

Appendix C2. MCLI methods and assumptions

Introduction

A multicomponent lifestyle intervention (MCLI) is a programme that aims to reduce a person's energy intake and help them to be more physically active by changing their behaviour. To be considered multicomponent, the programme must include diet, physical activity and behavioural therapy (for example, counselling sessions) (1). Behavioural techniques most commonly used are goal setting and review of goals (behaviour and outcome), action planning, barrier identification and problem solving, self-monitoring of behaviour, feedback on performance, instruction on how to perform behaviour and planning social support and social change (2).

Quantifying the effectiveness of multicomponent lifestyle interventions on body weight

Effect on weight loss

A comprehensive review of the literature on MCLI that performed a meta-analysis of randomised controlled trials concluded that there was strong evidence that MCLI can lead to a greater weight loss over a 12 to 18 month period than control arms (pooled mean difference - 2.6kg, 95%CI -2.8 to -2.4) (1). It is worth noting that this may be a conservative estimate because it is based on analyses which assume that the weight of individuals lost to follow up did not change over the course of the study. Studies report average 17% attrition. Therefore, participants finishing MCLI programmes are likely to lose more than 2.6kg.

MCLI can vary considerably in their characteristics and effect on weight loss (1). MCLI have been successfully applied to both men and women, young and older adults. Interventions that involve diet and exercise are more effective than those which involve diet only or exercise only (2). Further, programmes that specify a daily energy intake are associated with greater weight loss compared to those that do not (2). Along the same lines, there is some evidence that programmes that are six months of longer, and that involve face-to-face contact, supervised exercise, and group and individual sessions produce better results than those that do not (1).

Weight regain

Most studies with follow-ups beyond the active period of intervention have shown that there is gradual weight regain after MCLI. In Dansinger et al's meta-analysis of 46 trials of dietary counselling, most of which incorporated a physical activity component, only 15% reported continued weight loss in the maintenance phase while the rest reported weight regain (3). This meta-analysis concluded that on average, patients regain 0.03 BMI units per month during maintenance phases of dietary -based weight loss interventions. At this rate, patients would return to their baseline weight after approximately 5.5 years (3). A similar conclusion was reached by the NICE review, which found that on average, intervention groups regained 0.047kg/month more than control groups in the maintenance phase (4). Based on this rate,

participants of MCLI would return to their baseline weight after approximately 4.6 years. Few characteristics of the preceding MCLI were associated with rate of weight regain (4).

The main limitation of both reviews above is that most trials have up to two follow up points post-intervention. Therefore weight regain is assumed to be linear. However, results from one longer study, the Diabetes Prevention Programme (DPP), suggested that weight regain was not linear and may decline with time. In the DPP study, weight in the intervention arm did not reach that of the control group after 10 years of follow-up(4). More evidence with respect to weight regain post MCLI is still needed.

Cost and cost-effectiveness

The average cost of seven MCLIs carried out in England was £110.50 per participant (1). This cost included the cost of delivering the intervention and also administrative costs incurred by general practitioners who invited patients to take part in the weight management programmes. The key aspects that influence cost-effectiveness of MCLI are the amount of weight regained post-intervention, the amount of weight loss during the intervention, gender, initial BMI and age (5). In general, the heavier and older the person, the more likely the intervention is to be cost-effective (5). As expected, the larger the weight loss during the programme and slower the rate of regain, the more cost-effective the intervention (5).

A previous cost-effectiveness analysis of MCLI showed that interventions where the weight loss averaged one BMI point (equivalent to the average in the NICE review cited above (1)) were cost-effective among moderately and morbidly obese populations regardless of age and considering post-intervention weight returning to baseline weight over a period of 3 to 4 years (5). Interventions leading to a one BMI point reduction in weight among overweight individuals would only be cost-effective among older cohorts but not among younger cohorts based on expected rates of weight regain (3-5). Part of the reason for this is that at ages above 50, losing weight yields gains almost immediately, so the weight loss does not have to be maintained for long in order for the intervention to become cost-effective (5).

EConDA model

Data collection

Partner countries were asked to submit information on MCLI that were active or had been tested in their countries. Very little information was retrieved in this way. This was probably due to very few MCLI programmes being rolled out at national or regional level in EConDA countries. Therefore research studies which investigated the effect of MCLI on body weight in adults carried out in EConDa countries were also retrieved (see search methodology below). Studies investigating six different interventions were identified for the UK, one each for Greece, Finland and Portugal and two for the Netherlands. For the UK, an intervention delivered by the NHS was selected. For Netherlands, the intervention with best weight loss results was selected. The characteristics of interventions selected per country and their effect on weight loss are summarised in Table 1.

For Lithuania, Poland and Bulgaria, the Greek intervention will be used in the absence of country specific information. The assumption was made that a similar intervention delivered in these countries would have a similar effect on weight loss and would cost the same.

The model will use country specific information on the effect of MCLI on weight loss (Table 1). The impact of rolling out the country specific MCLI at national level on population body weight and associated future disease burden to 2050 will be modelled.

