Health promotion for a multiethnic population: the case of weight-gain prevention among a multiethnic population of mothers living in Amsterdam South-East

Hartman, M.A.

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CHAPTER 2

Targeting physical activity and nutrition interventions towards mothers with young children?
A review on components that contribute to attendance and effectiveness

Marieke A Hartman, Karen Hosper, Karien Stronks

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Abstract

Objective: To gain insight into intervention components targeted specifically to mothers of young children which may contribute to attendance and effectiveness on physical activity and healthy eating.

Design: Systematic literature searches were performed using MEDLINE, Embase, and cited references. Articles were included if they evaluated the effectiveness of a lifestyle intervention to promote physical activity and/or healthy eating in an experimental design among mothers with young children (age 0-5 years). Data were extracted on study characteristics, intervention components targeted towards mothers with young children, the attendance and effectiveness. Extracted data were analysed in a descriptive manner.

Results: Eleven articles describing 12 interventions met the inclusion criteria. Of the six studies that measured attendance, two reported a high attendance. Embedding the intervention within routine visits to child health clinics seems to increase attendance. Three studies found significant effects on physical activity and three on healthy eating. Effective interventions directed at physical activity included components such as counselling on mother-specific barriers, or community involvement in intervention development and implementation. One of the three interventions that effectively increased healthy eating had components targeted at mothers (i.e. used targeted motivational appeals).

Conclusions: The number of experimental intervention studies for promoting physical activity and healthy eating among new mothers is limited. However, useful first recommendations can be set for targeting interventions towards mothers in particular for promoting attendance, and physical activity. More insight is required about the need for targeting health promotion programmes at new mothers, especially of those directed at nutritional behaviour.
Background

Follow-up studies among adults show that weight gain in young women is, on average relatively large compared to older women [1-3]. Excessive weight gain during pregnancy, failure to lose weight in an appreciable period of time postpartum, and weight gain during the postpartum period may well partly explain this weight gain among young women [4-6]. New mothers are more likely to gain weight compared with young adult women without children [7]. In addition, longitudinal studies have shown that postpartum weight retention predicts overweight in the long-term [4, 5]. Therefore, promoting weight control among new mothers is valuable in obesity prevention.

A decrease in physical activity during transition into motherhood may explain the higher increase in weight gain among new mothers compared to non-mothers. A meta-analysis showed that mothers were less likely to be physically active than fathers and non-parents [8]. In particular, mothers of young children (under the age of 5) seem to be at risk for physical inactivity [9, 10]. Changes in nutritional behaviour before and after pregnancy are found inconsistently [11-13]. However, this does not mean that there is no room left to improve nutritional behaviour among mothers. An unhealthy diet and a decrease in physical activity are both related to weight gain among mothers with young children [7, 14, 15].

Preliminary findings of a recently published Cochrane review [16] extracted from six studies showed that among women recruited in the postpartum period (up to 12 months postpartum) a prescribed diet combined with structured exercise, or diet alone, compared with usual care seemed to enhance weight loss [16]. However, this Cochrane review focused on the effect of a change in diet or exercise on a change in weight without examining the factors that lead to behaviour change. In order to develop weight loss programmes, it is useful to have insight into how these behaviours can be promoted.

In addition, it seems worthwhile to look at how mothers can be encouraged to attend such programmes. The years it takes to establish a young family involve a major life transition for women in terms of their social, occupational and biological lives [17]. Most mothers of young children experience some constraints, for example, lack of time and energy, and the responsibilities of child care. These factors may influence their interest and ability to attend interventions [18].

Targeting nutrition and physical activity interventions to these mother-specific factors may enhance both their effectiveness and attendance rate. Therefore, the purpose of this review is to gain insight into targeted intervention components which may contribute to the attendance and effectiveness of interventions promoting physical activity and/ or healthy eating to mothers with young children (0-5).
Methods

Search strategy and data sources

Intervention studies were identified through a structured electronic database search in OVID Embase and MEDLINE. The search strategy, shown in Box 2.1, included searching on words in title or abstract, and MeSH terms. The search was limited to articles with MeSH term ‘human’ (or ‘humans’ in MEDLINE) and articles published from 1997 to 2009.

Selection criteria

Studies eligible for inclusion were intervention studies aimed at promotion of physical activity and/ or healthy eating; the target group was mothers (18+) with young children (0-5 years); the study design included a pre- and post measurement among an intervention and a control group. Studies were excluded if the intervention was a prescribed diet or exercise program with no attention paid to lifestyle change (e.g. sessions with prescribed exercise to achieve a certain percentage of the heart rate reserve for a certain amount of time). Also, studies were excluded if the study population consisted of mothers with mental health problems because this was considered to be a different subpopulation. Finally, studies were excluded if no information was available about the age of the children. An exception was made for participants of the Women, Infants, and Children (WIC) program since this program provides food, nutrition counselling and access to health resources specifically for low-income pregnant and postpartum women with children up to the age of five years in the United States (http://www.fns.usda.gov/wic/).

Procedure

The titles and abstracts were assessed by the first author (MAH). In cases of doubt the second author was consulted (KH). If a reference was considered to be relevant, the full paper was retrieved. Full papers were assessed against the review selection criteria. Reference lists of relevant articles were scanned. Extracted data included study characteristics, intervention
characteristics, intervention components targeted at mothers, and reported intervention attendance and effectiveness. By intervention components targeted at mothers, we mean the adapted intervention components to the situation of mothers with young children. By attendance, we mean not only attendance to intervention classes but also exposure to the intervention in other ways (i.e. dose received).

Information on the characteristics of the studies was collected so that the quality and the generalizability of the studies could be assessed. The following information about study characteristics was extracted: the country where the study was conducted, design (true experiment or quasi-experiment), description of the intervention and comparison group, response and attrition rate, and primary outcome measures.

Additionally, data was extracted separately for intervention components presumed to be related to attendance and effectiveness. Information on both kinds of results is important, since a low attendance or a low effectiveness will result in a low impact of the intervention. The results were analysed in a descriptive manner.

For attendance, intervention components targeted at mothers were summarized. Subsequently, the intervention components in studies with a low attendance were compared to those in studies with a high attendance. In addition, information was collected about possible explanations for non-attendance.

For effectiveness on physical activity and healthy eating, intervention components specifically targeted at mothers were summarized, related to effectiveness (statistically significant effects or not) and additional information was collected on the possible explanations for their effectiveness. Furthermore, if key elements of a systematic development of interventions were used (use of formative research, theory, behavioural change strategies, evidence, and targeting other characteristics than being a mother), these elements were then also summarized. Such elements should be taken into account when interpreting the results of the relationship between targeted components and the effectiveness of interventions because a systematic intervention development increases the likelihood of obtaining intended positive effects [19].

Results

Study selection
The initial search identified 1,556 publications. After eliminating duplicates and reviewing the titles and abstracts of these publications, the total was reduced to 42. These 42 articles were completely reviewed, after which 31 publications were excluded because they did not meet one or more of the inclusion criteria. The main reasons for exclusion were lack of a control group; a different outcome measurement than physical activity, or nutritional behaviour; or because mothers of children above 5 years of age were included in the study. Moreover,
four review articles were found, all describing studies which mainly investigated the relationship between weight-related behaviours and weight only using prescribed diet or exercise with no attention for lifestyle change [16, 20-22]. Equally, two intervention studies were also excluded for this reason. Finally, some articles seemed to report the results of the same study, because they describe the same intervention and the same number of participants. In one case, the article was chosen which described the effect evaluation [23] instead of the feasibility study [24]. In the other two cases, articles were selected which evaluated the effect on actual health-related behaviour [25, 26] instead of on the stages of change [27] or purchasing of fresh fruit and vegetables [28]. After checking references no other relevant articles were found. Therefore, a total of 11 articles were eligible, describing 12 interventions (Table 2.1).

**Study characteristics**

The eligible studies differed on many characteristics (Table 2.2). Most of the studies were conducted in the United States [25, 26, 29-33], two in Australia [34, 35], one in Canada [36], and one in Finland [23]. Four interventions were implemented in a clinical setting [23, 31, 33, 35], three in a community setting [34, 36], and five interventions were implemented within or along the Women, Infants, and Children program [25, 26, 29, 30, 32]. Three studies were quasi-experiments [23, 26, 35], and eight true experiments [25, 29-34, 36].

