A Systematic Review of Randomized Controlled Trials on the Effectiveness of Computer-Tailored Physical Activity and Dietary Behavior Promotion Programs: an Update

Karen Broekhuizen, M.Sc. · Willemieke Kroeze, Ph.D. · Mireille NM van Poppel, Ph.D. · Anke Oenema, Ph.D. · Johannes Brug, Ph.D.

Published online: 6 July 2012
© The Author(s) 2012. This article is published with open access at Springerlink.com

Abstract
Background A review update is necessary to document evidence regarding the effectiveness of computer-tailored physical activity and nutrition education.
Purpose The purpose of this study was to summarize the latest evidence on the effectiveness of computer-tailored physical activity and nutrition education, and to compare the results to the 2006 review.
Methods Databases were searched for randomized controlled trials evaluating computer-tailored physical activity and nutrition education aimed at primary prevention in adults, published from September 2004 through June 2011.
Results Compared to the findings in 2006, a larger proportion of studies found positive effects for computer-tailored programs compared to generic or no information, including those for physical activity promotion. Effect sizes were small and generally at short- or medium-term follow-up.
Conclusions The results of the 2006 review were confirmed and reinforced. Future interventions should focus on establishing larger effect sizes and sustained effects and include more generic health education control groups and objective measurements of dietary behavior.

Keywords Computer tailoring · Physical activity · Dietary behavior · Primary prevention

Introduction
The potential impact of physical activity and healthy dietary habits on the prevention of a range of chronic conditions is substantial [1, 2]. Effective physical activity and dietary promotion interventions are needed. Successful intervention strategies and techniques to motivate and guide people to adopt healthy choices need to be identified. Over the last decades, computer tailoring has proven to be an innovative and promising health education technique [3–12]. A computer-tailored intervention mimics interpersonal counseling using a computerized process, but, unlike interpersonal counseling, it can be widely distributed through interactive media channels at a relatively low cost. Computer tailoring allows for individualized feedback and advice on personal behavior, personal motivation, outcome expectations, self-efficacy, social and physical environmental opportunities, and other behavioral determinants.

In recent years, a number of systematic reviews and meta-analyses have been published on the effectiveness of computer-tailored health education covering a range of behaviors [4, 5, 9, 10, 13, 14]. The effects of tailoring may, however, be behavior specific. It has been argued that computer tailoring may be especially promising for complex health behaviors, such as physical activity and dietary behaviors [15]. Examples of complex health behaviors are...
gaining increased awareness of personal behavioral patterns, comparing one's own behaviors with recommendations, and setting and monitoring progress toward behavior change goals. The first systematic review that explicitly focused on the effectiveness of computer-tailored health education on physical activity and dietary behaviors was published in 2006 and included intervention studies published up to September 2004 [3]. In concordance with other more narrative reviews on computer-tailored health education [15, 16], the authors concluded that computer tailoring was promising, especially for dietary behaviors, although the effect sizes were small. The authors made key recommendations for improving research on computer tailoring, i.e., using objective outcome measures instead of self-report or using generic health education comparison groups instead of or in addition to no-intervention control groups. The latter would allow more precise evaluation of the effects of tailoring health education interventions. Finally, it was concluded that longer follow-up was needed to assess the sustained effects in all studies.

Since many original studies have been published since 2004, a review update is needed to document evidence regarding the effectiveness of computer-tailored physical activity and nutrition education programs. Furthermore, responding to recommendations made in 2006, comparing effects and specific study and intervention characteristics over time, is additive to other systematic reviews and meta-analyses. This review update aims to: (1) review the evidence on computer-tailored physical activity and nutrition education from studies published since September 2004, (2) compare the evidence from this review update to that derived from the original review regarding intervention characteristics, study characteristics, and effects, and (3) provide updated recommendations for further research and practice.

Methods

This paper reports on a second systematic review conducted using the study protocol of the original 2006 review. This protocol was based on guidelines extracted from the Cochrane Reviewers' Handbook [17].

Search Strategy and Data Sources

For the original review, intervention studies published from 1965 to September 2004 were identified through a structured computerized search of PubMed, PsychInfo, and Web of Science. For this update, a nearly identical search was conducted from September 2004 to June 2011. The review differed from 2006 as we added the search engines' most recent thesaurus terms, resulting in the following search terms for nutrition: ((nutrition OR feeding OR food OR diet OR dietary OR intake OR nutritional status OR feeding behavi* OR food consumption) AND (education OR behavior OR behavio* OR education)) AND (tailored OR tailoring OR tailor* OR expert system) and for physical activity: (exercise OR motor activity OR sports OR leisure activities) OR (physical* AND active) OR (physical* AND activity) OR (physical* AND activities) OR exercis* OR walking OR cycling OR sport* OR leisure activit* AND (education OR behavior OR behavio* OR education) AND (tailored OR tailoring OR tailor* OR expert system). No limitations for age or study design were added.

Selection of Studies

Just as in the original 2006 review, new studies had to examine a computer-tailored intervention aimed at promoting healthy physical activity or dietary behaviors for primary prevention of chronic diseases in apparently healthy adults. Evaluation studies that used a randomized controlled trial were included. Tailoring was defined by Kreuter as “the intention to reach one specific person, based on characteristics that are unique to that person, are related to the outcome of interest, and have been derived from an individual assessment” [18]. Interventions were considered to be computer tailored if the tailored advice was generated through a computerized process. Randomized controlled trials were included if: (1) published in a peer-reviewed scientific journal, 2) published in English, and 3) conducted in an adult sample (18+ years). Studies were excluded if the tailored intervention was part of a larger intervention program that made it impossible to isolate the effect of tailoring components from the other intervention components.

Data Extraction

Detailed information was extracted only from new studies that met the aforementioned inclusion criteria. Two reviewers independently summarized the new studies for content and methods. The following intervention characteristics were extracted: theories used for intervention development, variables used to tailor the computer-tailored information, the “tool” that was used to provide individual feedback, frequency of tailored feedback, and additional health education activities. Extracted study characteristics were: the country where the study was conducted, size and source of the study population, eligibility criteria, intervention modes, and primary outcome measures. Results from single and multiple post-test measurements were extracted. The outcomes included all physical activity and dietary behavior measures. To interpret and compare results from the studies that used differing measures to assess physical activity and dietary outcomes, effect sizes (ESs) were calculated if significant effects were found (provided the data were available). The effect size, Cohen's ES, was calculated by dividing the difference
between two means at follow-up by their pooled standard deviation [19, 20]. Cutoff points for ESs were 0.2–0.5 for small ES, 0.5–0.8 for moderate ES, and >0.8 for large ES [21]. The findings were summarized per behavioral outcome (physical activity, fat intake, fruit and vegetable consumption, and other dietary behaviors) and separately for short- (<3 months), medium- (3–6 months), and long-term (>6 months) follow-up.

Apart from reporting the results found in the current review, we compared these with the results of the original 2006 review. In order to check whether recommendations from the original review were met, we compared intervention and study characteristics of the present review with the original one. Frequencies on the number of studies that found significant effects, as well as the number of studies that used objective outcome measures, various types of comparison groups (generic health education versus no-intervention control groups), and long-term follow-up, as well as delivery mode (printed versus electronically) are provided, linked to the original or current review.

Results

Study Selection

The initial cross-database search resulted in 2,590 publications. After eliminating duplicates, 1,562 remained. Titles and abstracts were reviewed for eligibility criteria, resulting in 141 publications that were fully considered. Fifty publications were finally included: 29 studies on physical activity and 34 on dietary behaviors, 21 on fat consumption, 18 on fruit and vegetable consumption, and 14 on other dietary topics. Other dietary topics included: energy/carbohydrate intake, the consumption of sugar, dairy, fiber, whole grain, and body fat, as well as weight and waist circumference. Thirteen studies in the current review evaluated interventions that targeted both physical activity and diet. Some publications reported on the characteristics and effects of one intervention using various follow-up measurements (e.g., short- and long-term effects) [22–26, 39], effects in a variety of study samples [27–30], effects on other types of outcomes (e.g., fruit intake and variety of fruit intake) [31], or the effects of various doses of the intervention (e.g., delivered at once or at multiple time points) [32, 33]. As a consequence, this review update reports on the characteristics and effects of 25 interventions targeted at physical activity, 27 interventions targeted at dietary behavior, and 10 interventions for both behaviors. Of the 27 interventions on dietary behavior, 17 were directed at physical activity, i.e., pedometer, actigraph, or accelerometer. Five studies (17 %) measured aerobic fitness by either a (1 mile) walking test [47, 48], the Chester step test [49], or the submaximal exercise treadmill test [50].

Intervention Characteristics

Characteristics of the interventions from studies in the current review are summarized in the Electronic Supplementary Material. Both physical activity and nutrition education interventions were predominantly guided by the Trans-theoretical Model and Social Cognitive Theory. Most interventions (81 % of physical activity, 84 % of nutrition) provided tailored feedback on self-reported behavior. Two interventions (4 %) also provided feedback based on more objective data obtained from pedometers [34] or accelerometers [35]. Most interventions (92 % of physical activity, 68 % of nutrition) were tailored on presumed behavioral determinants such as intention, motivation, and stage of change, as well as self-efficacy and skills. Regarding nutrition education interventions, equal numbers of interventions provided print-delivered and electronically tailored feedback; however, the majority of physical activity interventions used electronic feedback formats (see also Table 1). Some interventions using electronic feedback had additional online discussion/message boards [36–38] (6 % of all interventions) or an e-buddy system (2 % of all interventions) [22, 38]. Electronic feedback was given on-screen (41 % of all interventions), by email reports (10 %), CD-ROM (4 %), or by mobile phone (2 %). Approximately one third of the interventions provided additional information such as booklets or information sheets. One intervention included weekly home visits [26, 39]. Less than half of the interventions provided tailored feedback more than once for dietary behaviors (48 %), and 65 % did so for physical activity.

Study Characteristics

The characteristics and effects for studies in the current review are shown in the Appendix. The majority of studies were conducted in the USA, followed by the Netherlands and Belgium, the UK, and several other countries.

