCT[37] **did not observe any improvements across a range of risk behaviours, including smoking.**

As shown in Figure 9, the pooled results of trials that could be included in a meta-analysis were similarly mixed. There was significant heterogeneity in all study outcomes but especially for smoking cessation. The overall estimate confirms previous analyses, insofar as they suggest that **despite a tendency towards improved smoking cessation in intervention groups, this effect is small and non-significant.**

Figure 9: Forrest plot of smoking cessation rates across RCTs of multiple risk behaviour interventions published since 2013

Study or subgroup	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI
An 2013	305	1131	63	567	24.8%	2.43 [1.89, 3.12]
Epton 2014	27	83	19	85	22.8%	1.46 [0.88, 2.41]
Griffin 2014	0	34	5	31	5.2%	0.08 [0.00, 1.44]
Kadda 2015	203	250	204	250	25.5%	1.00 [0.92, 1.08]
Lakerveld 2013	28	74	11	54	21.8%	1.86 [1.02, 3.39]
Total (95% CI)		**1572**		**987**	**100.0%**	**1.36 [0.66, 2.83]**
Total events	563		302			

Heterogeneity: $Tau^2 = 0.54$; $Chi^2 = 88.66$, df = 4 (P < 0.00001); $I^2 = 95\%$
Test for overall effect: Z = 0.83 (P = 0.41)



2.6 Cost-effectiveness of multiple risk behaviour change interventions

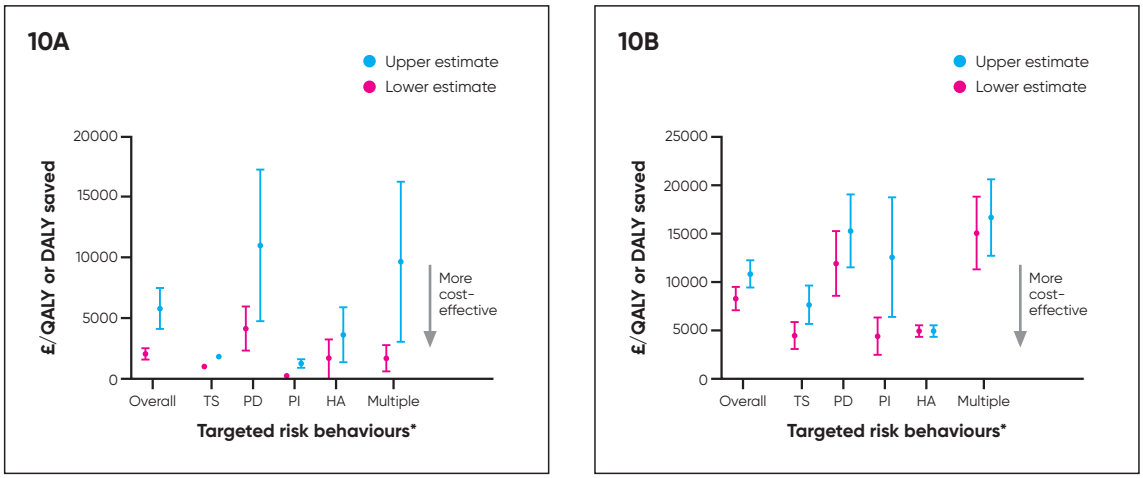
As part of an update of NICE guidance on behaviour change using individual approaches [PH49], two economic analyses were conducted to evaluate cost-effectiveness of interventions with different behavioural targets.

The first of these reviews only included interventions that had already been appraised as cost-effective in previous NICE guidance. It compared these across different behavioural domains; altogether 79 cost-effective interventions were identified (41 of which targeted smoking cessation and six of which multiple behaviours).[22] Figure 10A provides results of the analysis, broken down by the behavioural domains targeted. This suggests that multiple risk behaviour interventions can be cost-effective. However, **while all 41 smoking cessation interventions fell below the accepted £30,000 per quality/disability adjusted life years saved, only 83.3% of interventions with multiple health behaviour targets did.**[22]

A second economic review for NICE expanded on this analysis by systematically reviewing a broad range of cost-effectiveness studies, including those that assessed non-cost effective interventions.[23] The review covered 329 individual interventions in relevant cost-effectiveness studies or reviews (130 of which targeted smoking cessation and 48 of which multiple behaviours). It found that multiple behaviour change interventions yielded significantly higher cost-effectiveness estimates compared with smoking cessation interventions (Figure 10B).