Six studies included only postpartum mothers with children up to the age of one year [23, 26, 31, 33, 35, 36] in contrast with the five other studies which included mothers of children up to five years. Moreover, the study populations differed on socio-economic and ethnic composition. The American studies directed at WIC mothers mainly included a relatively high percentage of low-income women and women from minority groups [25, 26, 29, 30, 32]. Control groups consisted mainly of usual care [23, 25, 30] or no intervention [29, 34, 35]. The study population size varied from 22 to 3,122 participants.

The variation in response rates was large; 30.8% - 91.2%, but almost half of the studies gave no information about response rates. No information could be obtained about response rate for one study since respondents were recruited passively through a local community newspaper article on postnatal fitness [36]. In the other studies, respondents were recruited actively, i.e. were personally approached to participate in the study. Attrition rates varied from 7.6% to 31%.

Three studies were directed at promoting healthy eating, physical activity as well as weight change [23, 31, 33]; four studies were aimed at promoting healthy eating [25, 26, 29, 30]; and four at physical activity [32, 34, 35]. In all studies, nutritional behaviour was measured by self-reports; physical activity by self-reports or objective measurement (pedometer/accelerometer); and weight loss by self-reports or anthropometric measurements.
mothers were more likely to attend. Moreover, married, higher income, and unemployed educated were more likely to attend in both studies. In one study participants were more likely to be white, while in the other study there was no difference regarding attendance between ethnic groups. Moreover, married, higher income, and unemployed mothers were more likely to attend.

Table 2.1 Overview of interventions directed at mothers with young children to promote healthy eating and/or physical activity

<table>
<thead>
<tr>
<th>Nutrition interventions</th>
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<tbody>
<tr>
<td>• Campbell et al. (2004) [29]: The intervention, Foodsmart, concerned interactive tailored nutrition education that took approximately 20-25 minutes to complete on the computer. The intervention included four main components: 1) a full-motion video soap opera, 2) interactive ‘infomercials’, 3) tailored dietary feedback and 4) psychosocial feedback determined by baseline measurement</td>
</tr>
<tr>
<td>• Havas et al. (1998) [25]: The intervention Maryland WIC S-A-Day Promotion Program consisted of three components over a 6-month period: 1) three nutrition sessions conducted by peer educators, 2) printed materials and visual reminders (a photo novella which served as a guidebook for group discussions &amp; 5 clue cards; a booklet of recipes; a children’s activity book focused on F&amp;V; a videotape showing children singing about F&amp;V; a refrigerator magnet with the program’s logo; and a calendar/reminder sheets containing information about future nutrition sessions), and 3) direct mail (four different tailored letters accompanied by a tip sheet and a clue card)</td>
</tr>
<tr>
<td>• Havas et al. (2003) [30]: The multidimensional intervention Maryland WIC Food For Life (FFL) Program was targeted at participants’ stages of change and included (1) a 5-minute video featuring enthusiastic participants from the pilot study, (2) an attractive FFL brochure, (3) individualized feedback on their baseline food frequency questionnaire, (4) a kick-off fair, (5) four 45-minute workshops, (6) newsletters, (7) mail packets, (8) personalized invitations, (9) behaviour-reinforcing incentives, and (10) phone calls over a 6-month period</td>
</tr>
<tr>
<td>• Herman et al. (2008) [26]: Participants in the two intervention sites were issued S10 worth of vouchers per week, in US$1 units for the supermarket site and in US$2 units for the farmers’ market site, to buy produce of the participants’ choice. Vouchers were issued bimonthly and could be spent over the ensuing 2-month period</td>
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<thead>
<tr>
<th>Nutrition and physical activity interventions</th>
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<tr>
<td>• Kinunnen et al. (2007) [23]: The intervention included individual counselling on PA (one primary counselling session and 4 booster sessions) and diet (one primary counselling session and 3 booster sessions in addition to the PA booster sessions) during five routine visits to a public health nurse and an option to attend exercise classes held once per week for 45-60 minutes</td>
</tr>
<tr>
<td>• Leermakers et al. (1998) [31]: A 6-month weight loss intervention delivered via correspondence, which focused on low-fat/low-calorie eating habits and increasing PA. This intervention included three components: 1) two group sessions; 2) correspondence materials (16 written lessons about nutrition, exercise, and behaviour change strategies); and 3) telephone contact (weekly or biweekly)</td>
</tr>
<tr>
<td>• Østbye et al. (2009) [33]: Active Mothers Postpartum consisted of eight healthy eating sessions (Mom’s Time Out (MTO) classes), ten PA group sessions (ACTIVMOMS classes), and six telephone-counselling sessions over a 9-month period. Participants were also provided a study notebook, pedometer and sport stroller</td>
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<th>Physical activity interventions</th>
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<tr>
<td>• Cramp and Brawley (2006) [36]: Participants in the intervention condition received standard exercise training classes (SE) plus a group-mediated cognitive behavioural intervention (GMCB). SE consisted of an intensive phase (4 weeks) of exercise classes twice a week immediately followed by 4 weeks of a home-based phase in which participants were encouraged to implement their own exercise regime. In addition, during the intensive phase, participants received six 20-minute GMCB sessions consisting of self-regulatory skill training. During the home-based phase, one telephone contact was provided</td>
</tr>
<tr>
<td>• Fahrenwald et al. (2004) [32]: Moms on the Move consisted of three components: 1) provider counselling supplemented with 2) an interactive trifolded, two-sided coloured brochure, and 3) four structured, biweekly provider-delivered telephone contacts to promote PA</td>
</tr>
<tr>
<td>• Miller et al. (2002) [34]: Group 2 received a print intervention. Group 3 received both the print intervention and an invitation to attend a meeting at their childcare centre to discuss the development of local strategies for the promotion of PA among mothers of young children. This formed the basis for the development of intervention strategies (implemented through collaboration among participants, researchers, and community organisations). In addition, group 3 received a PA directory with avenues for accessing information about PA opportunities in their local community; a telephone call was made after the discussion group meetings; and notice boards were displayed to encourage dissemination of information about local opportunities for PA</td>
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<tr>
<td>• Watson et al. (2005) [35]: Nurses invited mothers in the intervention area to join pram walking groups. The pram walking groups were held once a week in a number of locations across the intervention area and were approximately 1 h of duration</td>
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</tbody>
</table>

WIC, Special Supplemental Nutrition Program for Women, Infants, and Children; F&V, fruit and vegetables; PA, physical activity.

Attendance

Within the six studies that reported attendance, full attendance ranged from 9 - 92% (Table 2.3). In two studies [30, 33] subgroup analyses were performed. Older (>30 years) and higher educated were more likely to attend in both studies. In one study participants were more likely to be white [33], while in the other study there was no difference regarding attendance between ethnic groups [30]. Moreover, married [33], higher income [33], and unemployed [30] mothers were more likely to attend.
Components within intervention studies reaching a low versus a high attendance

Two studies succeeded in reaching a high attendance of mothers [23, 36] (Table 2.3). The intervention of Kinnunen et al. [23] was embedded within routine visits to child health clinics, normally attended by 98% of the target population. This resulted in a 92% attendance to their intervention. Furthermore, Cramp and Brawley [36] reached an attendance of 75%. Their attempts involved conducting the intervention in a community-based fitness facility and providing child care for a nominal fee. Other interventions whereby child care was provided or an activity with mothers and children was organised did not result in high attendance [25, 33, 35].

Moreover, several other approaches were used in order to increase attendance among mothers with young children, although with minor results (9-27% attendance). To accommodate varying schedules of mothers, intervention sessions were repeated several times [25, 30, 33], or the intervention was held at the mothers’ preferred time of day [35]. Furthermore, intervention setting and time schedules were adapted to WIC voucher pickup to maximize the limited opportunities for reaching mothers [25, 30]. One group activity with mothers – pram walking – was organised to overcome social isolation among other things [35].

Explanations for attendance derived from additional attendance analyses

Four studies had conducted explorative attendance research through a questionnaire and/or focus group discussions [25, 30, 35] (Table 2.3). Results showed that reasons for non-attendance were, for instance, a lack of interest or withdrawal from the organisation that had implemented the intervention, WIC [25, 30, 37]. Moreover, some reasons mentioned for non-attendance were related to barriers specific to mothers, such as lack of childcare or conflicting schedules [25, 30, 33, 35]. Other reasons for non-attendance were more general, for example, work or school conflicts, transport difficulties, sickness and mobility of participants [25, 30, 33, 35, 37].