Studies in the USA predominantly assessed physical activity with the validated 7-day Physical Activity Recall [40–43]; this was the most commonly used tool. The next most common tool was the validated Short Questionnaire Assessing Health-Enhancing Physical Activity (SQUASH) [44] predominantly used by Dutch researchers. The International Physical Activity Questionnaire (IPAQ) [45, 46] was the third most commonly used assessment tool. Six studies (21 %) included objective assessments of physical activity, i.e., pedometer, actigraph, or accelerometer. Five studies (17 %) measured aerobic fitness by either a (1 mile) walking test [47, 48], the Chester step test [49], or the submaximal exercise treadmill test [50].
Fat reduction was most often assessed using food frequency questionnaires. In the USA, the Block questionnaire was used most frequently [51] and in the Netherlands, a questionnaire developed by Van Assema et al. [52]. Two studies obtained data from either an electronic scanner [53] or shopping receipts [34] in a supermarket setting. Data on fruit and vegetable consumption were obtained from questionnaires (the Block questionnaire in the majority of studies); one study also used shopping receipts [34]. Studies that included measures of weight or BMI either used self-report [38, 54] or measured [24, 27, 28, 34, 55, 56]. Fiber, grain, energy, or added sugar intakes were assessed by food frequency questionnaires [57, 58].

Effects on Physical Activity (Section A, Appendix)

Of the 29 studies on physical activity, 20 (69%) showed significant differences in favor of the computer-tailored intervention. Five studies looked at short-term effects [36, 37, 59–61], of which four found significant effects for the tailored intervention [36, 37, 59, 60] with small effect sizes, compared to no intervention. In one study, this applied to participants who did not comply to the physical activity guidelines at baseline [60]. Of the 17 studies with medium-term follow-up periods, 12 found significant effects with small effect sizes: six compared to no intervention [22, 36, 62–65], five compared to generic health education [24, 32, 33, 66, 67], and one compared to a health risk assessment [67]. Studies that investigated two computer-tailoring techniques [22, 54, 63, 67] found significant effects for both tailoring conditions. Six of the 13 studies with long-term follow-up found significant effects at various follow-up periods, four studies reported no effects at either short, medium, or long term [35, 61, 68, 69]; six studies reported sustained effects over time [22, 23, 25, 34, 36, 65, 67], and one study reported no effect at short term but a significant effect at medium term [62].
Effects on Fat Consumption (Section B, Appendix)

Of the 21 studies on fat consumption, 17 (81%) showed significant differences in favor of the computer-tailored intervention. Six studies tested short-term effects and reported significant effects of tailoring compared to no intervention [36, 60, 70, 71], or generic health education [72, 73] with small effect sizes. Two of those studies (also) targeted an at-risk population [60, 72]. At medium term, all eight studies found significant effects compared to no intervention [36, 70, 74], or generic health education [33, 72–75]. One of those studies targeted a low-income ethnically diverse population [76], and a second study also found a significant effect among risk consumers (i.e., people with fat intake levels higher than recommended at baseline) [72]. Ten studies tested the long-term effects of an intervention, and five found significant effects for tailoring compared to no intervention [29, 30, 70] or generic health education [24, 32] with small effect sizes. Two of the ten studies (also) targeted high-risk populations [29, 30], and another study targeted women aged 50–69 years [24]. Multiple measurements in time were reported for seven studies, of which five studies reported sustained significant effects [25, 36, 70, 72, 73], one study reported a significant effect at short term [26] that was not sustained in the long term [39], and one study reported no effects at both medium- and long-term time periods [77].

Effects on Fruit and Vegetable Consumption (Section C, Appendix)

Of the 18 studies on fruit and vegetable consumption, 15 (83%) showed significant differences in favor of the computer-tailored intervention. Two of these studies measured the short-term effects of a computer-tailored intervention, and both found significant effects compared to no intervention [36, 71] with small effect sizes in a general population. Six studies measured medium-term effects, of which five found significant effects compared to no intervention [36, 65, 78] or generic health education [33, 75] with small effect sizes. One study investigated the effects of two intervention conditions (either delivered in one or four installments) compared to generic health education and measured the effects of retailed feedback [75]. The latter measured the effect of retailed feedback provided in four installments. Eight of the 12 studies that tested the long-term effects of an intervention found significant effects for tailoring interventions compared to no intervention [31, 34, 65, 79] or generic health education [24, 32, 80, 81]. The eight studies found small effect sizes, except for one that had targeted church members, which found a large effect size over the long term [31]. Two studies with effective long-term interventions targeted populations who were over 50 years of age [24, 56]. Heimendanger and colleagues found a significant effect of (re)taiored advice when spread across four booklets, as opposed to no effect when the advice was delivered in a single booklet [81]. Nine studies reported multiple measurements in time, and seven of these reported sustained effects [25, 32, 34, 36, 65, 75, 78]. One of the nine studies reported no medium-term effect but a significant long-term effect [79], and one study reported no medium- or long-term effect [77].

Effects on Other Diet-Related Behaviors (Section D, Appendix)

Of the 14 studies on other dietary behaviors, 8 (57%) showed significant differences in favor of the computer-tailored intervention. Four interventions for weight loss found significant effects including: one short, medium, and long term [28]; one medium and long term [38]; and two long term only [34, 55]. Effect sizes were small [34, 55], medium [28], or large [38]. Of the three interventions on energy intake, one reported a significant short- and medium-term effect [72]. The corresponding effect size was small for the general study population and medium among risk consumers in the short term. In addition, at medium term, only the effect of print-based advice (as opposed to delivery through CD-ROM) was of significance in the general population with a small effect size. Both studies considering fiber consumption found significant short-, medium- [70], and long-term effects [34] with small effect sizes. The intervention on grain intake showed no significant effect, nor did an intervention aimed at reducing added sugar. No significant effect was observed for the intervention to change dairy consumption [82].

A Comparison Between the Present Update and the Original 2006 Review

The present review included 50 publications over just under 7 years, while the original review in 2006 included 30 publications over 13 years, showing an apparent increase in studies on physical activity and tailored nutrition education. This increase was most obvious for physical activity (29 studies in the present review, 11 in the original review).

Since 2004, the number of computer-tailored interventions electronically delivered has increased, particularly in physical activity studies (see Table 1). New delivery modes, such as mobile phone and CD-ROM, were introduced since 2004. Similar to the original review, in the majority of studies included in the present update, a no-intervention control group was included without a generic health education comparison group. Most studies continue to lack objective assessments of effects of nutrition interventions, but physical activity intervention studies often used objective assessments for behavior changes. As recommended in the original 2006 review, more nutrition intervention studies included long-term follow-up.

In this update, the majority of studies reported significant effects of computer tailoring, both for dietary and physical
activity behavior (the largest increase). However, effects sizes remained small in general for dietary as well as physical activity behavior.

Discussion

The present review update confirms and further strengthens the evidence that computer-tailored physical activity and nutrition education is likely to be effective [4, 5, 9, 10, 13, 14], although effect sizes related to tailored physical activity and nutrition education interventions are likely to be small. The evidence for long-term effects of computer tailoring remains inconclusive.

The present review is an update of a 2006 review of the literature published up to September 2004. A number of differences in the results of the original and updated review are noteworthy. First, both for physical activity and dietary behavior, the number of published studies has increased substantially. In addition, a larger proportion of published studies reported favorable effects of tailored interventions in the update period than in the original review. Evidence on the efficacy of computer-tailored education is now also apparent for physical activity promotion. Second, the use of objective outcome measurement instruments increased in studies on physical activity education, but not for nutrition education studies. Third, overall, there was no increase in comparisons of interventions with generic health education since 2004. Fourth, remarkably more studies with long-term follow-up were performed in the past years, particularly on nutrition education. Finally, the electronic delivery of feedback increased, particularly in studies on physical activity promotion; discussion boards/forums were frequently added to interventions.

The observed differences over time for the use of objective outcome measurements and various types of control groups, follow-up periods, and delivery modes require more attention. Since 2004, a larger number of objective measures have been included in tailoring studies, especially regarding physical activity education. In this field, accelerometers and pedometers have grown in popularity, due to increased usability and feasibility [83]. In the field of nutrition, no such development was seen. The objective measurement of dietary intake can be achieved by monitoring biologic dietary indicators, such as serum cholesterol and serum carotenoids [84]. However, the assessment of biologic indicators is relatively expensive, and these indicators are subject to genetic differences. Alternatively, two studies used shopping receipts and electronic shop scanners as objective indicators of food purchases [34, 53]. In addition, anthropometrics and waist circumference were the most frequent objective indicators.

The fact that the evidence in favor of computer-tailored physical activity and nutrition education is now stronger than based on the studies published up to 2004 is promising and important. However, the strongest evidence comes from studies that compared tailored interventions to no-intervention control groups. Thus, these studies could not assess the effects of tailoring compared to non-tailored interventions. Significant effects were most often found in studies with a no-intervention control group. If generic health education control groups were included in a study, the evidence was quite consistently in favor of tailoring. If this review had been restricted only to comparisons between tailored interventions with generic health education comparison groups, it would have focused specifically on the additional effects of tailoring in health education. Nevertheless, we believe that the comparison with no-intervention control conditions is also important, because it shows that tailored interventions are likely to be effective—because of the tailoring or other factors—and that is important information for health education practice. In addition, further exploration of the effectiveness of computer-tailored interventions compared to other control conditions, such as theory-based or personalized interventions, would be valuable to verify whether individually tailored education is better than theory-based and/or personalized education.

For physical activity and nutrition interventions to have an effect on health, the effects should be sustained over long periods of time [76]. The present review update shows that since 2004, more studies with long-term follow-up (>6 months) have been published. However, the positive effects of these studies were generally observed at short- and medium-term follow-up. Lack of long-term effects of health education interventions has been reported before. In a meta-analysis of computer-tailored interventions, Krebs and colleagues also found a significant trend of decreasing effect size when follow-up time increased [4]. Some evidence suggests that “dynamic tailoring” with more tailored feedback moments throughout a long intervention period may improve effects beyond the short term. The present updated review further shows that iterative feedback and tools supporting self-regulatory skills (e.g., goal setting activities, self-monitoring tools, skills building activities, email reminders, booster sessions, and interactive activities) are ways to realize such repeated tailoring [4, 5, 15, 85].

Not only has the number of electronically delivered interventions grown since 2004, but evidence for effectiveness has too. Before 2004, only a third of these “second-generation” dietary interventions were effective, compared to 60 % after 2004. For effective promotion of physical activity, the likelihood of effect appears not to be dependent on delivery mode. Furthermore, mobile phones were a delivery mode that was
not yet available in the studies in the original 2006 review. A study by Haapala et al. indicates that mobile phone delivery can be an effective method for supporting weight loss. By allowing for two-way communication and showing a log-on frequency that is twice the rate of other web-based programs [86, 87], mobile phones have potential for the future. Because of these advantages and given the massive increase of the use of smartphones worldwide, mobile technologies will and probably should be used more often to promote lifestyle changes [88].