Of smoking cessation interventions, 94.2% were considered cost-effective compared with 75.0% of multiple risk behaviour interventions.

Figure 10. A: Cost-effectiveness estimates by target behaviour derived from existing cost-effective interventions; B: Cost-effectiveness estimates by target behaviour derived from general cost-effectiveness studies



* HA-Hazardous alcohol use; TS-Tobacco smoking; PD-Poor diet; PI-Physical inactivity;
Error bars are 95% confidence intervals (CI); QALY/DALY-Quality/disability adjusted life years

3. Recommendations for commissioners

3.1 Which risk behaviours should be targeted?

The evidence reviewed suggests that smoking should be targeted in isolation. While interventions for smoking behaviour when targeted alone are clearly effective,[38] this briefing finds little, if any, evidence based on past systematic reviews and more recent research evidence that interventions targeting multiple risk behaviours are effective in increasing smoking cessation. **In addition, smoking cessation interventions by themselves are more cost-effective than multiple risk behaviour interventions.** Findings regarding alcohol use are less clear and reflect the rather small effects that are generally obtained in single-behaviour alcohol interventions.[39] Evidence is more favourable regarding interventions targeting poor diet or physical inactivity as the beneficial effects in multiple risk behaviour interventions reported here are comparable to those observed in single-behaviour interventions for these risk behaviours.[40,41] In addition, cost-effectiveness estimates for single vs. multiple behaviour interventions are similar for these health risk behaviours, particularly for interventions targeting poor diet.

It is also worth considering that none of the trials in the published reviews included the UK four-week quit model delivered to the standard that most local stop smoking services are currently delivering too. Integrating these services into a generic model is likely to **further weaken the provision of stop smoking interventions as a result of them being delivered by staff less skilled in behavioural support for smoking cessation.**

3.2 What number of risk behaviours should be targeted?

In general, it appears that a moderate number of risk behaviours targeted (two or three) results in the most favourable outcomes. However, the ideal number of behaviours targeted depends on the type of risk behaviour (see 3.1) as well as on other contextual factors, including resources, setting and the type of intervention being delivered (see 3.4). **There is not sufficient evidence to suggest that smoking cessation should be clustered with other health risk behaviours, but instead should be treated separately.**

3.3 Should risk behaviours be targeted simultaneously or sequentially?

There is currently insufficient evidence regarding the order in which behaviours should be targeted or whether interventions should attempt to target all behaviours at once.

3.4 Which contextual factors need to be considered?

Integrated 'lifestyle' services need to target health behaviours that commonly cluster together; data presented in this briefing indicated that only some and not all combinations of health behaviours cluster, thus any treatment developed needs to target clustering patterns that make theoretical sense. As indicated in 3.2, a moderate number of targeted health risk behaviours tend to improve outcomes, but only if sufficient resources are allocated. **If only limited time or resources are available, single-behaviour interventions are more effective.** In addition, multiple health risk behaviour interventions tend to do better if limited involvement is required from participants and delivery is face to face, using lay facilitators. **Single health behaviour targets are more appropriate when, as is often the case for smoking cessation interventions, practitioners directly treat patient populations which in turn requires active engagement of clients.**

3.5 Evaluation

Given the lack of good evidence that integrated 'lifestyle' services are effective and cost-effective, **any decision to pair smoking cessation services with other health behaviour services should not be taken lightly.** Such services would need rigorous evaluation and would benefit from a standard evaluation framework.

4. Conclusions

This briefing reports on the mixed evidence for the effectiveness and cost-effectiveness of interventions targeting multiple health risk behaviours. In this context it is important to remember that even if common underlying patterns in health behaviours prove intractable, there is a still a benefit in terms of coordinating the assessment of these behaviours and working with the individual to develop a programme of change to maximise the health gains that can be achieved. This suggests an approach that seeks to focus on a common underlying factor where this is realistic, as may be the case for health behaviours such as poor diet or physical inactivity, while retaining the option of focusing on specific behaviour patterns for other behaviours and cases, as would seem sensible in the case of smoking cessation.