Effectiveness

Six out of 12 interventions did not result in positive significant effects (Table 2.4). Two interventions resulted in inconsistent (i.e. significant and non-significant) results on varying types of physical activity, eating behaviours, and weight change [23, 31], and four resulted in no significant effects [29, 34, 35]. Regarding the remaining six interventions, positive significant changes were reported on physical activity [32, 34, 36] and healthy eating [25, 26, 30] in the short-term (1-8 months).

Three studies conducted additional subgroup analyses [25, 30, 33]. No intervention effects were found in subgroup analyses based on race, education, parity, or BMI category in one study [33]. Both studies of Havas et al. [25, 30] found that mothers younger than 30 years and with at least high school education showed significantly greater increases in healthy eating. One study also found this pattern for married and non-working women [25]. Furthermore,
### Table 2.2 Study characteristics

<table>
<thead>
<tr>
<th>Study (author, year, country)</th>
<th>Design</th>
<th>Intervention group (no. of participants in intervention group and characteristics total sample)</th>
<th>Control group (no. of participants in control group and control situation)</th>
<th>Response</th>
<th>Attrition</th>
<th>Outcome measure</th>
<th>Outcome</th>
<th>Measurement</th>
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<tr>
<td><strong>Nutrition interventions</strong></td>
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<td>Campbell et al. (2004) [29], USA</td>
<td>True-experiment</td>
<td>n 141 Age: 18+ years Age of children: Unborn (20%), ≤ 5 years Most highly educated 50% from minority groups (primarily African American) 2% men</td>
<td>n 166 No intervention</td>
<td>Not reported</td>
<td>25.2%</td>
<td>Fat intake, F&amp;V intake</td>
<td>Self-reported</td>
<td>-FFQ</td>
</tr>
<tr>
<td>Havas et al. (1998) [25], USA</td>
<td>True-crossover - Cluster randomized</td>
<td>n 1443 Age: 18+ years Age of children: Unborn, ≤ 5 years Low-income 53% blacks</td>
<td>n 1679 A standard approach - Nutrition education and voucher pickup</td>
<td>66-87% (acceptance rates resp. intervention – control phases)</td>
<td>24.5% short-term; 38.0% long-term</td>
<td>Food intake</td>
<td>Self-reported</td>
<td>- seven summary questions concerning frequency of consuming F&amp;V</td>
</tr>
<tr>
<td>Havas et al. (2003) [30], USA</td>
<td>True-crossover - Cluster randomized</td>
<td>n 1055 Age: 18+ years Age of children: ≤ 5 years Low-income 56.7% blacks</td>
<td>n 1011 A standard approach - Nutrition education</td>
<td>39%</td>
<td>27% short-term; 43% long-term</td>
<td>Food intake</td>
<td>Self-reported</td>
<td>-FFQ</td>
</tr>
<tr>
<td>Herman et al. (2008) [26], USA</td>
<td>Quasi-experiment</td>
<td>n (supermarket site) 140 n (farmers' market site) 168 Age: 17-43 years Age of children: &lt; 1 (mothers had recently delivered) Low-income 89.1% Hispanic, 5.9% African-American, 2.8% non-Hispanic white, 1.9% Asian American, 0.2% American Indian</td>
<td>n 143 A minimal non-food incentive</td>
<td>Not reported</td>
<td>25%</td>
<td>F&amp;V intake</td>
<td>Self-reported</td>
<td>- 24 hour dietary recall (interview)</td>
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### Table 2.2 Study characteristics (continued)

<table>
<thead>
<tr>
<th>Study (author, year, country)</th>
<th>Design</th>
<th>Intervention group (no. of participants in intervention group and characteristics total sample)</th>
<th>Control group (no. of participants in control group and control situation)</th>
<th>Response</th>
<th>Attrition</th>
<th>Outcome measure</th>
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<tr>
<td><strong>Nutrition and physical activity interventions</strong></td>
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</table>
| Kinnunen et al. (2007) [23], Finland | Quasi-experiment | n 48  
Age: 18+ years  
Age of children: 2 months  
From different educational levels (lower education 47%) | n 37  
A standard approach  
- Usual counselling that is merely general advice, rather than counselling | 80.7% | 7.6% | Weight loss  
Anthropometric measurements  
- Height and weight (10 months postpartum)  
- Waist circumference  
Self-reported  
- Height and weight  
(pre-pregnancy)  
Intake of vegetables, fruit and berries, fibres, sugar  
Self-reported  
FFQ | | |
| | | | | | | |
| Leermakers et al. (1998) [31], USA | True experiment | n 47  
Age: 18+ years  
Age of children: 3–12 months  
Whose weight exceed prepregnancy weight ≥ 6.8kg  
BMI ≥ 22 kg/m²  
97% was white | n 43  
Informational brochure about healthy eating and exercise | Not reported | 31% | Weight loss  
Anthropometric measurements  
- Height and weight | | |
| | | | | | | |
| Østbye et al. (2009) [33], USA | True experiment | n 225  
Age 18+ years  
Age of children: 6 weeks  
BMI ≥ 25 kg/m²  
45% black  
Most well educated, about 40% household income >US$60 000 | n 225  
A minimal care-arm  
- Biweekly newsletters with general tips for postpartum mothers | 75.3%† | 30% | Weight loss  
Anthropometric measurements  
- Height and weight  
PA Self-reported  
- PA recall  
Food intake Self-reported - 60-item Block FFQ | | |
| | | | | | | |
| Cramp and Brawley (2006) [36], Canada | True experiment | n 32  
Age: 20-46 years  
Age of children: 6 weeks–1 year  
Primarily sedentary | n 35  
An attention control group  
- standard exercise classes  
Volunteer participants* | 15% PA  
Self-reported - PAR | | |
| | | | | | | |
| Fahrenwald et al. (2004) [32], USA | True experiment | n 22  
Age: 17-42 years  
Age of children: 6 weeks-5 years  
In the contemplation or preparation stage of PA behaviour change  
Low-income  
9.1% from minority groups | n 22  
An attention control group  
- Provider-counselled intervention  
on self-breast examination | 91.2%  
PA  
Self-reported  
Objective measurement  
Pedometer | | |
| | | | | | | |
| Miller et al. (2002) [34], Australia | True experiment  
- cluster-randomized  
- stratified clusters on socio-economic index for area | n (group 2) 164  
Age of children: 0 – 5 years  
Majority had a partner with a full-time job (90%) | n (group 3) 199  
No intervention | 30.8%  
short-term; 21% long-term  
PA  
Self-reported - 7 day recall questions | | |
| | | | | | | |
| Watson et al. (2005) [35], Australia | Quasi-experiment | n 60  
Age: μ = 29 years  
Age of children: < 6 months  
Most were highly educated (almost 40%)  
majority was native born Australian (80%) | n 48  
No intervention  
Not reported  
19.4% attrition  
PA  
Self-reported - Adapted questions from the 1999 National Physical Activity Survey | | |

PA, physical activity; F&V, fruit and vegetables; FFQ, Food Frequency Questionnaire; IPAQ, International Physical Activity Questionnaire; PAR, 7-day Physical Activity Recall.  
*Passively recruited participants (via a local community newspaper article on post natal fitness)  
†798 reached by phone, 136 not eligible, 64 did not complete baseline (=598 eligible), 148 refused; response calculated 1-(148/598)×100=75.3%
### Table 2.2: Study characteristics (continued)