Overall, studies published since 2004 appear to have partially taken into account the recommendations for further research in the original review. Although more objective outcome measurement instruments were used in studies published after 2004, this was restricted to interventions on physical activity. Further, despite the increased number of studies, the proportion of comparisons with generic health education has not increased since 2004. Long follow-ups have been included more frequently in more recent studies, but only in nutrition interventions. Comparisons with generic health education, instead of no-intervention control groups, are most important because they provide information on the effects of tailoring. Therefore, we repeat and strongly advocate the recommendation to study tailoring as compared to other intervention methods, such as generic health education. Long-term follow-up should remain a priority, as well as the inclusion of objective outcome measures including their use in nutrition intervention research.

This review update has limitations. We used the same review protocol as was applied in the original 2006 review. Therefore, potential limitations such as the non-blinding of reviewers to authorship or the journal of the reviewed publications also applied to the present review. A lack of unequivocal scientific evidence that blinding is essential to obtain valid review results was already discussed in the original 2006 review [3, 89, 90]. In addition, a new independent reviewer assessed eligibility of the studies for the present update, which could have led to some differences in decisions and interpretations. Previous research has shown that updating a review can affect both the direction and the precision of the outcome [91, 92]. Yet, two reviewers who were involved in the reviewing process of the original 2006 review were also part of the present update team. No risk of bias and/or quality assessment evaluations were performed for either the original and updated review, although the use of such tools has been recommended for systematic reviews [17]. Fortunately, because only randomized controlled trials were included, the variety in methodological quality was small. Nevertheless, the methodological quality of the studies included in this review could have had an impact on estimates of effects, which might have affected the validity of the conclusions. Finally, as with any review of published literature, the present update may have been affected by publication bias that may have caused an overestimation of the positive findings.

Notwithstanding these potential limitations, this review importantly updates the systematic overview of developments and evidence regarding computer-tailored physical activity and nutrition education over the past years. Furthermore, this review update provides the most recent overview of the content and effects of computer-tailored interventions in the field of physical activity and nutrition. Reviews of the literature need to be updated regularly in order to provide up-to-date overviews of the evidence base to inform health promotion practice and to provide new recommendations for research to further strengthen the evidence base. This comparison is strengthened by our use of comparable reviewing methods at two time points, 2006 and 2011, giving us the opportunity to compare effects, intervention, and study characteristics over time. Such updating of reviews using a similar methodology is advocated and common practice in review consortia such as the Cochrane collaboration.

On the whole, from this updated review, it can be concluded that the evidence on computer-tailored interventions for the promotion of physical activity and dietary change has become stronger and now is also convincing for physical activity promotion. However, this effect particularly accounted for studies with no-intervention control groups, effect sizes were generally small, and the evidence is generally restricted to rather short-term effects, i.e., up to 3 months follow-up. Further, it remains unclear whether the effect of tailored interventions is caused by tailoring as such or by the fact that tailored interventions are more likely to be carefully designed and based on behavioral theory. Previously formulated recommendations regarding the use of objective outcome measurements, generic HE control groups, and long-term follow-up periods for the development of computer-tailored interventions were only partially met. Based on the present review, the use of computer-tailored interventions in physical activity and healthy nutrition promotion can be advocated, but future interventions should especially focus on: (1) establishing larger effect sizes and sustained effects, (2) using more objective measurements in studies on dietary behavior, (3) using more generic HE control groups and especially control groups in which the generic health education is also carefully designed and theory-based in order to distinguish the effect of tailoring from the effects of theory-based intervention development, and (4) including more long-term follow-up measurements. Future research should also focus on why and how computer-tailored physical activity and nutrition interventions are effective, by conducting mediation analyses [23, 93], and supporting large-scale dissemination of such interventions [94].

Acknowledgments We gratefully acknowledge René Otten of the VU University Medical Library for his assistance in searching the databases.

Conflict of Interest The authors have no conflict of interest to disclose.
### Table 2  Study characteristics and effects found in the studies included in the review