A comprehensive approach to behaviour change needs to separate the behavioural targets from the intervention strategies, insofar as the assessment of the problem should involve looking at personal, social, and material resources available to support change and usually target one problem, while putting others on the back burner to come back to as progress is made with the first.

In agreement with the reported findings, previous multiple risk behaviour intervention studies in the UK[42–49] and elsewhere[50–54] have had disappointing results. There have been changes, at least in the short-term, in some behaviour patterns but those that are more harmful, such as smoking, have not changed.[43] A potential reason for this is arguably that the interventions have not taken sufficient advantage of the common modifiable nature of the behaviour patterns. That is, they have treated each behaviour as a separate target rather than seeking to change one or more motivational, capability and/or opportunity elements underpinning them all.[55] Alternatively, smoking, given its pervasive effect on all levels of the motivational system[56] and complex interplay with other health behaviours, may present a particularly difficult case, which may mean that its treatment is unsuitable for integration with other risk behaviour interventions.

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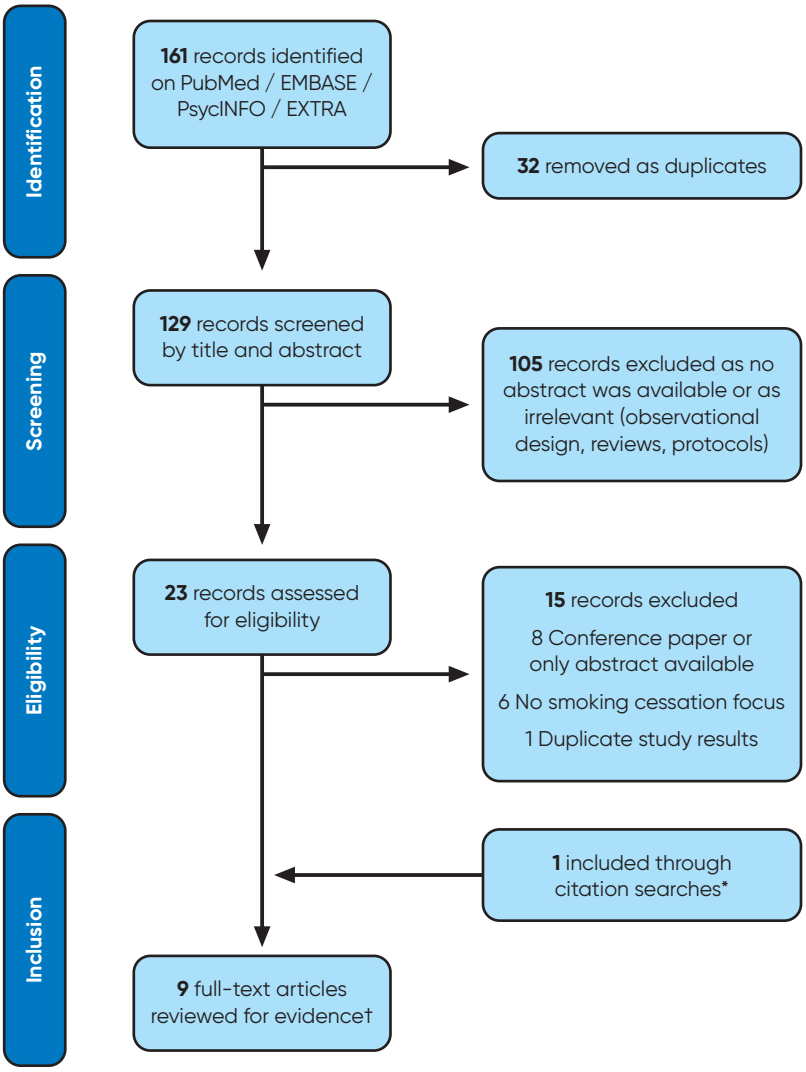
6. Appendices