<table>
<thead>
<tr>
<th>Study (author, year, country)</th>
<th>Design</th>
<th>Intervention group</th>
<th>Control group</th>
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<td><strong>n</strong> 37 A standard approach - Usual counselling that is merely general advice, rather than counselling</td>
<td><strong>80.7%</strong></td>
<td><strong>7.6%</strong></td>
<td>Weight loss Anthropometric measurements - Height and weight PA Self-reported - PA recall Food intake Self-reported - FFQ &amp; two 24-hour dietary recall interviews</td>
</tr>
<tr>
<td>Leermakers et al. (1998) [31], USA</td>
<td>True experiment</td>
<td><strong>n</strong> 47 Age: 18+ years Age of children: 3–12 months Whose weight exceed prepregnancy weight ≥ 6,8kg BMI ≥ 22 kg/m² <strong>97%</strong> was white</td>
<td><strong>n</strong> 43 Informational brochure about healthy eating and exercise</td>
<td><strong>Not reported</strong></td>
<td>31% Weight loss</td>
<td>Height and weight PA Self-reported - Paffenbarger Physical Activity Questionnaire Food intake Self-reported - 60-item Block FFQ</td>
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<td>Østbye et al. (2009) [33], USA</td>
<td>True experiment</td>
<td><strong>n</strong> 225 Age 18+ years Age of children: 6 weeks–1 year BMI ≥ 25 kg/m² Well educated, about 40% household income &gt;US$60 000</td>
<td><strong>n</strong> 225 A minimal care-arm - Biweekly newsletters with general tips for postpartum mothers</td>
<td><strong>75.3%†</strong></td>
<td><strong>30%</strong></td>
<td>Weight loss Anthropometric measurements - Height and weight PA, physical activity; F&amp;V, fruit and vegetables; FFQ, Food Frequency Questionnaire; IPAQ, International Physical Activity Questionnaire; PAR, 7-day Physical Activity Recall.</td>
</tr>
<tr>
<td>Cramp and Brawley (2006) [36], Canada</td>
<td>True experiment</td>
<td><strong>n</strong> 32 Age: 20-46 years Age of children: 6 weeks–1 year Primarily sedentary</td>
<td><strong>n</strong> 35 An attention control group - standard exercise classes</td>
<td><strong>Volunteer participants</strong></td>
<td>15%</td>
<td>PA Self-reported - PAR</td>
</tr>
<tr>
<td>Fahrenwald et al. (2004) [32], USA</td>
<td>True experiment</td>
<td><strong>n</strong> 22 Age: 17–42 years Age of children: 6 weeks–5 years In the contemplation or preparation stage of PA behaviour change Low-income 9.1% from minority groups</td>
<td><strong>n</strong> 22 An attention control group - Provider-counselled intervention on self-breast examination</td>
<td><strong>91.2%</strong></td>
<td><strong>15.4%</strong></td>
<td>PA Self-reported - PAR Objective measurement - Pedometer</td>
</tr>
<tr>
<td>Miller et al. (2002) [34], Australia</td>
<td>True experiment - cluster-randomized - stratified clusters on socio-economic index for area</td>
<td><strong>n</strong> (group 2) 164 <strong>n</strong> (group 3) 199 Age of children: 0–5 years Majority had a partner with a full-time job (90%)</td>
<td><strong>n</strong> 19 1 No intervention</td>
<td><strong>30.8%</strong></td>
<td><strong>20% short-term; 21% long-term</strong></td>
<td>PA Self-reported - 7 day recall questions</td>
</tr>
<tr>
<td>Watson et al. (2005) [35], Australia</td>
<td>Quasi-experiment</td>
<td><strong>n</strong> 60 Age: μ = 29 years Age of children: &lt; 6 months Most were highly educated (almost 40%) Majority was native born Australian (80%)</td>
<td><strong>n</strong> 48 No intervention</td>
<td><strong>Not reported</strong></td>
<td>19.4% attention</td>
<td>PA Self-reported - Adapted questions from the 1999 National Physical Activity Survey</td>
</tr>
</tbody>
</table>

PA, physical activity; F&V, fruit and vegetables; FFQ, Food Frequency Questionnaire; IPAQ, International Physical Activity Questionnaire; PAR, 7-day Physical Activity Recall.

* Passively recruited participants (via a local community newspaper article on postnatal fitness)

† 1798 reached by phone, 136 not eligible, 64 did not complete baseline (=598 eligible), 148 refused; response calculated 1-(148/598)×100 = 75.3%
<table>
<thead>
<tr>
<th>Study</th>
<th>Attendance</th>
<th>Intervention components targeted towards mothers aimed to increase attendance</th>
<th>Explanations for non-attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High attendance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Kinnunen et al. (2007) [23]| 92%                                                                         | Intervention setting is a child health clinic and sessions during routine visits  
- The postpartum women were recruited through the child health care system, which is available to all families with children in every municipality in Finland and is funded by public tax revenue. Almost all (98%) children attend these public child health clinics (CC) for regular check-ups  
- The study protocol was implemented during five routine visits to a public health nurse at the CC. These visits coincided with the child’s age of 2, 3, 5, 6 and 10 months  | - In the intervention group 90% women participated in all PA counselling sessions and 94% women in all dietary counselling sessions  
- On average, the women participated in 4.9 of the five physical activity counselling sessions and in 3.9 of the four dietary counselling sessions  
- The average participation rate in the (optional) group exercise sessions was 50.7% (sd 28.5) of the sessions available for each woman  |
| Cramp and Brawley (2006) [36]| 75%                                                                         | Intervention setting nearby and for free  
- The intensive phase was conducted at a community-based fitness facility (large commercial gym) which provided its facility free of charge  
- Childcare provided  
- Provided childcare on-site for a nominal fee or the option to bring babies into class  | - Participants completed on average 6 of 8 post natal exercise classes for a 75% attendance rate  |
| **Low attendance**        |                                                                             |                                                                                                                                                  |                                                                                                  |
| Østbye et al. (2009) [33]  | 27%                                                                         | Repeated intervention sessions  
- All WNOAM classes were offered 2-6 times a week, including Saturdays and different times of day, to accommodate various schedules of both working and stay-at-home mothers  
- MTO sessions were offered each month at convenient times, usually adjacent to ACTIVMOMS classes  | - 60 out of 225 women attended 6 or more classes, 68 attended 1-5 classes, 97 attended 0 classes  
- Participants attended a mean of 3.8 classes and a mean of 3.3 counselling calls  
- Those who took part in the classes were more likely to be older, white, married, and had more education and higher income than those who did not participate  |
| Watson et al. (2005) [35]  | 20%                                                                         | Mother and child activity on preferred time of day  
- Mothers were asked their preferred time of day for a pram walking group  
- Pram walking is designed to overcome the barriers to physical activity of child care, cost, time and social isolation  | - Over the 6 months 12 mothers (20%) walked once a fortnight and 9 mothers (15%) walked at least once a month  
- 42% of intervention mothers joined a pram walking group less than once a month and 23% did not attend any  
- At the start of the pram walking there was close to 40 mothers walking across 5 groups. After the 1st month the number dropped and remained below 25 mothers  |

**Table 2.3** Intervention components targeted towards mothers, the attendance, and explanations for attendance

- **Study Attendance**  
  - High attendance  92%  
  - Low attendance  27%  

- **Explainations for non-attendance**  
  - General explanations  
  - Coordinating schedules including the women’s own schedule (full-time work, school)  
  - Explanation related to mothers in specific  
  - Problems securing child care  
  - Coordinating schedules including those of other children in the family  
  - Day of the week or time of day did not suit  
  - It was the baby’s sleep time
<table>
<thead>
<tr>
<th><strong>Havas et al. (1998) [25]</strong></th>
<th><strong>19%</strong></th>
<th><strong>Repeated intervention sessions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Attendance at the nutrition sessions varied considerably by site</td>
<td>- To accommodate the varying schedules of the participants, the peer-led nutrition sessions were repeated three times a day (9:00 am, 10:30 am, and 1:00 pm) for 2 days at each site</td>
<td></td>
</tr>
<tr>
<td>- Overall, 19% attended all 3 sessions, 14% attended two sessions, 20% attended one session, and 46% attended no sessions</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **Intervention setting and time schedule adapted to WIC voucher pickup** |
|-------------------------|---|
| - At 12 sites, nutrition sessions were held prior to the regular WIC voucher pickup days thereby allowing clients to pick up their vouchers 1 or 2 days early and to avoid crowds. At the other 4 sites, nutrition sessions were held on days coinciding with regular voucher pickup |

<table>
<thead>
<tr>
<th><strong>Childcare provided</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Provided childcare by another peer educator (usually)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>General explanations</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Work or school conflict</td>
</tr>
<tr>
<td>- Lack of interest/thought nutrition sessions would be boring and uninformative/ a few preferred staying at home</td>
</tr>
<tr>
<td>- Withdrawal from WIC / thought that nutrition sessions would be like WIC education programmes</td>
</tr>
<tr>
<td>- Mobility and instability/ no longer being in the WIC program</td>
</tr>
<tr>
<td>- Not reached by reminder phone call</td>
</tr>
<tr>
<td>- Family of personal sickness</td>
</tr>
<tr>
<td>- Transportation difficulties/ misconception that attending the session would require an extra trip to the WIC site (instead of pick up WIC vouchers at the same time)</td>
</tr>
<tr>
<td>- Lack of time/conflict with other activities/ scheduling conflicts</td>
</tr>
<tr>
<td>- Childcare difficulties</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Havas et al. (2003) [30]</strong></th>
<th><strong>9%</strong></th>
<th><strong>Repeated intervention sessions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Attendance at the fairs/workshops varied by site</td>
<td>- The program minimized disruption of WIC's procedures and maximized the limited opportunities available for reaching participants</td>
<td></td>
</tr>
<tr>
<td>- Approximately 22% attended 1 session, 15% attended 2/3 sessions, 9% attended 4/5 sessions, while 54% attended none</td>
<td>- In phase 2, five day-long fairs, allowing participants to come at any time, covering the same topics as phase 1 workshops were held</td>
<td></td>
</tr>
</tbody>
</table>

| **Intervention setting and time schedule adapted to WIC voucher pick-up** |
|-------------------------|---|
| - The program minimized disruption of WIC's procedures and maximized the limited opportunities available for reaching participants |