| First author(s) \[reference number\] | Country | Study population \[N\] | Intervention modes \[a\] | Validated questionnaire | Outcome measurement instruments | Outcome measurement units | Results\[b\] and effect size\[c\] at short (ST), medium (MT), or long term (LT)\[d\] |
|-------------------------------------|---------|------------------------|------------------------|------------------------|-------------------------------|--------------------------|-----------------------------------------------|
| **A. Physical activity**            |         |                        |                        |                        |                               |                          |                                               |
| Adachi, 2007 \[28\]                | Japan   | Overweight Japanese women [205] recruited from the general population (Adachi, 2007) | C Self-help booklet | ? | 15-item | Self-rated physical activities (points 1 (bad) – 3 (good)) | LT No significant effects |
| Tanaka, 2010 \[27\]                |         | Overweight Japanese men [51] recruited from the general population (Tanaka, 2010) | EXP1 C + self-monitoring of weight and walking | Pedometer | Daily walking steps |                                               |
|                                     |         |                         | EXP2 CT advice | EXP3 CT advice + self-monitoring of weight and walking |                                               |                                               |
| Carroll, 2010 \[96\]               | USA     | Inactive participants [394] recruited through primary care providers | C Generic HE | Yes | 7-Day PA | Leisure-time PA (min/week) | MT No significant effects |
| Dunton, 2008 \[62\]                | USA     | Women [156] (21–65) recruited from the general population | C No intervention | Yes | Standardized activity inventory | Non-leisure-time PA (min/week) | ST No significant effects |
|                                     |         |                         | EXP1 CT advice | Recall | Fitness walking test | MT Significant effect on MVPA  
ES: 0.24 |
| Hageman, 2005 \[66\]               | USA     | Women [31] (50–69 years) recruited through newspaper advertisement | C Generic HE | Yes | Modified 7-day physical activity recall | MVPA (min/week)  
Expended daily calories  
Aerobic fitness (VO2 max in ml/kg/min), flexibility (cm)  
ES: 0.42 | MT Significant effect on VO2 max |
|                                     |         |                         | EXP1 CT advice | Fitness walking test |                                               |                          |
| Hurling, 2007 \[37\]               | UK      | Participants [77] (50–55 years) recruited through market research recruitment agency | C No intervention | Yes | IPAQ | Overall PA (MET min/week) | ST Significant effect on leisure-time PA  
Accelerometer data  
Overall sitting time (h/week)  
Weekday sitting time (h/week)  
Weekend sitting time (h/week)  
Weekday physical activity (MET range)  
Weekend physical activity (MET range)  
ES: N/A |                                               |
| Jacobs, 2004 \[95\]                | USA     | Women [511] (50–64) recruited from nutrition and PA program (WISEWOMAN) | C Generic HE | ? | 31-item PAA questionnaire | Score from 31-item scale: not very active (0) – very active (42) | LT No significant effect on PA score  
Overall PA (MET min/week)  
Weekday physical activity (MET range)  
Weekend physical activity (MET range)  
ES: N/A |                                               |
| First author(s)\textsuperscript{a} | Country | Study population [N] | Intervention modes\textsuperscript{b} | Validated questionnaire | Outcome measurement instruments | Outcome measurement units | Results\textsuperscript{c} and effect size\textsuperscript{d} at short (ST), medium (MT), or long term (LT)\textsuperscript{e} |
|---------------------------------|---------|----------------------|---------------------------------------|------------------------|---------------------------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Marcus, 2007 [67] | USA | Sedentary participants [239] (18–65) recruited from the general population | EXP1 CT advice | C Generic HE | Yes | 7-Day physical activity recall | MPA/VPA (min/week) | MT Significant effect on PA in EXP2 compared to C \[ ES: 0.46 \] |
| Marcus, 2007 [69] | USA | Sedentary participants [249] (18+) from the general population | EXP1 CT advice (internet) | C Generic HE | Yes | 7-Day physical activity recall | MPA/VPA (min/week) | MT Significant effect on PA in EXP1 compared to C \[ ES: 0.39 \] \[ MT No significant difference between EXP1 and EXP2 \] \[ LT Significant effect on PA in EXP2 compared to C \[ ES: N/A \] \[ LT No significant effect on PA in EXP1 compared to EXP2 \[ LT No significant difference between EXP1 and EXP2 \] |
| Napolitano, 2006 [68] | USA | Sedentary women [280] recruited from the general population | EXP2 CT advice (telephone-based) | C1 Generic HE | Yes | Submaximal exercise treadmill test | Aerobic fitness (VO2max in ml/kg/min) | MT/LT No significant effect on MVPA |
| Oenema, 2008 [60] | The Netherlands | Participants [2,159] (>30) recruited from online research panel | EXP2 CT advice | C Self-help booklet | No intervention | Yes | Short version of IPAQ | % compliant to PA guideline (moderate intensity PA for at least 30 min/day at least 5 days/ week) \[ ES: 0.16 \] |
| Pekmezzi, 2009 [97] | USA | Sedentary Latinas [93] (18–65) recruited from the general population | EXP1 CT advice | C Generic HE | Yes | 7-Day physical activity recall | MPA/VPA (min/week) | MT No significant effect on MVPA |
| First author(s) | Country | Study population | Intervention modes | Validated questionnaire | Outcome measurement instruments | Outcome measurement units | Results at short (ST), medium (MT), or long term (LT) |
|----------------|---------|------------------|--------------------|------------------------|--------------------------------|--------------------------|--------------------------------------------------|
| Prochaska, 2008 [54] | USA | Participants [1400] at risk for at least one risk behavior (exercise, stress, BMI >25 kg/m² and smoking) recruited from a major medical university | C Health risk assessment | Yes | Self-reported level of exercise | % exercising moderately 30 min/day for at least 5 days/week | MT Significant effect on % exercising moderately 30 min/day for at least 5 days/week in EXP1 and EXP2 compared to C |
| Quintiliani, 2010 [59] | USA | Female college students [408] recruited from universities/colleges | C Generic HE | Yes | US Behavioral Risk Factor Surveillance Survey | MVPA (min/week) | ST Significant effect on VPA in EXP2 compared to C |
| Slootmaker, 2009 [35] | The Netherlands | Participants [102] (20–40 years) recruited from worksites | C Generic HE | ? | AQuAA [100] | LPA/MPA/VPA (MET min/week) Aerobic fitness (VO2max in ml/kg/min) | MT/LT No significant effects |
| Smeets, 2007 [33] | The Netherlands | Participants [2,827] (18–65) recruited from companies and the general population | C Generic HE | Yes | SQUASH | Action moments/week | MT Significant effect on PA of EXP1 compared to C |
| De Vries, 2008 [32] | The Netherlands | | | | | | |
| Smeets, 2008 [64] | The Netherlands | Participants [487] (18–65 year) recruited from the general population | C No intervention | Yes | SQUASH | Total PA (MET min/week) | MT Significant effect on transport related PA and total PA among motivated participants |
| Spittaels, 2007 [63] | Belgium | Participants [434] (20–55 year) recruited through parents and | C No intervention | Yes | IPAQ | Total MVPA (min/week) | MT Significant effect on transportation PA, leisure-time PA and weekday |
| First author(s) [reference number] | Country | Study population [N] | Intervention models | Validated questionnaire | Outcome measurement instruments | Outcome measurement units | Results\(^a\) and effect size\(^b\) at short (ST), medium (MT), or long term (LT)\(^c\) |
|-----------------------------------|---------|----------------------|---------------------|-------------------------|--------------------------------|--------------------------|-----------------------------------------------------------------|
| Spittaels, 2007 [98]              | Belgium | Participants [526] (25–55 year) recruited from worksites | C Generic HE | Yes | IPAQ | Total PA (min/week) | EXP1 CT advice  | EXP1 CT advice+ repeated feedback  | Transportation PA (min/week) Households PA (min/week) Leisure-time PA (min/week) Job-related PA (min/week) Weekday sitting time (min/day) Weekend sitting time (min/day) | EXP2 compared to C ES (transportation PA): 0.21 ES (leisure-time PA): 0.52 ES (weekday sitting time): 1.58 |
| Sternfeld, 2009 [36]              | USA     | Participants [787] recruited from administration offices of a large healthcare organization | C No intervention | Yes | Physical Activity Questionnaire adapted from Cross-Cultural Activity Patterns Questionnaire | Total PA (MET min/week) | EXP1 CT advice | EXP1 CT advice+ stage-of-change based emails | VPA (min/week) walking (min/week) sedentary behavior among those who chose the PA path of the intervention | EXP1 compared to C ES: N/A |
| Van Keulen, 2011 [65]             | The Netherlands | Participants [1,629] (45–70) recruited from general practices | C1 No intervention | Yes | 28-item modified Community Health Activities Model Program for Seniors | PA (hours/week) |  |  |  | EXP1 TC advice |
|                                  |         |                      | C2 Coaching |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                  |         |                      | C3C2+EXP1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                  |         |                      | EXP1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| First author(s) [reference number] | Country       | Study population [N] | Intervention modes b | Validated questionnaire | Outcome measurement instruments | Outcome measurement units | Results a and effect size b at short (ST), medium (MT), or long term (LT) c |
|-----------------------------------|---------------|-----------------------|----------------------|------------------------|--------------------------------|--------------------------|-------------------------------------------------------------------------|
| Van Stralen, 2009 [22]           | The Netherlands | Participants [1971] (>50 years) recruited from Regional Municipal Health Councils | C No intervention | Yes | 1-item from SQUASH | Self-rated PA (total weekly days of MPA) | MT (3 months) Significant effect on self-rated PA in EXP1 and EXP2 compared to C ES: 0.20 |
| Van Stralen, 2011 [23]           |               |                        | EXP 1 CT advice (psychosocial) |                |                               |                          | ES: 0.20                                                                  |
|                                  |               |                        | EXP 2 CT advice (psychosocial+ environmental) |                |                               |                          | MT (3 months) Significant effect on PA initiation among insufficiently active participants in EXP1 and EXP2 compared to C ES: 0.26 ES: 0.21 |
|                                  |               |                        |                          |                |                               |                          | MT (6 months) Significant effect on self-rated PA in EXP1 and EXP2 compared to C ES: 0.30 ES: 0.35 |
|                                  |               |                        |                          |                |                               |                          | MT (6 months) Significant effect on PA initiation among insufficiently active participants in EXP1 and EXP2 compared to C ES: 0.32 ES: 0.27 |
|                                  |               |                        |                          |                |                               |                          | MT (6 months) Significant effect on PA maintenance among sufficiently active participants in EXP 1 and EXP 2 compared to C ES: 0.33 ES: 0.34 |
| Walker, 2009 [24]                | USA           | Women [225] (50–69) recruited from the general population | C Generic HE EXP 1 CT advice | Yes | Modified 7-day Physical Activity Recall MVPA (min/day) | Kilocalories expended per kilogram/day | MT Significant effect on lower body muscular strength ES: −0.36 |
| Walker, 2010 [25]                |               |                        | EXP 1 CT advice |                |                               |                          | LT (12 months) Significant effect on self-rated PA in EXP1 and EXP2 compared to C ES: 0.18 (for both EXP1 and EXP2) |
|                                  |               |                        |                          |                |                               |                          | LT (12 months) Significant effect on lower body muscular strength ES: 0.36 |
| First author(s) | Country          | Study population   | Intervention modes | Validated questionnaire | Outcome measurement instruments                                                                 | Result(s) and effect size at short (ST), medium (MT), or long term (LT) |
|----------------|------------------|--------------------|--------------------|--------------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Wanner, 2009   | Switzerland      | Participants [1,531] recruited from the general population | C Generic HE EXP1  | ?                        | 4-item derived from official PA monitoring in Swiss population Accelerometer                      | ES: −0.41                                                               |
| Werkman, 2010  | The Netherlands  | Recent retirees [415] (55–65) recruited from pre-retirement workshops | C Generic HE EXP1  | Yes                      | Dutch version of the PA Scale for the Elderly (PASE) [96]                                       | ST/LT No significant effect on MPA and VPA                              |
|                |                  |                    | CT advice           |                          |                                                                                                 |                                                                          |
| Winett, 2007   | USA              | Participants [1071] recruited from churches | C No intervention   | ?                        | Pedometer                                                                                       | LT (7 and 16 months) Significant effect on PA in EXP2 compared to C ES (7 months): 0.23 ES (16 months): 0.27 |
|                |                  |                    | EXP1 CT advice      |                          |                                                                                                 |                                                                          |
|                |                  |                    | EXP2 CT advice+church support |                          |                                                                                                 |                                                                          |
| B. Fat consumption |               |                     |                    |                          |                                                                                                 |                                                                          |
| Blair Irvine, 2004 | USA         | Participants [517] recruited from a large hospital | C No intervention   | Yes                      | 21-item Diet Habits Questionnaire                                                               | ST Significant effects on fat eating habits/behavior ES (1-month): −0.49 ES (2-months): −0.18 |
| Dutton, 2008  | USA              | Sedentary women [280] recruited from the general population | C Generic HE        | Yes                      | National Cancer Institute Screeners                                                             | MT/LT No significant effects on fat intake                             |
| Ekler, 2005    | USA              | Latinas [357] recruited from the general population | C Generic HE        | Yes                      | Nutrition data system: 24 h dietary recall interview                                           | ST Significant effects on total and saturated fat intake in EXP2 compared to EXP1 |
| Ekler, 2006    |                  |                    | EXP1 CT advice      |                          |                                                                                                 | LT No sustained significant effects                                     |
| First author(s) | Country | Study population [N] | Intervention modes | Validated questionnaire | Outcome measurement instruments | Outcome measurement units | Results* and effect size† at short (ST), medium (MT), or long term (LT)‡ |
|----------------|---------|----------------------|-------------------|------------------------|--------------------------------|--------------------------|---------------------------------------------------------------------|
| Fries, 2005 [70] USA | Participants [754] (18–72) recruited from physician practices | EXP2 CT advice+ Promotoras C No intervention | ? | Fat and fiber behavior-related questionnaire | Score from 0–3 | ST Significant effect on dietary fat behavior ES: −0.41 MT Significant effect on dietary fat behavior ES: −0.29 LT Significant effect on dietary fat behavior ES: −0.23 |
| Gans, 2009 [75] USA | Participants [1841] with low income, recruited from waiting rooms of public health clinics | C Generic HE Yes | Adapted Food Habits Questionnaire | Fat intake (Food Habits Questionnaire score: low score=high prevalence fat-lowering behavior, thus lower fat intake) | ST Significant effect on fat intake in EXP2 and EXP3 compared to C ES (EXP2-C): −0.31 ES (EXP3-C): −0.31 |
| Jacobs, 2004 [95] USA | Women [511] (50–64) recruited from nutrition and PA program (WISEWOMAN) | C Generic HE Yes | 54-item Dietary risk assessment | Score from 54-item scale: 0–108 not very atherogenic (0) to very atherogenic diet (108) | LT No significant effect on saturated fat and cholesterol intake |
| Kroeze, 2008 [72] The Netherlands | Participants [442] (18–65) recruited from companies and general population | C Generic HE Yes | 104-item FFQ | Total fat intake (g/day, %en) Saturated fat intake (g/day, %en) | ST Significant effects on total fat and saturated fat intake in EXP1 compared to C ES (total fat): −0.31 ES (saturated fat): −0.22 ST Significant effects on total fat intake among risk consumers in EXP1 compared to C ES: −0.41 ST Significant effects on total fat in EXP2 compared to C ES: −0.23 |
| First author(s) \[reference number\] | Country | Study population \[N\] | Intervention modes | Validated questionnaire | Outcome measurement instruments | Outcome measurement units | Results\[a\] and effect size\[b\] at short (ST), medium (MT), or long term (LT)\[c\] |
|-------------------------------------|---------|------------------------|--------------------|--------------------------|-------------------------------|--------------------------|--------------------------------------------------------------------------------|
| Kroese, 2008 \[73\]               | The Netherlands | Participants \[574\] (18–65) recruited from large companies and the general population | C Generic HE       | Yes                        | 104-item FFQ                 | Total fat intake \((g/day)\) | ST Significant effects on total fat and saturated fat intake among risk consumers in EXP2 compared to C ES (total fat): −0.49 ES (saturated fat): −0.42 MT Significant effect on total fat and saturated fat intake among risk consumers in EXP2 compared to C ES (total fat): −0.53 ES (saturated fat): −0.54 |
|                                    |         | EXP1 CT advice (personal) |                   |                           |                               | ST Significant effect on awareness of fat intake in EXP1 and EXP3 compared to C ES (EXP1): 0.30 ES (EXP3): 0.41 |
|                                    |         | EXP2 CT advice (personal-normative) |                   |                           |                               | ST Significant effect on fat intake and saturated fat intake in EXP3 compared to C ES (fat intake): −0.52 ES (saturated fat intake): −0.46 MT Significant effect on fat intake in EXP1, EXP2 and EXP3 compared to C ES (EXP1): 0.34 ES (EXP2): 0.55 ES (EXP3): 0.53 |
|                                    |         | EXP3 CT advice (personal-normative-action) |                   |                           |                               | MT Significant effect on saturated fat intake in EXP3 compared to C ES: −0.51 |
| Ni Mhurchu, 2010 \[53\]           | New Zealand | Participants \[1,104\] recruited from a selection of customers registered to use the Shop ‘N Go System and in-store and community-based recruitment | C No intervention | ?                        | Electronic scanner (Shop ‘N Go system) % of energy from saturated fats in purchases | MT Significant effect on fat and saturated fat intake among underestimators in EXP3 compared to C ES (fat intake): −0.64 ES (saturated fat intake): −0.63 |