Two intervention scenarios will be modelled with the following assumptions:

1. MCLI participants regain the lost weight over 5 years and return to their baseline weight as is suggested by two large reviews (3, 4) linearly.
2. MCLI participants keep the lost weight off over time.

Further assumptions for both scenarios above are:

1. 12% of obese persons take up a MCLI when offered it by their General Practitioner or Family Doctor. This figure is based on the response rate reported in Jolly et al's study where over 6,000 letters were sent out from GP practices inviting eligible patients to participate in a MCLI (1)page 67.
2. 87% of those who start a MCLI complete it. This figure is based on the average attrition/follow-up rate of the 11 interventions identified for EConDA countries (1).
3. Only obese individuals ($BMI \geq 30$) will be offered a MCLI as it has been previously shown that interventions achieving weight loss of a similar magnitude to interventions in table 1 are more cost-effective in more obese individuals (5).
4. Individuals taking up the MCLI will be selected at random from the entire population distribution of obesity.

Table 1 Selected multicomponent lifestyle interventions for EConDA countries

Country	Intervention	N	% reduction BMI/weight	% regain BMI	Cost of intervention	Length of follow up	Details
Greece	Group sessions targeting diet and PA (6) (Petrogianni, 2013)	108 adults with hypercholesterolemia	2.11% statistically significant reduction in BMI (-1.6 kg) (from mean 28.4 to 27.8 in intervention gp at month 3)	N/A	175 Euros (Pers. comm. Moschos G, 2015)	3 months	Participants in the intervention group attended 7 60 minute group sessions (5 participants per session) based on the Health Belief Model and Social Cognitive Theory. Sessions motivated participants to set targets to improve diet and physical activity. Participants kept food diaries and used pedometers.
UK	Size down-NHS group-based weight loss programme (7) (Jolly,2011)	100	2.5kg reduction (imputed analysis) 3.7kg reduction in complete cases analysis @ 12 months follow up (from BMI 33.77 to 33.03; 0.67 BMI unit reduction in a year in imputed analysis)	0.56 kg/year average of studies *	£91.87 per participant (see above)	12 months	8 two hours sessions over 3 months delivered by lay person taken NVQ level 3- 25 hrs of training from dietitian plus assessment to pass. Sessions were run in community venues. Particular focus was on long term changes in patterns of eating behaviour, achieving a balanced diet, and increasing physical activity in daily life. Topics covered included: managing behaviour around food, prevention of relapse, the eatwell plate, nutritional information, interactive visual aids to show the fat and sugar content of foods and adaptation of recipes. Theoretical background was based on the cycle of change (8). Behaviour change strategies used were goal setting, stages of change and self monitoring with a food diary (7).
Finland	Finnish intervention (9) (Lindstrom, 2003)	522 (265 intervention; 257 control)	4.3kg reduction at 12 months (BMI change -1.6 units), 3.5kg reduction at 3 year follow up	0.56 kg/year average of studies *	N/A	3 years	7 compulsory individual sessions with dietitian/physician in year one then every 3 months indefinitely. Sessions had a preplanned topic (e.g. saturated fat, fiber, problem solving) but discussions were individualized focusing on specific individual problems. Plus voluntary group sessions (e.g. low-fat cooking lessons, visits to local supermarkets and expert lectures). Sessions underpinned by stages of change theory (8). Participants were given a low fat diet (<30% calories from fat), exercise recommendation (30 minutes). Supervised exercise sessions were offered free of charge. Participants were encouraged to set behaviour change goals.

Netherlands	Dutch intervention (10, 11)(Mensink, 2003)	114 (55 intervention; 55 control)	2.25 kg reduction at 12 months; -1.1 units BMI change (in imputed analysis), 3.1 kg reduction in complete cases analysis. At 24 months, 1.8 kg reduction (imputed) 2.4 kg (complete cases)	N/A	N/A	24 months	8 behavioural sessions over 2 years given by trained dietitians plus 208 supervised physical activity sessions. Behavioural sessions cover topics such as label reading and novel foods, artificial sweeteners and coping in special occasions. Fat and carbohydrate restriction based on Dutch Nutrition Council guidelines. If participants did not lose 5-7% weight by year 2, given 'mild' energy restriction diet. Supervised moderate intensity physical activity for 30 min 5 days a week.
Portugal	Self determination theory (12) (Silva et al)	239	5.49 kg reduction (in imputed analysis), 6.03 kg reduction in complete cases analysis.	N/A	110 Euros (Pers comm Ana Rito 2015)	12 months	30 120 min 1:1 sessions with dietitians, nutritionists, exercise physiologists (all PhD or Ms level) over 12 months. Sessions covered the following broad topics: increasing knowledge (e.g. understanding energy balance), triggering weight loss and improving diet, adopting and increasing physical activity, addressing barriers, promoting self-regulation and developing autonomy, improving body image and preparing weight management. The underpinning theoretical background was self-determination theory which holds that human motivation varies in the extent to which it is autonomous or controlled and that behaviour change requires an internalization process. Intervention included reduced energy diet, recommended and supervised physical activity.