<table>
<thead>
<tr>
<th><strong>General explanations</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Many had assumed our sessions would be similar to WIC's and therefore did not attend.</td>
</tr>
<tr>
<td>- Attending is a great logistical challenge given the obstacles many participants faced such as: work, transportation and stresses of inner-city life</td>
</tr>
<tr>
<td>- Change in the frequency of distribution of WIC vouchers to every three months meant that attending two thirds of our sessions required special trips</td>
</tr>
<tr>
<td>- Attending is a great logistical challenge given the obstacles many participants faced such as: child-rearing responsibilities</td>
</tr>
</tbody>
</table>
### Table 2.4 Components of interventions, the effectiveness, and explanations for effectiveness

<table>
<thead>
<tr>
<th>Study</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short-term effect</strong></td>
<td>Mean increases in daily consumption of F&amp;V were larger among intervention participants (0.56 (SD 0.11) servings) v. control participants (0.13 (SD 0.17) servings; P= 0.002)</td>
</tr>
<tr>
<td><strong>Effect on subgroups</strong></td>
<td>White women, women &lt; 30 years of age, high-school graduates, married, or not working woman showed significantly greater increases in consumption</td>
</tr>
<tr>
<td></td>
<td>Significant increases in consumption of F&amp;V were found for intervention participants in pre-contemplation, contemplation and preparation stage at baseline, but not among those in the action and maintenance stages</td>
</tr>
<tr>
<td><strong>Long-term effect</strong></td>
<td>Effects on F&amp;V remained significant at one year</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key elements of a systematic development which may contribute to promoting lifestyle change</th>
<th>Intervention components targeted towards mothers aimed to promote lifestyle change</th>
<th>Explanations for effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivational appeals directed to mothers</td>
<td>Two major motivational appeals were used to stimulate the adoption of the targeted behaviours, namely 1) set a good example for your children by eating more F&amp;V, and 2) take care of yourself by eating more F&amp;V not only during pregnancy but also afterwards</td>
<td></td>
</tr>
<tr>
<td>Attendance effectiveness relationship</td>
<td>Changes in self-efficacy, attitudes, social support, and knowledge of national consumption recommendations accounted for most of the intervention effect on increased consumption</td>
<td></td>
</tr>
<tr>
<td>Mediation</td>
<td>A strong relationship between attendance at the nutrition sessions and changes in consumption was found; the more sessions attended, the more F&amp;V servings consumed</td>
<td></td>
</tr>
</tbody>
</table>

**Havas et al. (1998) [25]**

- **Short-term effect**
  - Mean increases in daily consumption of F&V were larger among intervention participants (0.56 (SD 0.11) servings) v. control participants (0.13 (SD 0.17) servings; P= 0.002)

**Effect on subgroups**
- White women, women < 30 years of age, high-school graduates, married, or not working woman showed significantly greater increases in consumption
- Significant increases in consumption of F&V were found for intervention participants in pre-contemplation, contemplation and preparation stage at baseline, but not among those in the action and maintenance stages

**Long-term effect**
- Effects on F&V remained significant at one year

**Havas et al. (2003) [30]**

- **Short-term effect**
  - Difference in change in intervention participants v. controls was -1.62 (SD 0.33%) %E from fat (P<0.001), 0.4 (SD 0.11) servings of F&V (P<0.001), and of 1.01 (SD 0.31) g fibre (P=0.001)

**Effect on subgroups**
- Significant differences between intervention and controls in both Black and White participants.
- Larger change among women aged <30 years and with at least high school education

**Long-term effect**
- Effects remained after one year for fat (-0.74 (SD 0.38%) %E v. 0.87 (SD 0.41%) %E, P = 0.03) and for F&V consumption (0.1 (SD 0.13) v. -0.32 (SD 0.14) servings, P = 0.03), but not for fibre
### Table 2.4

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<thead>
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<td>Significant effect on healthy eating</td>
</tr>
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<td></td>
<td></td>
<td>- Mean increases in daily consumption of F&amp;V were larger among intervention participants (0.56 (SD 0.11) servings) v. control participants (0.13 (SD 0.17) servings; P= 0.002)</td>
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</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- Significant increases in consumption of F&amp;V were found for intervention participants in pre-contemplation, contemplation and preparation stage at baseline, but not among those in the action and maintenance stages</td>
<td>Havas et al. (2003) [30]</td>
</tr>
<tr>
<td></td>
<td>Long-term effect</td>
<td>- Effects on F&amp;V remained significant at one year</td>
<td>Short-term effect</td>
</tr>
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<td>Larger change among women aged &lt;30 years and with at least high school education</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 2. Theoretical framework</td>
<td>Attendance effectiveness relationship</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- TTM, SLT</td>
<td>- The more sessions attended, the greater the changes in intake. This applies to all three dietary variables</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 3. Behaviour change strategies</td>
<td>Peer educators</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- EDU, SS, PE, GS, ST</td>
<td>- Peer educators, of whom many had participated previously in WIC, teach at the fairs and workshops, made reminder telephone calls, and mailed educational packets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Targeted to SES/ ethnicity</td>
<td>Motivational appeals directed to mothers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Peer educators</td>
<td>Two major motivational appeals were used to stimulate the adoption of the targeted behaviours, namely 1) set a good example for your family by eating more F&amp;V, and 2) take care of yourself by eating more F&amp;V not only during pregnancy but also afterwards</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Newsletters had large fonts and simple illustrations</td>
<td>A photo novella with a mother role model as guidebook for nutrition sessions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- In phase 2: simplified messages, and a free bag of food</td>
<td>Peer educators</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- During the nutrition sessions, peer educators guided participants through exercises in the photonovella, facilitated discussion, and provided social support to help them achieve their goals</td>
<td>Attendance effectiveness relationship</td>
</tr>
</tbody>
</table>
Table 2.4 Components of interventions, the effectiveness, and explanations for effectiveness (continued)

<table>
<thead>
<tr>
<th>Study</th>
<th>Effectiveness</th>
<th>Key elements of a systematic development which may contribute to promoting lifestyle change</th>
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<tr>
<td>Herman (2008) [26]</td>
<td>Short-term effect&lt;br&gt;- Difference in increases in servings of F&amp;V per 4186kJ of food consumed for participants at the farmers’ market site (from 2.2 to 3.9) and supermarket site (from 2.9 to 4.1) v. the control site (from 2.6 to 3.0; F=9.75; P&lt;0.001)</td>
<td>1. Evidence-based&lt;br&gt;- Strategies to promote the choice of targeted foods by lowering their cost relative to those of alternative foods</td>
<td>Interventions components targeted towards mothers aimed to promote lifestyle change</td>
<td>Explanations for effectiveness&lt;br&gt;- A sustained increase in F&amp;V consumption at 6 months after intervention (farmers’ market and supermarket sites participants ate an average of 4.0 servings; participants at the control site reported an average of 3.1; F=6.66; P=0.001)</td>
</tr>
<tr>
<td></td>
<td>Long-term effect&lt;br&gt;- A sustained increase in F&amp;V consumption at 6 months after intervention (farmers’ market and supermarket sites participants ate an average of 4.0 servings; participants at the control site reported an average of 3.1; F=6.66; P=0.001)</td>
<td>2. Behaviour change strategies&lt;br&gt;- INC</td>
<td></td>
<td>Note&lt;br&gt;- Increases in intake were primarily increases in consumption of vegetables</td>
</tr>
<tr>
<td></td>
<td>No significant effect on healthy eating&lt;br&gt;</td>
<td>3. Targeted to SES/ethnicity&lt;br&gt;- Vouchers for F&amp;V for a supermarket or a farmers’ market</td>
<td></td>
<td>No significant effect on healthy eating</td>
</tr>
<tr>
<td>Campbell et al.  (2004) [29]</td>
<td>Short-term effect&lt;br&gt;- No significant differences between intervention and control groups for F&amp;V consumption and fat intake</td>
<td>1. Formative research&lt;br&gt;- Process and outcome evaluation of the original program (Stamp Smart)</td>
<td>Role modelling&lt;br&gt;- In the video soap opera the plot was centred on a woman who pretends she is pregnant to swindle money from the estate of her former boyfriend. Initially, the woman learns about prenatal nutrition to help her make her ‘faked’ pregnancy appear to be genuine. Later, she improves her diet for the sake of her baby and husband-to-be</td>
<td>2. Theoretical framework&lt;br&gt;- SCT, TTM</td>
</tr>
</tbody>
</table>
### Components of interventions, the effectiveness, and explanations for effectiveness (continued)