Note: \[a\] Results are presented as standardized effect sizes (ES) with 95% confidence intervals (CIs) unless otherwise stated.

\[b\] The effect size was calculated as Cohen’s d.

\[c\] ST, MT, and LT refer to short-term (up to 6 months), medium-term (6 to 12 months), and long-term (over 12 months) outcomes, respectively.
| First author(s) a | Country | Study population [N] | Intervention modes b | Validated questionnaire | Outcome measurement instruments | Outcome measurement units | Results c and effect size d at short (ST), medium (MT), or long term (LT) e |
|------------------|---------|----------------------|----------------------|------------------------|-------------------------------|--------------------------|-----------------------------------------------|
| Oenema, 2008 [60] | The Netherlands | Participants [2,159] (>30) recruited from online research panel | EXP3 Discount | C No intervention | Yes | 35-item FFQ | Saturated fat intake (fat points/day from 0 to 80) | ST Significant effect on saturated fat intake ES: −0.16 |
| Prochaska, 2005 [30] | USA | Sedentary primary care patients [5,407] at risk for at least one of the target behaviors recruited from primary care practices (Prochaska, 2005-458). | EXP1 CT advice | C No intervention | Yes | 22-item Dietary Behavior Questionnaire Score on subscales: avoidance, substitution modification | Significant effects on avoidance, modification and substitution ES (avoidance): 0.24 ES (modification): 0.18 ES (substitution): 0.22 |
| Prochaska, 2004 [29] | USA | Parents of teenagers [2,460] at risk for at least one of the target behaviors recruited from schools (Prochaska, 2005-486) | EXP1 CT advice | C No intervention | Yes | 22-item Dietary Behavior Questionnaire Score on subscales: avoidance, substitution modification | Significant effects on avoidance, modification and substitution ES (avoidance): 0.24 ES (modification): 0.18 ES (substitution): 0.22 |
| Smeets, 2007 [33] | The Netherlands | Participants [2,827] (18–65) recruited from companies and the general population | EXP1 CT advice (once delivered in 3 months (Smeets, 2007)) | C Generic HE | Yes | FFQ | Fat intake (g) | MT Significant effect on fat intake in EXP1 compared to C ES: −0.12 |
| De Vries, 2008 [32] | The Netherlands | Participants [2,827] (18–65) recruited from companies and the general population | EXP1 CT advice (once delivered in 3 months (Smeets, 2007)) | C Generic HE | Yes | FFQ | Saturated fat intake (g) | ES: −0.12 |
| First author(s)   | Country | Study population [N]                                                                 | Intervention modes | Validated questionnaire | Outcome measurement instruments | Outcome measurement units | Results and effect size at short (ST), medium (MT), or long term (LT)² |
|------------------|---------|-------------------------------------------------------------------------------------|-------------------|-------------------------|-------------------------------|--------------------------|---------------------------------------------------------------|
| Sternfeld, 2009  | USA     | Participants [787] recruited from administration offices of a large healthcare organization |                   |                         | Diet questionnaire based on Block Food Questionnaire | % compliant to guidelines for saturated fat intake | LT Significant effect on % compliant to guideline on saturated fat intake in EXP2 compared to C ES: −0.18 ST Significant effect on saturated and trans fat intake ST Significant effect on saturated and trans fat intake among those who chose the fats/sugar path of the intervention MT Significant effect on saturated and trans fat intake ES: N/A |
| De Bourdeaudhuij, 2007 | Belgium | Participants [539] recruited from companies                                           |                   |                         |                               | Total fat intake (g/day) | MT Significant effect on energy from fat and total fat intake in EXP1 compared to C1 and C2 Energy from fat (%) Fat intake (separate food groups) (g/day) | EXP1 compared to C1 ES (energy from fat): −0.37 ES (total fat intake): −0.32 EXP1 compared to C2 ES (energy from fat): −0.13 ES (total fat intake): 0.09 MT Significant difference in energy from fat between C1 and C2 ES: −0.24 MT Significant effect on energy from fat and total fat intake among participants who meet/do not meet fat intake recommendations in EXP1 compared to C1 and C2 ES: N/A |
| Walker, 2009     | USA     | Women [225] (50–69) recruited from the general population                             |                   |                         | Web-based Block98 FFQ       | % calories from fat       | LT (6 months) Significant effect on % calories from saturated fat ES: −0.30 |
| Walker, 2010     | USA     |                                                                                     |                   |                         |                               | % calories from saturated fat | ES: −0.30 |

Table 2 (continued)
| Study Title (Reference) | Population (Country) | Study Population (N) | Study Population (Age) | Study Design/Method | Intervention | Evaluation Methods | Outcome | Follow-Up | Significant Results |
|------------------------|----------------------|----------------------|------------------------|---------------------|--------------|--------------------|---------|-----------|------------------|
| Werkman, 2010 [56]     | The Netherlands      | Recent retirees [415] | (55 – 65)              | Exp1                | Generic HE   | Yes                | Semi-quantitative Fat intake (en%) | LT (12 months) | No significant effects on fat intake |
| Winett, 2007 [34]      | USA                  | Participants [1,071] | recruited from churches| Exp1                | CT advice    | No                 | Block98 FFQ % kcal from fat        | LT         | No significant effects on fat intake |
| Alexander, 2010 [80]   | USA                  | Participants [2,540] | (21 – 65)              | Exp1                | CT advice    | Yes                | 16-item FFQ by National Cancer Institute | LT         | Significant effect on fruit and vegetables intake in the past month in EXP2 compared to C and EXP1, ES: 0.10 |
| Blair Irvine, 2004 [71]| USA                  | Participants [517]   | recruited from a large hospital | Exp1                | CT advice    | Yes                | 5-A-Day Screener                   | ST         | Significant effects on fruit and vegetables consumption, ES (1 month): 0.21, ES (2 months): 0.04 |
| Dutton, 2008 [77]      | USA                  | Sedentary women [280] | recruited from the general population | Exp1                | Self-help booklet | Yes                | National Cancer Institute Screeners Fruit and vegetables intake (daily servings) | MT/LT      | No significant effects on fruit and vegetables intake in EXP1 and EXP2 compared to C and EXP3, ES (EXP1-C): 0.18 |
| Gans, 2009 [75]        | USA                  | Participants [1,841] | with low income, recruited from waiting rooms of public health clinics | Exp1                | CT advice    | ? 7-item National Cancer Institute fruit and vegetables screener assessment tool | MT         | Significant effect on fruit and vegetables intake in EXP1 and EXP2 compared to C and EXP3, ES (EXP1-C): 0.18 |

Note: C = Control, EXP1 = Intervention 1, EXP2 = Intervention 2, CT = Computer-based Technology, FFQ = Food Frequency Questionnaire, ES = Effect Size.
| First author(s) a | Country | Study population [N] | Intervention modes b | Validated questionnaire | Outcome measurement instruments | Outcome measurement units | Results c and effect sizes d at short (ST), medium (MT), or long term (LT) e |
|------------------|---------|----------------------|----------------------|------------------------|-------------------------------|---------------------------|--------------------------------------------------|
| Heimendinger, 2005 [81] | USA | Participants [3,402] (18+) recruited through Cancer Information Service offices (callers) | C Generic HE (1 booklet) | Yes | 1-item | Fruit and vegetables intake (daily servings) | LT | Significant effect on fruit and vegetables intake in EXP2 and EXP3 compared to C ES: N/A |
| Kreuter, 2005 [79] | USA | Lower-income African–American women [1,227] (18–65) from 10 urban public health centers | C No intervention | Yes | 13-item FFQ | Fruit and vegetables intake (servings/day) | MT | No significant effects on fruit and vegetables intake LS | LT | Significant effect on fruit and vegetables intake in EXP3 compared to other groups ES: N/A |
| Nitzke, 2007 [78] | USA | Participants [2,024] (18–24) recruited from non-college venues | C No intervention | Yes | 5 A Day Screener | Fruit and vegetables intake (servings) | MT | Significant effects on fruit and vegetables intake and perceived vegetables intake ES (fruit intake): 0.12 LS | LT | Significant effects on fruit and vegetables intake and perceived vegetables intake ES (fruit intake): 0.14 LS | ES (perceived vegetables intake): 0.08 |
| Do, 2008 [31] | USA | EXP1 CT advice | 2-item | Perceived daily intake | LS | Significant effects on fruit and vegetables intake and perceived intake of vegetables and fruit and vegetables |