Table Summary input data for multi-component weight management interventions

Country	Reduction in BMI*	% BMI lost regained after 5 years	Cost of intervention per patient
Greece	0.6	100	175 Euros
UK	0.7	100	£91.87
Finland	1.6	100	110 Euros (Proxy)
Netherlands	1.1	100	110 Euros (Proxy)
Portugal	2.2	100	110 Euros
Lithuania	Greece Proxy	Greece Proxy	Greece Proxy
Poland	Greece Proxy	Greece Proxy	Greece Proxy
Bulgaria	Greece Proxy	Greece Proxy	Greece Proxy

* Absolute units of BMI; reduction in intervention group at 12 months for UK, Finland, Netherlands and Portugal and at 3 months for Greece

Literature review search methodology

Database: Pubmed

Search: 1

Date: 03/11/2014

Search strategy: ("Healthy lifestyle intervention"(MeSH) OR "multidisciplinary intervention"(MeSH) OR "lifestyle change intervention"(MeSH) OR "multicomponent lifestyle intervention") AND Obesity(MeSH)

Results retrieved: 31

Exported:31

Search:2

Date:03/11/2014

Search strategy: ("Healthy lifestyle intervention"(MeSH) OR "multidisciplinary intervention"(MeSH) OR "lifestyle change intervention"(MeSH) OR "multicomponent lifestyle intervention") AND Exercise(MeSH)

Results retrieved: 24

Exported: 16 (duplicates)

Search: 3

Date: 03/11/2014

Search strategy: ("Healthy lifestyle intervention"(MeSH) OR "multidisciplinary intervention"(MeSH) OR "lifestyle change intervention"(MeSH) OR "multicomponent lifestyle intervention") AND "behavior therapy"(MeSH)

Results retrieved: 13

Exported: 0

Search: 4

Date: 03/11/2014

Search strategy: ("Healthy lifestyle intervention"(MeSH) OR "multidisciplinary intervention"(MeSH) OR "lifestyle change intervention"(MeSH) OR "multicomponent lifestyle intervention") AND "cognitive therapy"(MeSH)

Results retrieved: 6

Exported: 0

Search 5

Date: 03/11/2014

Search strategy: ("Healthy lifestyle intervention"(MeSH) OR "multidisciplinary intervention"(MeSH) OR "lifestyle change intervention"(MeSH) OR "multicomponent lifestyle intervention") AND "talking therapy"

Results retrieved: 0

Exported: 0

Database: Google Scholar

Search: 1

Date: 30/10/14

Search strategy: all the words "multicomponent lifestyle interventions" "obesity"

2010 - 2014

Results retrieved: In the title of the article = 0. Anywhere in the article = 21

Exported: 16

Search: 2

Date: 30/10/14

Search strategy: all the words "multi-component lifestyle interventions" "obesity"

2010 - 2014

Results retrieved: In the title of the article = 0. Anywhere in the article = 18

Exported: 14

Search: 3

Date: 30/10/14

Search strategy: all the words "multicomponent lifestyle interventions" "physical activity"

2010 - 2014

Results retrieved: In the title of the article = 0. Anywhere in the article = 21 (from the list shown, already saved 14 from previous search).

Exported: 7

Search: 4

Date: 30/10/14

Search strategy: all the words "multi-component lifestyle interventions" "physical activity"

2010 - 2014

Results retrieved: In the title of the article = 0. Anywhere in the article = 19 (from the list shown, already saved 13 from previous search).

Exported: 3

Search: 5

Date: 30/10/14

Search strategy: all the words "multi-component lifestyle interventions" "cognitive therapy"

2010 - 2014

Results retrieved: In the title of the article = 0. Anywhere in the article = 2 (from the list shown, already saved from previous search).

Exported: 0

Search: 6

Date: 30/10/14

Search strategy: all the words "multicomponent lifestyle interventions" "cognitive therapy"

2010 - 2014

Results retrieved: In the title of the article = 0. Anywhere in the article = 1 (from the list shown, already saved from previous search).

Exported: 0

Search: 7

Date: 30/10/14

Search strategy: all the words “multi-component lifestyle interventions” “behavioural therapy”

2010 - 2014

Results retrieved: In the title of the article = 0. Anywhere in the article = 2 (from the list shown, already saved from previous search).

Exported: 0

Search: 8

Date: 30/10/14

Search strategy: all the words “multicomponent lifestyle interventions” “behavioural therapy”

2010 - 2014

Results retrieved: In the title of the article = 0. Anywhere in the article = 1 (from the list shown, already saved from previous search).

Exported: 0

Search: 9

Date: 30/10/14

Search strategy: all the words “multicomponent lifestyle interventions” “talking therapy”

2010 - 2014

Results retrieved: In the title of the article = 0. Anywhere in the article = 0

Exported: 0

Search: 10

Date: 30/10/14

Search strategy: all the words “multi-component lifestyle interventions” “talking therapy”

2010 - 2014

Results retrieved: In the title of the article = 0. Anywhere in the article = 0

Exported: 0

Total number of results: 80

Total in Matrix with duplicates removed: 50

30 articles were removed due to:

1. Not relevant
2. Duplicate
3. Initial link to article did not work and a search via Google the article could either not be found or was not relevant when reviewed.
4. Free abstract was not available to view the article).

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