#### Herman (2008) [26]

**Short-term effect**
- Difference in increases in servings of F&V per 4186 kJ of food consumed for participants at the farmers' market site (from 2.2 to 3.9) and supermarket site (from 2.9 to 4.1) vs. the control site (from 2.6 to 3.0; F=9.75; P<0.001)

**Long-term effect**
- A sustained increase in F&V consumption at 6 months after intervention (farmers' market and supermarket sites participants ate an average of 4.0 servings; participants at the control site reported an average of 3.1; F=6.66; P=0.001)

**Note**
- Increases in intake were primarily increases in consumption of vegetables

#### Evidence-based
- Strategies to promote the choice of targeted foods by lowering their cost relative to those of alternative foods

#### Behaviour change strategies
- INC

#### Targeted to SES/ethnicity
- Vouchers for F&V for a supermarket or a farmers' market

#### No significant effect on healthy eating
- Campbell et al. (2004) [29]

**Short-term effect**
- No significant differences between intervention and control groups for F&V consumption and fat intake

**Formative research**
- Process and outcome evaluation of the original program (Stamp Smart)

**Theoretical framework**
- Cognitive response techniques [50]

**Behaviour change strategies**
- EDU, ML, FB

**Evidence-based**
- Computer-based tailoring

**Targeted to SES/ethnicity**
- Adapted language use
- Provided headphones and audio narration

**Role modelling**
- In the video soap opera the plot was centred on a woman who pretends she is pregnant to swindle money from the estate; the soap opera was developed for a women's (non-pregnant) audience to make her 'faked' pregnancy appear to be genuine. Later, she improves her diet for the sake of her baby and husband-to-be

#### Kinnunen et al. (2007) [23]

**Short-term effect on food intake**
- Mean proportion of high-fibre bread (of total weekly amount of bread) increased by 16.1% (95% CI 4.3-27.9) at 10 months postpartum in the intervention group v. controls when adjusted for confounders (P=0.008)
- No significant effects on intake of F&V, berries, high-sugar snacks, and having breakfast and at least one hot meal per day between the groups by 10 months postpartum

**Short-term effect on PA**
- No significant effects in leisure time PA between groups

**Short-term effect on weight loss**
- 50% of the intervention group v. 30% of the control group returned to their pre-pregnancy weight by 10 months postpartum (P=0.06); adjusted OR=3.89 (95% CI 1.16, 13.04), P=0.028
- The ORs for retaining maximum 2 kg or 5 kg at 10 months postpartum did not differ significantly between the groups

**Exercise classes developed specifically for postpartum women**
- An option to attend supervised group exercise sessions with both endurance and muscular training developed specifically for postpartum women
### Table 2.4 Components of interventions, the effectiveness, and explanations for effectiveness (continued)

<table>
<thead>
<tr>
<th>Study</th>
<th>Effectiveness</th>
<th>Key elements of a systematic development which may contribute to promoting lifestyle change</th>
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<th>Explanations for effectiveness</th>
</tr>
</thead>
</table>
| Leermakers et al. (1998) [31] | Short-term effect on PA  
- No significant change in energy expenditure in both groups (n (correspondence group) 30; n (control group) 16) | 1. Formative research  
- A pilot study was conducted | Correspondence focused, among others, on how to overcome postnatal specific barriers to PA  
- A tailored correspondence component to the special needs of new mothers which focused on strategies to modify diet and exercise behaviours (e.g. encouragement of including babies in mother’s exercise; information about appropriate strollers and special baby carriers) | No Mediation  
- Weight loss was unrelated to the changes in diet or exercise (P > 0.1)  
Adherence effectiveness relationship  
- Number of self-monitoring records returned was correlated to weight loss (r=0.50, P < 0.005).  
- No significant associations between homework completion or telephone contact and weight loss |
| | Short-term effect on food intake  
- Both groups (n (correspondence group) = 30; n (control group) 16) reduced daily energy intake and %E from fat with a similar magnitude | 2. Behaviour change strategies  
- EDU, SM, DS, GS, GP | | |
| | Short-term effect on weight loss  
- Correspondence group lost more weight than the control group (7.8kg v. 4.9kg; P < 0.03), and lost a greater % of their pre-treatment body weight (10.0 (SD 5.8%) v. 5.8 (SD 5.7) %, P < 0.005)  
- Correspondence subjects lost 79% of their excess postpartum weight v. 44% of the control (P =0.01)  
- 33% of the correspondence group v. 11.5% of the control group returned to, or below, their pre-pregnancy weight (P < 0.05) | 3. Evidence-based  
- Correspondence interventions, including telephone and computer contact | | |
<table>
<thead>
<tr>
<th>Study</th>
<th>Components of interventions, the effectiveness, and explanations for effectiveness (continued)</th>
</tr>
</thead>
</table>
| Østbye et al. (2009) [33] | **Short-term effect on food intake**  
- Mean caloric intake and percent calories from fat decreased in both groups, effects in groups were not significantly different  
- Also no differences on soda, sweetened drinks, fries or chips, or F&B per day, or fast food per week  
**Short-term effect on PA**  
- Both groups increased their bouts of activity per week and their total minutes of activity per week, effects in groups were not significantly different  
- Also no differences on sedentary behaviour (TV hours per day)  
**Short-term effect on weight loss**  
- Women in both groups experienced modest weight loss, effects in groups were not significantly different  
- Also no differences on return to pre-pregnancy weight, percent weight loss, change in BMI category, and proportion losing ≥4.5 or 1.0kg  |
| 1. Formative research  
- Survey about interest and preferences for weight loss intervention [51]  
- Pilot test of the intervention materials  
2. Behaviour change strategies  
- EDU, GP, DS, ST | Exercise classes developed specifically for postpartum women  
- ACTIVMOMS sessions include specific exercises designed to enhance recovery from pregnancy-related changes in body structure and function. Using a stroller or front-facing baby carrier, classes enable mothers to exercise with their babies. The classes were taught by certified postpartum exercise instructors  
**Discussion of barriers to PA, and weight loss in general common for the postpartum period**  
- Barriers for exercise and PA shared by all new mothers were emphasized and discussed as a group [52]  
- Educational activities helped women develop strategies to overcome common barriers to weight loss in the postpartum period, such as lack of time, energy, and motivation [52]  
**Attendance effectiveness relationship**  
- Class participation was significantly associated with weight change in bivariate analysis (P=0.01), but not with change in diet or PA  
- Multi-variable analysis controlling for age, race, education, income, and baseline BMI attenuated the effect of class participation on weight change (P=0.57)  
- Completion of counselling calls was not associated with weight or behaviour outcomes  |

**Effect on subgroups**  
- No intervention effects were found in subgroup analyses based on race, education, parity, or BMI category
Table 2.4 Components of interventions, the effectiveness, and explanations for effectiveness (continued)