a Reference number b Intervention modes c Results d Effect sizes e Time frames
| Country | Study population | Intervention modes | Validated questionnaire | Outcome measurement instruments | Outcome measurement units | Results and effect size at short (ST), medium (MT), or long term (LT) of fruit and vegetables intake |
|---------|------------------|--------------------|------------------------|-------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------|
| USA     | Sedentary primary care patients at risk for at least one of the target behaviors recruited from primary care practices | C No intervention | Yes | 22-item Dietary Behavior Questionnaire Score on subscale fruit and vegetables | ES (fruit intake): 0.15 ES (vegetables intake): 0.13 ES (perceived vegetables intake): 0.11 ES (perceived fruit and vegetables intake): 0.12 | LT Significant effects on variety in fruit and vegetables consumption, consumption of seasonal fruits, juices and high beta-carotene vegetables ES (variety fruit) >1.00 ES (variety vegetables) >1.00 ES (seasonal fruit consumption) >1.00 ES (juices consumption) >1.00 ES (high beta-carotene vegetables consumption) >1.00 |
| USA     | Parents of teenagers at risk for at least one of the target behaviors recruited from schools | EXP1 CT advice | | | | |
| The Netherlands | Participants (18-65) recruited from companies and the general population | C Generic HE | Yes | FFQ | | |
| The Netherlands | Participants (18-65) recruited from companies and the general population | EXP1 CT advice (once delivered in 3 months) | | | | |
| The Netherlands | Participants (18-65) recruited from companies and the general population | EXP2 CT advice (3 times delivered in 9 months) | | | | |
| USA     | Parents of teenagers at risk for at least one of the target behaviors recruited from schools | EXP1 CT advice | | | | |
| USA     | Sedentary primary care patients at risk for at least one of the target behaviors recruited from primary care practices | C No intervention | Yes | 22-item Dietary Behavior Questionnaire Score on subscale fruit and vegetables | ES (fruit intake): 0.15 ES (vegetables intake): 0.13 ES (perceived vegetables intake): 0.11 ES (perceived fruit and vegetables intake): 0.12 | LT Significant effects on variety in fruit and vegetables consumption, consumption of seasonal fruits, juices and high beta-carotene vegetables ES (variety fruit) >1.00 ES (variety vegetables) >1.00 ES (seasonal fruit consumption) >1.00 ES (juices consumption) >1.00 ES (high beta-carotene vegetables consumption) >1.00 |
| USA     | Parents of teenagers at risk for at least one of the target behaviors recruited from schools | EXP1 CT advice | | | | |
| The Netherlands | Participants (18-65) recruited from companies and the general population | C Generic HE | Yes | FFQ | | |
| The Netherlands | Participants (18-65) recruited from companies and the general population | EXP1 CT advice (once delivered in 3 months) | | | | |
| The Netherlands | Participants (18-65) recruited from companies and the general population | EXP2 CT advice (3 times delivered in 9 months) | | | | |
| First author(s) | Country      | Study population [N] | Intervention modes | Validated questionnaire | Outcome measurement instruments | Outcome measurement units | Results and effect sizes at short (ST), medium (MT), or long term (LT) |
|----------------|--------------|----------------------|--------------------|-------------------------|---------------------------------|---------------------------|---------------------------------------------------------------|
| Sternfeld, 2009 | USA          | Participants [787] recruited from administration offices of a large healthcare organization | C No intervention  | Yes Diet questionnaire based on Block Food Questionnaire | Fruit and vegetables intake (cup-equivalents/day) | ST Significant effect on fruit and vegetables intake | ES: 0.32                      |
|                |              |                      |                    |                         |                                 |                           | ES: 0.08                      |
|                |              |                      |                    |                         |                                 |                           | ST Significant effect on fruit and vegetables intake among those who chose the fruit and vegetables path of the intervention |
|                |              |                      |                    |                         |                                 |                           | MT Significant effect on fruit and vegetables intake | ES: N/A                      |
| Van Keulen, 2011 | The Netherlands | Participants [1,629] (45–70) recruited from general practices | C1 No intervention  | Yes 16-item short questionnaire | Fruit intake (servings/day) | MT Significant effect on fruit intake of EXP1 compared to C1 and C3 | ES (EXP1-C1): 0.19 |
|                |              |                      |                    |                         |                                 |                           | ES (EXP1-C3): 0.18 |
|                |              |                      |                    |                         |                                 |                           | MT Significant effect on vegetables intake of EXP1 compared to C1 and C3 | ES (EXP1-C1): 0.10 |
|                |              |                      |                    |                         |                                 |                           | ES (EXP1-C3): 0.12 |
|                |              |                      |                    |                         |                                 |                           | LT (~11 months) Significant effect on fruit intake of EXP1 compared to C1 | ES: 0.32                      |
|                |              |                      |                    |                         |                                 |                           | LT (~11 months) Significant effect on vegetables intake of EXP1 compared to C1, C2 and C3 | ES (EXP1-C1): 0.33 |
|                |              |                      |                    |                         |                                 |                           | LT (~18 months) Significant effect on fruit intake of EXP1 compared to C1, C2 and C3 | ES (EXP1-C1): 0.24 |
|                |              |                      |                    |                         |                                 |                           | LT (~18 months) Significant effect on vegetables intake of EXP1 compared to C1, C2 and C3 | ES (EXP1-C1): 0.19 |
|                |              |                      |                    |                         |                                 |                           | LT (~18 months) Significant effect on vegetables intake of EXP1 compared to C1 | ES (EXP1-C2): 0.35 |
|                |              |                      |                    |                         |                                 |                           | LT (~18 months) Significant effect on vegetables intake of EXP1 compared to C1 | ES (EXP1-C2): 0.24 |
|                |              |                      |                    |                         |                                 |                           | LT (~18 months) Significant effect on vegetables intake of EXP1 compared to C1 | ES (EXP1-C3): 0.24 |

Notes:
- LT: Long term (≥11 months)
- ST: Short term (<11 months)
- MT: Medium term (11–18 months)
| First author(s) \[reference number\] | Country | Study population [N] | Intervention modesb | Validated questionnaire | Outcome measurement instruments | Outcome measurement units | Results and effect sizec at short (ST), medium (MT), or long term (LT)d |
|----------------------------------|--------|---------------------|-------------------|------------------------|-------------------------------|--------------------------|--------------------------------------------------------------------------------|
| Walker, 2009 [24]               | USA    | Women [225] (50–69) recruited from the general population | C Generic HE | Yes | Web-based Block98 FFQ | Fruit and vegetables intake (daily servings) | ES: 0.27 LT (6 months) Significant effect on fruit and vegetables intake |
| Walker, 2010 [25]               |        | EXP1 CT advice      |                   |                        |                               | ES: 0.22 LT (12 months) Significant effect on fruit and vegetables intake |
| Werkman, 2010 [56]             | The Netherlands | Recent retirees [415] (55–65) recruited from pre-retirement workshops | C Generic HE | Yes | Semi quantitative | Fruit and vegetables intake (g/MJ) | LT No significant effect on fruit and vegetables intake |
| Winett, 2007 [34]              | USA    | Participants [1,071] recruited from churches | C No intervention | Yes | Block98 FFQ | Fruit and vegetables intake (g/1000 kcal) | LT (7 months) Significant effect on fruit and vegetables intake in EXP1 compared to C |
|                                |        | EXP1 CT advice      |                   |                        |                               | ES: 0.44 Significant effect on fruit and vegetables intake in EXP2 compared to C |
|                                |        | EXP2 CT advice+ church support |                   |                        |                               | ES: 0.57 LT (16 months) Significant effect on fruit and vegetables intake in EXP1 compared to C |
|                                |        |                      |                   |                        |                               | ES: 0.12 Significant effect on fruit and vegetables intake in EXP2 compared to C |
|                                |        |                      |                   |                        |                               | ES: 0.32 |
| D. Other dietary topics        |        |                      |                   |                        |                               | |
| Adachi, 2007 [28]              | Japan  | Overweight Japanese women [205] recruited from the general population (Adachi, 2007) | C1 Self-help booklet ? | Weight parameters | BMI (kg/m²) | ST Significant effect on BMI in EXP1 & EXP2 compared to C1 & C2 among overweight Japanese women |
| Tanaka, 2010 [27]              |        | Overweight Japanese men [51] recruited from the general population (Tanaka, 2010) | C2C+self-monitoring of weight and walking | EXP1 CT advice | EXP2 CT advice+ self-monitoring of weight and walking | BMI | ES EXP1-C1: −0.60 |
|                                |        |                      |                   |                        |                               | ES EXP1-C2: −0.48 |
|                                |        |                      |                   |                        |                               | ES EXP2-C1: −0.77 |
|                                |        |                      |                   |                        |                               | ES EXP2-C2: −0.66 |
| First author(s) | Country | Study population [N] | Intervention modes | Validated questionnaire | Outcome measurement instruments | Outcome measurement units | Results and effect sizes at short (ST), medium (MT), or long term (LT) |
|-----------------|---------|----------------------|-------------------|-------------------------|---------------------------------|----------------------------|------------------------------------------------------------------|
| Elder, 2005 [26] | USA     | Latinas [357] recruited from the general population | EXP1 CT advice | Yes | Nutrition data system (NDS): 24 h dietary recall interview | Total energy intake (kcal) Total carbohydrates intake (g) | ST Significant effect on BMI in EXP2 compared to C1 among overweight Japanese men BMI ES EXP2-C1: −0.69 |
| Elder, 2006 [39] |         |                      | EXP2 CT advice+ promotoras | ? | Fat and fiber behavior-related questionnaire | Score from 0–3 | MT Significant effect on BMI in EXP2 compared to C1 & C2 among overweight Japanese women BMI ES EXP2-C1: −0.70 ES EXP2-C2: −0.58 |
| Fries, 2005 [70] | USA     | Participants [754] (18–72) recruited from physician practices | EXP1 CT advice | | | | LT No significant effect on BMI in EXP2 compared to C1 among overweight Japanese men |
| Haapala 2009 [55] | Finland | Overweight participants [125] (25-44) from the general population | EXP1 CT advice | | Weight parameters Body weight (kg) | | LT Significant effect on weight loss and waist circumference |
| Kroeze, 2008 [72] | The Netherlands | Participants [442] (18-65) recruited from companies and general population | EXP1 CT advice (CD-ROM) EXP2 CT advice (print) | Yes | 104-item FFQ | | ST Significant effects on energy intake in EXP1 and EXP2 compared to C |
|                 |         |                      |                  |                          |                                | ES: −0.28 | ES: −0.38 |
| First author(s) | Country | Study population [N] | Intervention modes | Validated questionnaire | Outcome measurement instruments | Outcome measurement units | Results and effect sizes at short (ST), medium (MT), or long term (LT) |
|----------------|---------|----------------------|-------------------|------------------------|-------------------------------|--------------------------|---------------------------------------------------------------|
| Poddar, 2010 [82] | USA | College students [294] recruited from a land grant, research-intensive university | C No intervention | ? | 7 day food records | Average daily dairy servings | ST Significant effects on energy intake among risk consumers in EXP1 and EXP2 compared to C: ES: −0.50, ES: −0.66 |
| Prochaska, 2008 [54] | USA | Participants [1400] at risk for at least one risk behavior (exercise, stress, BMI >25 kg/m² and smoking) recruited from a major medical university | C Health Risk Assessment | Yes | Self-report | % above/below BMI>25 kg/m² | MT No significant effect on BMI |
| Rothert, 2006 [38] | USA | Overweight and obese (BMI=27–40 kg/m²) participants [2862] recruited from health care delivery system | C Generic HE | ? | Self-report | % of baseline weight lost | MT/ST Significant effect on % of baseline weight lost: ES=1.00 |
| Stemfeld, 2009 [36] | USA | Participants [787] recruited from administration offices of a large healthcare organization | C No intervention | Yes | Diet questionnaire based on Block Food Questionnaire | Added sugars (g/day) | ST/MT No significant effects on added sugars |
| Walker, 2009 [24] | USA | Women [225] (50–69) recruited from the general population | C Generic HE | Yes | Web-based Block98 FFQ | Whole-grain intake (daily servings) | LT No significant effects |
| Werkman, 2010 [56] | The Netherlands | Recent retirees [415] (55–65) recruited from pre-retirement workshops | C Generic HE | Yes | Bioelectrical impedance analysis | % Body fat | LT Significant effect on waist circumference among men with low education |
|                  |         |                      | EXP1 CT advice   |                          | Semi quantitative FFQ | Energy intake (MJ/day) |                          |
|                  |         |                      | EXP1 CT advice   |                          | Weight parameters |                          |                          |
|                  |         |                      | EXP1 CT advice   |                          | Weight circumference among men with low education |                          |                          |
| First author(s) | Country | Study population [N] | Intervention modes | Validated questionnaire | Outcome measurement instruments | Outcome measurement units | Results and effect size at short (ST), medium (MT), or long term (LT) |
|----------------|---------|----------------------|--------------------|------------------------|--------------------------------|----------------------------|------------------------------------------|
| Winett, 2007 [34] USA | Participants [1,071] recruited from churches | C No intervention Yes Block98 FFQ | Weight parameters | | Fiber intake (g/1,000 kcal) Weight (lb) | LT (7 months) | Significant effect on fruit and vegetables intake in EXP1 compared to C ES: 0.35 Significant effect on fruit and vegetables intake in EXP2 compared to C ES: 0.44 Significant effect on weight in EXP2 compared to C ES: 0.21 LT (16 months) Significant effect on fruit and vegetables intake in EXP1 compared to C ES: 0.20 Significant effect on fruit and vegetables intake in EXP2 compared to C ES: 0.28 |