6.1 Search Strategy

Step	Term category	Search string	Pubmed	EMBASE	PsycINFO/ EXTRA	Total
1	"Intervention" terms†	((lifestyle ADJ1 intervention*) OR (lifestyle ADJ1 program*) OR (life ADJ1 style ADJ1 intervention*) OR (life ADJ1 style ADJ1 program*) OR (behavio?r* ADJ1 change ADJ1 intervention*) OR (behavio?r* ADJ1 change ADJ1 program*) OR (multiple ADJ1 risk ADJ1 factor ADJ1 program*) OR (multiple ADJ1 risk ADJ1 factor ADJ1 intervention*) OR (multifactorial ADJ1 lifestyle ADJ1 intervention*) OR (multifactorial ADJ1 lifestyle ADJ1 program*) OR (health ADJ1 behavio?r* ADJ1 program*) OR (health ADJ1 behavio?r* ADJ1 intervention*) OR (multiple ADJ1 health ADJ1 behavio?r* ADJ1 change ADJ1 intervention*) OR (multiple ADJ1 behavio?r* ADJ1 risk ADJ1 factor* ADJ1 intervention*) OR (multiple ADJ1 behavio?r* ADJ1 risk ADJ1 factor* ADJ1 program*) OR (multiple ADJ1 risk ADJ1 behavio?r* ADJ1 intervention*) OR (multiple ADJ1 risk ADJ1 behavio?r* ADJ1 program*)).tw	3,494	8,667	2,406	*14,567*
2	"Smoking Cessation" terms‡	((tobacco OR cigarette* OR smok*) AND (stop* OR quit* OR cess* OR red*)).tw	23,184	92,577	22,599	*138,360*
3	Additional behaviour terms‡	(alcohol* OR (drinking ADJ1 behavio?r) OR beer OR wine* OR cider OR alcopop* OR spirit* OR (drink* ADJ2 (binge OR excessive OR harm* OR heavy OR misus* OR abus* OR consum*)) OR intoxicat* OR inebriat* OR drunk* OR overweight OR obes* OR (health* ADJ2 (diet* OR eating OR food*)) OR(unhealth* ADJ2 (diet* OR eating OR food*)) OR (fruit* ADJ2 (eat* OR intak* OR consum* OR increase* OR portion* OR serving* OR frequenc* OR number* OR preference* OR choice*)) OR (vegetable* ADJ2 (eat* OR intak* OR consum* OR increase* OR portion* OR serving* OR frequenc* OR number* OR preference* OR choice*)) OR (5 ADJ1 a ADJ1 day) OR (five ADJ1 a ADJ1 day) OR (junk ADJ1 food) OR (fast ADJ1 food) OR (eating ADJ1 behavio?r) OR (food ADJ1 preference*) OR nutrition OR diet* OR (sedentary ADJ1 lifestyle) OR (sedentary ADJ1 behavio?r*) OR sedentar* OR exercise OR inactiv* OR (physical* ADJ3 (fit* OR train* OR activ* OR inactiv* OR endur*)) OR (exercis* ADJ3 (fit* OR train* OR activ* OR inactiv* OR endur*)) OR ((promot* OR uptake* OR encourage* OR increase* OR start* OR adher*) ADJ3 (exercise* OR gym* OR sport* OR fit*)) OR ((decreas* OR reduc* OR discourage*) ADJ3 (sedentary OR deskbound)) OR ((watch* OR view*) ADJ2 (tv OR television)) OR sport* OR walk* OR running OR jogging OR bicycling OR biking OR swimming OR (active ADJ1 (travel* OR transport* OR commut*))).tw	342,419	1,993,277	366,880	*2,702,576*
4	Combination	2 and 3	1,341	26,781	5,681	*33,803*
5	Combination	1 and 4	23	442	98	*563*
6	Limits	Human; English; published since 2013	5	124	32	**161**

Search carried out 29/04/2016; †For pubmed [tiab] was used in lieu of .tw and terms were grouped with " " instead of ADJ1; ‡MESH terms for Pubmed only (for smoking cessation: "Tobacco Use Cessation"; for other behaviour terms: "Alcohol Drinking"; "Sedentary Lifestyle"; "Overweight")

6.2 PRISMA Flowchart



* Only studies not already included in relevant systematic reviews13,20 or Public Health Research Consortium Report21 were included;
† The following articles were selected:

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9. Parekh, S., King, D., Boyle, F.M., Vandelanotte, C., 2014. Randomized controlled trial of a computer-tailored multiple health behaviour intervention in general practice: 12-month follow-up results. *The International Journal of Behavioral Nutrition and Physical Activity* 11.