<table>
<thead>
<tr>
<th>Study</th>
<th>Effectiveness</th>
<th>Key elements of a systematic development which may contribute to promoting lifestyle change</th>
<th>Intervention components targeted towards mothers aimed to promote lifestyle change</th>
<th>Explanations for effectiveness</th>
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</thead>
<tbody>
<tr>
<td><em>Significant effect on physical activity</em></td>
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<tr>
<td>Camp and Brawley (2006) [36]</td>
<td>Short-term effect</td>
<td>- Mean volume of moderate to vigorous PA (= frequency×duration) in the intervention group increased more (from 126.34 (SD 152.26) to 400.38 (SD 288.64) than in the control group (from 125.32 (SD 131.25) to 222.24 (SD 177.37); F(1, 52) = 8.36 P&lt;0.01)</td>
<td>Group counselling focused on how to overcome postnatal-specific barriers to PA</td>
<td>- Self-regulatory efficacy partially mediated the relationship between intervention condition and post home-based PA (outcome expectations did not) [40]</td>
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<tr>
<td></td>
<td></td>
<td>1. Theoretical framework - SCT, SET</td>
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<td></td>
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<td>2. Behaviour change strategies - GS, SM, ST, FB</td>
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<td>3. Evidence-based - Theory-based intervention framed in both social cognitive theory and group dynamics</td>
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<td>4. Targeted to SES/ethnicity - free-of-charge use of a large commercial gym</td>
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<td>5. - Mediation - Self-regulatory efficacy partially mediated the relationship between intervention condition and post home-based PA (outcome expectations did not) [40]</td>
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<tr>
<td>Fahrenwald et al. (2004) [32]</td>
<td>Short-term effect</td>
<td>- Significantly greater improvement in PA behaviour in the experimental group (effect size ≥0.80) for each of the PA indexes</td>
<td>A brochure with pros, cons and strategies to overcome barriers to PA identified by mothers</td>
<td>- Changes in PA outcome variables were not mediated through changes in stages of PA behaviour change, exercise benefits/barriers, self-efficacy for exercise, processes of exercise adoption i.e. self-liberation, counter-conditioning, environmental re-evaluation, and social support for exercise from family and friends [54]</td>
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<td></td>
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<td>- Mean daily steps increased from M=5,825.03 (SD 1,867.34) to M=9,180.88 (SD 1,700.40; t(10) = 6.16, P &lt;0.001)</td>
<td>- A brochure with examples of key pros and cons to PA that are specific to mothers of young children, and strategies to overcome frequently cited barriers to PA which (e.g. serving as a positive role model for children) was emphasized; mothers were asked to think about how their PA can benefit the whole family)</td>
<td>- Provider counselling - The brochure was the guidebook during provider counselling sessions. Mothers had to identify two desired benefits of PA, two personal barriers, and planned ways to overcome these barriers</td>
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<td></td>
<td></td>
<td>1. Formative research - Questionnaire examining TTM-constructs related to PA of mothers [33]</td>
<td>A brochure with pros, cons and strategies to overcome barriers to PA identified by mothers</td>
<td>- Changes in PA outcome variables were not mediated through changes in stages of PA behaviour change, exercise benefits/barriers, self-efficacy for exercise, processes of exercise adoption i.e. self-liberation, counter-conditioning, environmental re-evaluation, and social support for exercise from family and friends [54]</td>
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<td>2. Theoretical framework - TIM</td>
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<td>3. Behaviour change strategies - PC, SS, EDU, SM, GS</td>
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<td>4. Evidence-based - TIM interventions</td>
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<td>5. Targeted to SES/ethnicity - 7th grade reading level of the brochure</td>
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<tr>
<td>Study</td>
<td>Short-term Effect</td>
<td>Long-term Effect</td>
<td>Behaviour Change Strategies</td>
<td>Evidence-based</td>
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<td>Miller et al (2002) [34] (group 3)</td>
<td><strong>Short-term effect</strong>&lt;br&gt;- Group 3 women were significantly more likely to meet guidelines at post-intervention (59.9%) than group 1 (control group) participants (46.3%).</td>
<td><strong>Long-term effect</strong>&lt;br&gt;- No effects on long-term (5 months)</td>
<td>1. 'Formative research'&lt;br&gt;- Group 3: Discussion groups about perceived barriers to PA&lt;br&gt;2. Behaviour change strategies&lt;br&gt;- EDU, SS, CB&lt;br&gt;3. Evidence-based&lt;br&gt;- Community-wide PA interventions; targeting multiple levels of influence</td>
<td>A brochure with pros &amp; cons and strategies to overcome barriers to PA identified by mothers&lt;br&gt;- See Miller group 2 Discussion groups to explore barriers to PA that formed the basis for the development of intervention strategies&lt;br&gt;- E.g. walking groups that met immediately after delivering children to the childcare centre; sharing knowledge of existing services in the local area; many active women invited other mothers to join them in their activities such as a tennis group in which women rotated playing tennis and childcare&lt;br&gt;- E.g. Project staff lobbying local leisure-service providers to include or improve childcare services, and to make their time table of activities more ‘mom-friendly’ (e.g. scheduling aqua-aerobics classes at the same time as children’s learn-to-swim classes)&lt;br&gt;Note: developed strategies varied for each childcare centre</td>
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<tr>
<td>Miller et al (2002) [34] (group 2)</td>
<td><strong>Short-term effect</strong>&lt;br&gt;- Compared to women in group 1 (control group), Group 2 women did not change PA significantly, after controlling for age and PA at baseline</td>
<td></td>
<td>1. Behaviour change strategies&lt;br&gt;- EDU</td>
<td>A brochure with pros &amp; cons and strategies to overcome barriers to PA identified by mothers&lt;br&gt;- Group 2 and 3: A booklet containing information about the benefits of PA, and strategies for overcoming barriers that are specific to mothers of young children</td>
</tr>
</tbody>
</table>
Table 2.4 Components of interventions, the effectiveness, and explanations for effectiveness (continued)

<table>
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<tbody>
<tr>
<td></td>
<td>- No significant increases in the proportion of women classified as performing adequate PA in the intervention as well as in the control group</td>
<td>- GP, EDU (optional)</td>
<td>- Pram walking to overcome the barriers to PA of child care, cost, time and social isolation</td>
<td>- Mothers emphasized the importance of walking routes that met the needs of women with babies and young children</td>
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<td></td>
<td>- No significant difference in PA participation between the two groups</td>
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<td>- Pram walking routes taking into consideration: the width and condition of the path, road crossing on the route, accessibility by public transport, the aesthetic nature of the route and the presence of clean toilets and shade or shelter with a seat for feeding, preferably at the starting point</td>
<td>- The majority of mothers joined a pram walking group for the exercise and to get out of the house and meet other postpartum women</td>
</tr>
</tbody>
</table>

General: PA, physical activity; F&V, fruit and vegetables; %E, percentage of energy; TV, television; PAR, 7 d Physical Activity Recall; SES, socio-economic status; WIC, Special Supplemental Nutrition Program for Woman, Infants and Children.


Behaviour change strategies: EDU, education; PC, Discussing pros and cons; SS, providing/social support; PE, peer educator; GP, guided practice; GS, goal setting; RF, reinforcement; DS, discussing strategies to overcome barriers; ST, Skill training; INC, incentives; ML, modelling; FB, feedback; SM, self-monitoring; CB, capacity building.
white women showed significantly greater increases in fruit and vegetable consumption in one study [25], while in the other study significant changes in healthy eating were found in both black and white participants [30].

Of the three studies measuring long-term results (7 months - 1 year) [25, 30, 34], only Havas et al. [25] reported long-term nutritional behaviour change. Henceforth, the description of the results will focus on short-term effects since these are available for all studies.

Components within interventions which resulted in significant versus no significant effects
More systematically developed interventions were more likely to be effective (Table 2.4). Four interventions were developed using less than three out of five key components of a systematic development (i.e. formative research, theory-based, behaviour change strategies, evidence-based, or targeted to SES/ethnicity), none resulting in significant effects [23, 33-35]. Out of the other eight interventions using three key components or more, six interventions appeared to be effective in changing physical activity and healthy eating positively [25, 26, 30, 32, 34, 36].

Of the seven interventions directed at promoting healthy eating, three showed positive statistically significant results [25, 26, 30], of which only one was targeted at motivations of mothers [25]. The motivational appeals regarded ‘set a good example for your children’ and ‘take care of yourself by eating more fruits and vegetables also after pregnancy’ [38]. In addition, more general behavioural change strategies such as the use of peer educators [25, 30] and role modelling [29] were used in order to promote healthy eating.