C control condition, EXP1 experimental condition 1, EXP2 experimental condition 2, EXP3 experimental condition 3, ES effect size, [125] 125 participants, (50–69) 50 to 69 years old, HE health education, (L/M/V/MV) PA (low-/moderate-/vigorous-/moderate to vigorous-intensity) physical activity, CT computer-tailored, VO2max maximal oxygen uptake, MET metabolic equivalent, FFQ food frequency questionnaire, IPAQ International Physical Activity Questionnaire, SQUASH Short Questionnaire Assessing Health-enhancing physical activity, AQuAA Activity Questionnaire for Adolescents and Adults, BMI body mass index, N/A not available

a Some publications reported on the characteristics and effects of the same intervention and are therefore clustered in one cell
b No intervention equals no info in the 2006 review; generic HE equals generic info in the 2006 review
c Significant effect = effect that reached statistical significance (p<0.05)
d Effect sizes were calculated when mean and SD were available at post-test and a significant effect in favor of tailoring had been found. ES is interpreted according to Cohen’s guidelines [67] based on an application in Dolan et al. [69]; cutoff values of 0.2–0.5 = small, 0.5–0.8 = moderate, and >0.8 = large effects
e Short term (ST), <3 months; medium term (MT), 3–6 months; long term (LT), >6 months
f In the study of Tanaka et al. [27], only EXP2 versus the self-help booklet was tested
Open Access This article is distributed under the terms of the Creative Commons Attribution License which permits any use, distribution, and reproduction in any medium, provided the original author(s) and the source are credited.

References

1. Ezzati M, Lopez AD, Rodgers A, Vander Hoorn S, Murray CJ. Selected major risk factors and global and regional burden of disease. *Lancet*. 2002;360:1347-60.
2. Hooper L, Summerbell CD, Higgins JP, et al. Dietary fat intake and prevention of cardiovascular disease: Systematic review. *BMJ*. 2001;322:757-63.
3. Kroeze W, Werkman A, Brug J. A systematic review of randomized trials on the effectiveness of computer-tailored education on physical activity and dietary behaviors. *Ann Behav Med*. 2006;31:205-23.
4. Krebs P, Prochaska JO, Rossi JS. A meta-analysis of computer-tailored interventions for health behavior change. *Prev Med*. 2010;51:214-21.
5. Lustria ML, Cortese J, Noar SM, Glueckauf RL. Computer-tailored health interventions delivered over the Web: Review and analysis of key components. *Patient Educ Couns*. 2009;74:156-73.
6. Neville LM, O’Hara B, Milat A. Computer-tailored physical activity behavior change interventions targeting adults: A systematic review. *Int J Behav Nutr Phys Act*. 2009;6:30.
7. Neville LM, Milat AJ, O’Hara B. Computer-tailored weight reduction interventions targeting adults: A narrative systematic review. *Health Promot J Austr*. 2009;20:48-57.
8. Neville LM, O’Hara B, Milat AJ. Computer-tailored dietary behaviour change interventions: A systematic review. *Health Educ Res*. 2009;24:699-720.
9. Noar SM, Benac CN, Harris MS. Does tailoring matter? Meta-analytic review of tailored print health behavior change interventions. *Psychol Bull*. 2007;133:673-93.
10. Noor SM, Grant Harrington N, Shemanksi Aldrich R. The role of message tailoring in the development of persuasive health communication messages. In: Beck CS, ed. Communication Yearbook 33. Routledge, 2009:73-133.
11. Eyles HC, Mhurchu CN. Does tailoring make a difference? A systematic review of the long-term effectiveness of tailored nutrition education for adults. *Nutr Rev*. 2009;67:464-80.
12. Yap TL, Davis LS. Physical activity: The science of health promotion through tailored messages. *Rehabil Nurs*. 2008;33:55-62.
13. Enwald HP, Huotari ML. Preventing the obesity epidemic by second generation tailored health communication: An interdisciplinary review. *J Med Internet Res*. 2010;12:e24.
14. Portnoy DB, Scott-Sheldon LA, Johnson BT, Carey MP. Computer-delivered interventions for health promotion and behavioral risk reduction: A meta-analysis of 75 randomized controlled trials, 1988-2007. *Prev Med*. 2008;47:3-16.
15. Brug J, Oenema A, Campbell M. Past, present, and future of computer-tailored nutrition education. *Am J Clin Nutr*. 2003;77:1028S-34S. 
16. Skinner CS, Campbell MK, Rimer BK, Curry S, Prochaska JO. How effective is tailored print communication? *Ann Behav Med*. 1999;21:290-8.
17. Cochrane Handbook for Systematic Reviews of Interventions. The Cochrane Collaboration, 2011.
18. Kreuter MW, Strecher VJ, Glassman B. One size does not fit all: The case for tailoring print materials. *Ann Behav Med*. 1999;21:276-83.
19. Cohen J. *Statistical Power Analysis for the Behavioural Sciences*. New York: Academic; 1977.
20. Cohen JA. Power primer. *Psychol Bull*. 1992;112:155-159.
21. Mullen PD, Simons-Morton DG, Ramirez G, Frankowski RF, Green LW, Mains DA. A meta-analysis of trials evaluating patient education and counseling for three groups of preventive health behaviors. *Patient Educ Couns*. 1997;32:157-73.
22. van Stralen MM, de Vries H, Muddie AN, Bolman C, Lechner L. Efficacy of Two Tailored Interventions Promoting Physical Activity in Older Adults. *Am J Prev Med*. 2009;37:405-17.
23. van Stralen MM, de Vries H, Muddie AN, Bolman C, Lechner L. The long-term efficacy of two computer-tailored physical activity interventions for older adults: Main effects and mediators. *Health Psychol*. 2011;30:442-52.
24. Walker SN, Pullen CH, Boeckner L, et al. Clinical trial of tailored activity and eating newsletters with older rural women. *Nurs Res*. 2009;58:74-85.
25. Walker SN, Pullen CH, Hageman PA, et al. Maintenance of activity and eating change after a clinical trial of tailored newsletters with older rural women. *Nurs Res*. 2010;59:311-21.
26. Elder JP, Ayala GX, Campbell NR, et al. Interpersonal and print nutrition communication for a Spanish-dominant Latino population: Secretos de la Buena Vida. *Health Psychol*. 2005;24:49-57.
27. Tanaka M, Adachi Y, Adachi K, Sato C. Effects of a non-face-to-face behavioral weight-control program among Japanese overweight males: A randomized controlled trial. *Int J Behav Med*. 2010;17:17-24.
28. Adachi Y, Sato C, Yamatsu K, Ito S, Adachi K, Yamagami T. A randomized controlled trial on the long-term effects of a 1-month behavioral weight control program assisted by computer tailored advice. *Behav Res Ther*. 2007;45:459-70.
29. Prochaska JO, Velicer WF, Rossi JS, et al. Multiple risk expert systems interventions: Impact of simultaneous stage-matched expert system interventions for smoking, high-fat diet, and sun exposure in a population of parents. *Health Psychol*. 2004;23:503-16.
30. Prochaska JO, Velicer WF, Redding C, et al. Stage-based expert systems to guide a population of primary care patients to quit smoking, eat healthier, prevent skin cancer, and receive regular mammograms. *Prev Med*. 2005;41:406-16.
31. Do M, Kattelmann K, Boeckner L, et al. Low-income young adults report increased variety in fruit and vegetable intake after a stage-tailored intervention. *Nutr Res*. 2008;28:517-22.
32. de Vries H, Kremers SPJ, Smeets T, Brug J, Eijmekaer K. The effectiveness of tailored feedback and action plans in an intervention addressing multiple health behaviors. *Am J Health Promot*. 2008;22:417-25.
33. Smeets T, Kremers SPJ, Brug J, de Vries H. Effects of tailored feedback on multiple health behaviors. *Ann Behav Med*. 2007;33:117-23.
34. Winett RA, Anderson ES, Wojcik JR, Winett SG, Bowden T. Guide to health: Nutrition and physical activity outcomes of a group-randomized trial of an Internet-based intervention in churches. *Ann Behav Med*. 2007;33:251-61.
35. Slootmaker SM, Chinapaw MJM, Schuit AJ, Seidell JC, van Mechelen W. Feasibility and effectiveness of online physical activity advice based on a personal activity monitor: Randomized controlled trial. *J Med Internet Res*. 2009;11:e27.
36. Sternfeld B, Block C, Quenexberry CPJ, et al. Improving diet and physical activity with ALIVE: A worksite randomized trial. *Am J Prev Med*. 2009;36:475-83.
37. Hurling R, Cott M, Boni MD, et al. Using internet and mobile phone technology to deliver an automated physical activity program: Randomized controlled trial. *J Med Internet Res*. 2007;9:e7.
39. Elder JP, Ayala GX, Campbell NR, et al. Long-term effects of a communication intervention for Spanish-dominant Latinas. Ann J Prev Med. 2006;33:159-66.
40. Hellman EA, Williams MA, Thalken L. Modifications of the 7-Day Activity Interview for Use Among Older Adults. J Appl Gerontol. 1996;15:116-32.
41. Hayden-Wade HA, Coleman KJ, Sallis JF, Armstrong C. Validation of the telephone and in-person interview versions of the 7-day PAR. Med Sci Sports Exerc. 2003;35:801-9.
42. Sallis JF, Haskell WL, Wood PD, et al. Physical activity assessment methodology in the Five-City Project. Am J Epidemiol. 1985;121:91-106.
43. Blair SN, Haskell WL, Ho P, et al. Assessment of habitual physical activity by a seven-day recall in a community survey and controlled experiments. Am J Epidemiol. 1985;122:794-804.
44. Wendel-Vos GC, Schuit AJ, Saris WH, Kromhout D. Reproducibility and relative validity of the short questionnaire to assess health-enhancing physical activity. J Clin Epidemiol. 2003;56:1163-9.
45. Craig CL, Marshall AL, Sjostrom M, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc. 2003;35:1381-95.
46. Rosenberg DE, Bull FC, Marshall AL, Sallis JF, Bauman AE. Assessment of sedentary behavior with the International Physical Activity Questionnaire. J Phys Act Health. 2008;5(Suppl 1):S30-54.
47. Kline GM, Porcari JP, Hintermeister R, et al. Estimation of VO2max from a one-mile track walk, gender, age, and body weight. Med Sci Sports Exerc. 1987;19:253-9.
48. Hageman PA, Walker SN, Pullen CH, Pellerito P. Test-Retest Reliability of the Rockport Fitness Walking Test and Other Fitness Measures in Women Ages 50-69 Years. J Geriatr Phys Ther. 2001;24.
49. Buckley JP, Sim J, Eston RG, Hession R, Fox R. Reliability and validity of measures taken during the Chester step test to predict aerobic power and to prescribe aerobic exercise. Br J Sports Med. 2004;38:197-205.
50. Morris M, Lamb KL, Hayton J, Cotterrell D, Buckley J. The validity and reliability of predicting maximal oxygen uptake from a treadmill-based sub-maximal perceptually regulated exercise test. Eur J Appl Physiol. 2010;109:983-8.
51. Block G, Hartman AM, Naughton D. A reduced dietary questionnaire: Development and validation. Epidemiology. 1990;1:58-64.
52. Van Assema P, Brug J, Ronda G, Steenhuis I. The relative validity of a short Dutch questionnaire as a means to categorize adults and adolescents to total and saturated fat intake. J Hum Nutr Diet. 2001;14:377-90.
53. Blair Irvine A, Ary DV, Grove DA, Gillilan-Morton L. The effectiveness of an interactive multimedia program to influence eating habits. Health Educ Res. 2004;19:290-305.
54. Kroese W, Oenema A, Campbell M, Brug J. The efficacy of Web-based and print-delivered computer-tailored interventions to reduce fat intake: Results of a randomized, controlled trial. J Nutr Educ Behav. 2008;40:226-36.
55. Kroese W, Oenema A, Dagnelie PC, Brug J. Examining the minimal required elements of a computer-tailored intervention aimed at dietary fat reduction: Results of a randomized controlled dismantling study. Health Educ Res. 2008;23:880-91.
56. De Bourdeaudhuij I, Stevens V, Vandelanotte C, Brug J. The impact of a website-delivered computer-tailored intervention for increasing physical activity in the general population. Prev Med. 2007;44:209-17.
57. Feunekes GI, Van Staveren WA, De Vries JH, Burema J. Reproducibility of a semi-quantitative food frequency questionnaire to assess the intake of fats and cholesterol in The Netherlands. Int J Food Sci Nutr. 1995;46:117-23.
58. Quintiliani LM, Campbell MK, Bowling JM, Steck S, Haines PS, DeVellis BM. Results of a randomized trial testing messages tailored to participant-selected topics among female college students: Physical activity outcomes. J Phys Act Health. 2010;7:517-26.
59. Oenema A, Brug J, Dijkstra A, de Weerdt I, de Vries H. Efficacy and use of an internet-delivered computer-tailored lifestyle intervention, targeting saturated fat intake, physical activity and smoking cessation: A randomized controlled trial. Ann Behav Med. 2008;35:125-35.
60. Wanner M, Martin-Diener E, Braun-Fahrlander C, Bauer G, Martin BW. Effectiveness of active-online, an individually tailored physical activity intervention, in a real-life setting: Randomized controlled trial. J Med Internet Res. 2009;11:e23.
61. Dunton GF, Robertson TP. A tailored internet-plus-email intervention for increasing physical activity among ethnically-diverse women. Prev Med. 2008;47:605-11.
62. Spittaels H, De Bourdeaudhuij I, Vandelanotte C. Evaluation of a website-delivered computer-tailored intervention for increasing physical activity in the general population. Prev Med. 2007;44:209-17.
63. Smedts T, Brug J, de Vries H. Effects of tailoring health messages on physical activity. Health Educ Res. 2008;23:402-13.
64. van Keulen HM, Mesters I, Ausems M, et al. Tailored print communication and telephone motivational interviewing are equally successful in improving multiple lifestyle behaviors in a randomized controlled trial. Ann Behav Med. 2011;41:104-18.
65. Hageman PA, Walker SN, Pullen CH. Tailored versus standard internet-delivered interventions to promote physical activity in older women. J Geriatr Phys Ther. 2005;28:28-33.
66. Marcus BH, Napolitano MA, King AC, et al. Telephone versus print delivery of an individualized motivationally tailored physical activity intervention: Project STRIDE. Health Psychol. 2007;26:401-9.
67. Napolitano MA, Whiteley JA, Papandonatos G, et al. Outcomes from the women's wellness project: A community-focused physical activity trial for women. Prev Med. 2006;43:447-53.
68. Marcus BH, Lewis BA, Williams DM, et al. A comparison of Internet and print-based physical activity interventions. Arch Intern Med. 2007;167:944-9.
69. Fries E, Edinboro P, McClish D, et al. Randomized trial of a low-intensity dietary intervention in rural residents: The Rural Physician Cancer Prevention Project. Am J Prev Med. 2005;28:162-8.
70. Blair Irvine A, Ary DV, Grove DA, Gillilan-Morton L. The effectiveness of an interactive multimedia program to influence eating habits. Health Educ Res. 2004;19:290-305.
71. Oenema A, Brug J, Dijkstra A, de Weerdt I, de Vries H. Efficacy and use of an internet-delivered computer-tailored lifestyle intervention, targeting saturated fat intake, physical activity and smoking cessation: A randomized controlled trial. Ann Behav Med. 2008;35:125-35.
72. Wanner M, Martin-Diener E, Braun-Fahrlander C, Bauer G, Martin BW. Effectiveness of active-online, an individually tailored physical activity intervention, in a real-life setting: Randomized controlled trial. J Med Internet Res. 2009;11:e23.
73. Dunton GF, Robertson TP. A tailored Internet-plus-email intervention for increasing physical activity among ethnically-diverse women. Prev Med. 2008;47:605-11.
78. Nitzke S, Kritsch K, Boeckner L, et al. A stage-tailored multimodal intervention increases fruit and vegetable intakes of low-income young adults. *Am J Health Promot.* 2007;22:6-14.
79. Kreuter MW, Sugg-Skinner C, Holt CL, et al. Cultural tailoring for mammography and fruit and vegetable intake among low-income African-American women in urban public health centers. *Prev Med.* 2005;41:53-62.
80. Alexander GL, McClure JB, Calvi JH, et al. A randomized clinical trial evaluating online interventions to improve fruit and vegetable consumption. *Am J Public Health.* 2010;100:319-26.
81. Heimendinger J, O'Neill C, Marcus AC, et al. Multiple tailored messages are effective in increasing fruit and vegetable consumption among callers to the cancer information service. *J Health Commun.* 2010;15:65-82.
82. Poddar KH, Hosig KW, Anderson ES, Nickols-Richardson SM, Duncan SE. Web-based nutrition education intervention improves self-efficacy and self-regulation related to increased dairy intake in college students. *J Am Diet Assoc.* 2010;110:1723-7.
83. The Handbook of Health Behavior Change. New York: Springer Publishing Company, 2009.
84. Babor TF, Sciamanna CN, Pronk NP. Assessing multiple risk behaviors in primary care. Screening issues and related concepts. *Am J Prev Med.* 2004;27:42-53.
85. Brug J, Steenhuis I, Van AP, Glanz K, De Vries H. Computer-tailored nutrition education: Differences between two interventions. *Health Educ Res.* 1999;14:249-56.
86. Tate DF, Wing RR, Winett RA. Using Internet technology to deliver a behavioral weight loss program. *JAMA.* 2001;285:1172-7.
87. Harvey-Berino J, Pintauro S, Buzzell P, et al. Does using the Internet facilitate the maintenance of weight loss? *Int J Obes Relat Metab Disord.* 2002;26:1254-60.
88. Soureti A, Murray P, Cobain M, Chinapaw MJ, van MW, Hurling R. Exploratory study of web-based planning and mobile text reminders in an overweight population. *J Med Internet Res.* 2011;13:e118.
89. Van Rooyen S, Godlee F, Evans S, Smith R, Black N. Effect of blinding and unmasking on the quality of peer review. *J Gen Intern Med.* 1999;14:622-4.
90. Davidoff F. Masking, blinding, and peer review: The blind leading the blinded. *Ann Intern Med.* 1998;128:66-8.
91. Mclnnes E, Duf L, McClarey M. Challenges in updating a systematic review. *Nursing Times Res.* 1999;4:66-71.
92. Stead LF, Lancaster T, Silagy CA. Updating a systematic review—what difference did it make? Case study of nicotine replacement therapy. *BMC Med Res Methodol.* 2001;1:10.
93. van Stralen MM, de Vries H, Mudder AN, Bolman C, Lechner L. The working mechanisms of an environmentally tailored physical activity intervention for older adults: A randomized controlled trial. *Int J Behav Nutr Phys Act* 2009;6.
94. Brouwer W, Kroeze W, Cruizzen R, et al. Which intervention characteristics are related to more exposure to internet-delivered healthy lifestyle promotion interventions? A systematic review. *J Med Internet Res.* 2011;13:e2.
95. Jacobs AD, Ammerman AS, Ennett ST, et al. Effects of a Tailored Follow-Up Intervention on Health Behaviors, Beliefs, and Attitudes. *Journal of Women's Health.* 2004;13:557-68.
96. Carroll JK, Lewis BA, Marcus BH, Lehman EB, Shaffer ML, Sciamanna CN. Computerized tailored physical activity reports a randomized controlled trial. *Am J Prev Med.* 2010;39:148-56.
97. Pekmezzi DW, Neighbors CJ, Lee CS, et al. A culturally adapted physical activity intervention for Latinas: A randomized controlled trial. *Am J Prev Med.* 2009;37:495-500.
98. Spittaels H, De Bourdeaudhuij I, Brug J, Vanderlatte C. Effectiveness of an online computer-tailored physical activity intervention in a real-life setting. *Health Educ Res.* 2007;22:385-96.
99. Chinapaw MJ, Slootmaker SM, Schuit AJ, van ZM, van MW. Reliability and validity of the Activity Questionnaire for Adults and Adolescents (AQuAA). *BMC Med Res Methodol.* 2009;9:58.
100. Liu RD, Buffart LM, Kersten MJ, et al. Psychometric properties of two physical activity questionnaires, the AQuAA and the PASE, in cancer patients. *BMC Med Res Methodol.* 2011;11:30.