In contrast, all eight interventions trying to promote physical activity included components targeted at mothers; mostly at overcoming barriers specific for mothers (e.g. physical changes, lack of time, social support, or energy) (Table 2.4). Five studies with components targeted at mothers did not show significant results on physical activity [23, 31, 33-35]. Of these studies, three were aimed at multiple behaviour change [23, 31, 33]. The two other interventions consisted of a single intervention; a brochure with tips for how to overcome barriers [34], or exercise – pram walking – groups [35]. These components were also elements in the three studies that showed significant results on physical activity [32, 34, 36]. For example, exercise classes were organised [36], and brochures were used with tips including how to overcome mother-specific barriers [32, 34]. However, these studies had additional (targeted) components (i.e. were multi-component) to promote physical activity (as a single behaviour). Both Cramp and Brawley [36] and Fahrenwald et al. [32] used in addition interactive counselling about perceived barriers and making plans on how to overcome these barriers. Furthermore, in the group III intervention of Miller et al. [34] intervention mothers were asked to participate in discussion groups to explore their perceived barriers for physical activity. Outcomes formed the basis for the development of intervention strategies.
Explanations for effectiveness derived from additional analyses

Some studies investigated, and mostly found evidence for the influence of effective interventions through mediators (mainly social support and self-efficacy) [34, 39, 40] and attendance on physical activity or healthy eating [25, 30, 33] (Table 2.4). In addition, Leermakers et al. [31] analysed the influence of adherence. The number of self-monitoring records returned was found to be significantly correlated with weight loss. Home work completion or telephone contact were not found to be associated with greater changes. No studies evaluated the targeted intervention components in relationship with effectiveness on physical activity. Regarding targeting, only the perception of pram walking groups by mothers was investigated in one study [35]. Mothers emphasized the importance of having walking routes that met the needs of women with babies and young children. The majority of mothers who joined a pram walking group did so for exercise, to get out of the house, and to meet other young mothers.

Discussion

The aim of this review was to gain insight into targeted intervention components which may contribute to the attendance and effectiveness of interventions promoting physical activity and/ or healthy eating to mothers with young children. Six out of the 12 studies included here measured attendance, of which two reported a high attendance. Especially the embedding of the intervention in routine visits to child health clinics seems to increase attendance rates. Cited explanations for non-attendance were general as well as mother-specific factors such as, lack of interest, withdrawal from intervention setting, and conflicting schedules.

Moreover, only six of the interventions reported statistically significant effects. Of these, three studies found positive effects on physical activity and three on healthy eating. Effective interventions directed at physical activity were multi-component and included such elements as counselling on mother-specific barriers, or community involvement in intervention development and implementation. Interventions that effectively increased healthy eating did not all have components targeted at mothers. Only one study used mother-specific motivational appeals to promote healthy eating. No studies evaluated the targeted intervention components in relationship with effectiveness of the intervention in particular.

The low attendance reported for most of the interventions shows the difficulty of reaching mothers of young children in programmes for promoting health behaviours – as mentioned by other authors [31, 33, 34, 41, 42]. This is also reflected in the large number of attempts to increase attendance with only minor results. For example, in spite of the fact that lack of time is frequently found to be a major barrier for mothers [43], targeted intervention components such as repeated intervention sessions to overcome scheduling problems did not result in high attendance rates. This may be due to the fact that underlying factors causing time constraints among mothers are neglected in such a strategy (see also Watson et al. [35]).
In a survey by Brown et al. [18], mothers mostly reported that having no time was due to commitments to children, housework and shopping. This may originate in restrictive role expectations towards mothers, and the mother's perception of 'being a good mother' [17, 44]. Strategies that take these factors into account may provide opportunities for promoting attendance.

Furthermore, child care responsibilities and costs have been identified by mothers as two important barriers for attending weight-loss interventions [43, 45]. However, studies that solved the problem of childcare and had no costs did not consistently result in high attendance [25, 35, 36]. This may be due to a lack of interest for lifestyle change on the part of mothers. In a previous qualitative study investigating perceived barriers to attend weight loss programmes, in addition to costs and child care, disinterested mothers perceived lack of time, family duties, and conflicts with working schedule as barriers more compared to interested mothers [43]. In intervention studies with no costs and solutions for child care, indeed a lack of interest was mentioned as one of the reasons for a low attendance by actively recruited participants [25, 37]. While another study with no costs and need for child care achieved a high attendance. In this study participants were recruited passively and thus were more likely to be highly motivated [36]. Therefore, motivating mothers, for example, through mass media campaigns in order to get them physically active or eat healthier seems a worthwhile point for reaching more mothers. Since the wellbeing of children is very important to mothers [17], emphasizing that mothers are role models for their children might increase interest.

Because the well-being of children is important to mothers, it is reasonable that an intervention setting for the good of children will increase attendance. This is supported by the study of Kinnunen et al. [23], whereby an intervention was embedded within routine visits to child health clinics resulting in a high attendance. Embedding the intervention in the routine of mother and child also gets round the problems of lack of time and child care responsibilities. Two other studies showed, however, that embedding the intervention within mothers’ routine visits to an intervention setting might not contribute to the attendance when there is withdrawal from this setting [25, 30].

With regard to the question on which intervention components contribute to the effectiveness on behaviour change, we found that all reviewed physical activity interventions included components targeted at mothers with young children. For physical activity, interactive counselling or discussion sessions about social and practical barriers perceived by mothers and making plans on how to overcome these barriers within the individual environment [32, 36] or local community settings [34] seems to promote physical activity among mothers. Such a strategy can address important constraints frequently cited by mothers, such as lack of time, energy, childcare, social support, and obligations to other roles [8].

Only one of the interventions aimed at improving healthy eating had components targeted towards mothers, while three out of four studies aimed at promoting healthy eating as single behaviour showed statistically significant results. This one study rather used mother-specific
motivational appeals than targeting mother-specific barriers. This may be because changing dietary behaviour is easier for mothers when compared with changing their physical activity pattern. In a previous study, young adult women reported that they saw a whole range of healthy eating behaviours as highly feasible but not many physical activity behaviours [46]. Mothers did perceive fruit and vegetable consumption to be more feasible compared with non-mothers although they perceived leisure-time physical activity, physical activity for transport purposes, and incidental physical activity as less feasible compared to women without children.

Definite conclusions about which components may contribute to intervention effectiveness cannot be drawn, however, from the studies included in this review since the actual contribution of components targeted at mothers of young children on the effectiveness has not been evaluated. Only the appreciation of pram walking groups was found by Watson et al. [35]. Therefore, the effectiveness on physical activity and on healthy eating may also depend on the multi-component character or the systematic development of most of the effective interventions included in this review. Furthermore, theory-based developed interventions aimed at reaching intervention effects on physical activity or healthy eating through theoretical constructs (i.e. mediators) that are important for mothers, such as self-efficacy and social support, might increase effectiveness [34, 39, 40]. There is a need for more process evaluations which focus on the question of how intervention effects are obtained.

Furthermore, in order to disseminate the use of interventions, it is necessary to know to which subpopulations the program effects can be generalized. Notable was that while all studies with mainly low-income or ethnic minority participants in this review had targeted their interventions to these low-income and/ or minority groups [25, 26, 29, 30, 32], only two studies performed subgroup analyses [25, 30]. More of such analyses are needed to gain insight into the effectiveness of interventions for specific target groups. In accordance, future studies that conduct subgroup analysis for mothers versus non-mothers can give more information about the generalizability of interventions directed at women in general towards mothers in specific.

The main limitations of this review study are the limited amount of eligible studies found, that information-gathering was restricted to printed material, and the low comparability of the studies. For instance, studies differed on the quality of design, sample size, and outcome measurements. For this reason, the choice for descriptive analyses was made and no meta-analyses could be done. Nevertheless, these descriptive analyses can be useful for intervention practice since they could provide examples for future intervention development and implementation. For health promotion, it might be worthwhile also to include study designs other than randomized controlled trials (i.e. true experiments) in a review. The use of randomized controlled trials is not always appropriate to evaluate health promotion interventions [47], subsequently reviewing interventions evaluated in other designs such as quasi-experiments can be more applicable for practice.
Conclusions

Although promoting weight control among new mothers is valuable in obesity prevention, the number of experimental intervention studies for promoting physical activity and healthy eating among new mothers is limited. Nevertheless, first recommendations useful for intervention practice can be set. Opportunities for increasing attendance of future interventions directed at mothers are, for example, embedding interventions into the mother and child routine, addressing the restricting role-expectations for mothers, or motivating mothers for lifestyle change activities first. In addition, systematic development and multi-component interventions seems important to the success of these interventions. Moreover, chances for promoting physical activity among mothers are targeting the methods used regarding mother-specific barriers. Few evidence is found yet, however, to suggest the need for and recommend ways of targeting at new mothers for stimulating healthy eating. More research is required to substantiate the findings, especially with regard to the promotion of healthy eating. Process and subgroup analyses can contribute to more insight into how interventions work and for which subgroups.
References


