Improving exposure to Internet-delivered health behaviour change interventions

An exploration of determinants and dissemination strategies

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Improving Exposure to Internet-Delivered Health Behaviour Change Interventions

An exploration of determinants and dissemination strategies

Het verbeteren van blootstelling aan gezondheidsbevorderende internetinterventies

Een exploratie van determinanten en verspreidingsstrategieën

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1

General introduction

The Internet has become the key medium to obtain health information for many people. This makes the Internet an attractive and increasingly used medium for the delivery of health behaviour change programs aiming to contribute to the primary prevention of chronic diseases. Although in theory Internet applications hold great promise for the delivery of health promotion and behaviour change interventions, evidence suggests that the use of such Internet interventions is disappointingly low, especially when these interventions are implemented for use by the general public. Until recently, research on Internet-delivered health behaviour change interventions primarily focused on the effect evaluation of such interventions in more or less controlled research settings. Considerably less research attention has been directed at exploring or promoting, the dissemination, reach and use of such interventions after they have become available for use by the public. In order to improve overall impact of these interventions, more insight is needed in how to improve dissemination, reach and use of Internet-delivered health promotion interventions.

This thesis reports on six studies that identify which factors can contribute to a better dissemination of and exposure to Internet-delivered health behaviour change interventions (from now on referred to as 'Internet interventions') for adult target populations. The focus will be on Internet interventions aimed to promote health behaviours that contribute to the primary prevention of chronic diseases, such as obesity, cardiovascular diseases, diabetes mellitus, and cancer. Such interventions include programs that promote healthy eating and physical activity, that encourage smoking cessation and discourage alcohol consumption. The thesis focuses on interventions aiming to reach the general adult public and on implementation in real-life settings (i.e., outside of a study setting). This introductory chapter describes the trends in access and use of the Internet, the background of Internet interventions, the study aims, the theoretical frameworks used in this thesis, and presents an overview of the individual studies within this thesis.

Development of Internet access and use

Since the introduction to the general public, the number of Internet users has grown rapidly. In 1993, the first Internet service provider in the Netherlands (XS4ALL) started to provide access to the general public. In 1997, there were 1 million users in the Netherlands, which more than doubled in the three consecutive years, so that at the end of 2001 there were about 8 million users. In May 2003 the threshold of 10 million users was crossed and recent figures show that approximately 14 million, 93% of people aged 12 to 75 year, in the Netherlands have access to the Internet.[1] There has been rapid growth in Internet users worldwide, with an approximate increase of 450% between 2000 and 2010, and the current penetration rate is estimated at 28% of the population worldwide.[2] The Netherlands is one of the countries with the highest Internet penetration rates, together with the United States, Canada, South Korea,

Japan, and the Scandinavian countries.[3] This massive increase in users has made the Internet a channel with great potential for delivering public health interventions.

The majority of the Dutch population has Internet access[1] and saturation in access appears to be reached. Therefore, early criticism that only a very selected number of people can be reached with Internet interventions can be discounted. It has been argued, however, that the 'digital gap', meaning not everyone in the population can be reached equally, might still be an issue as the access to the Internet differs by age and socio-economic/educational level.[4-6] In recent years, studies have shown that Internet access among older people and people in lower socio-economic positions is increasing steadily and differences in Internet access between these groups have become smaller.[7-9] However, motivation and skill to use the Internet may still result in lower reach in these groups.[6,10]

Despite the high rates of access, differences in the intensity and frequency of use between demographic groups still remain.[1] In 2009, 90% of people aged 12 to 75 used the Internet in the last three months and most of them used it daily or at least weekly. Men use the Internet more frequently and intensely than women, and the intensity and frequency of use tends to increase by educational level and decrease with age. In addition, although the use of e-mailing and searching for general information are relatively equal among various demographic groups, other aspects of Internet use vary according to demographics. For example, adolescents use the Internet more often than other age groups for chatting and for entertainment (games, music or downloading software). Men use most functions that the Internet has to offer more often than women, such as calling through the Internet, using chat, searching news, online auctions and shopping (e.g., eBay), Internet banking and entertainment. The use of the Internet regarding searching news, Internet banking, and downloading software, increases with educational level. It is likely that the use of Internet interventions have similar differences in use across groups. Therefore, it is important to take demographic factors into account in studies into reach and dissemination of Internet interventions.

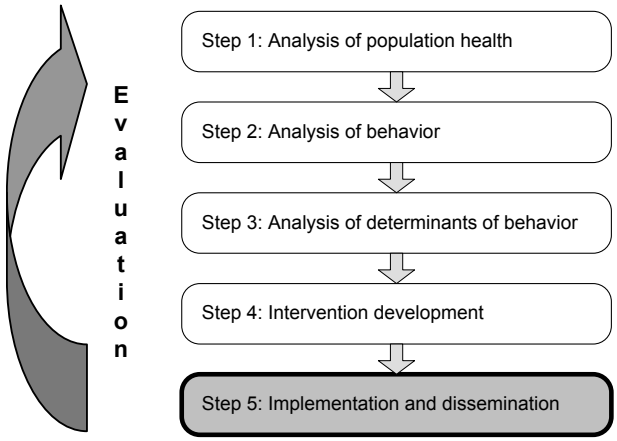
Data from 2005 show that of the Dutch Internet users, nearly three quarters used the Internet for searching for health information.[11] Of this group, 36% searched for nutrition, diet, vitamins, and other nutrition related topics, 28% exercise or fitness topics, 16% weight loss topics, and 7% for how to quit smoking. Women and higher educated people tended to look for health information more often than other groups. Similar figures have been found for the US, where in 2006, 80% of the website users searched for health information.[12] The fact that the Internet is used frequently by a wide range of population groups makes it a suitable medium to deliver health promotion interventions, with a potentially high impact if large numbers of people can be reached.

Planned development and dissemination of (Internet) interventions

Implementation and dissemination of an intervention are important and integral parts of a planned approach to health education and promotion. Using a planned approach for intervention development not only increases the likelihood that an intervention will be successful in achieving the desired outcomes, it also increases the likelihood that an intervention has good prospects for adoption and implementation.[13,14] Health education and promotion planning models therefore help to improve the quality of interventions. Five essential steps are distinguished in the model depicted in Figure 1.1. The first three steps consist of identifying serious and prevalent health problems, behavioural risk factors, and important and changeable determinants of risk behaviours. In the fourth step, appropriate intervention methods, strategies, and materials that address the most important and modifiable determinants identified in the previous step, need to be selected or developed to form an intervention program. The fifth step is to implement and disseminate the intervention in a way that ensures a large proportion of the target population is reached and exposed to the education content. Evaluation can and should take place in all the steps and can provide evidence for efficacy and appropriateness of the choices made in all steps.

The studies described in this thesis will focus on the fifth step, implementation and dissemination of Internet interventions. Even though it is the last step in the model, implementation and dissemination should be anticipated in the earlier steps of the development process. This is, for example, possible through creating a linkage group at the beginning of the development process, consisting of developers, implementers and potential users of the interventions.[13] This linkage group can increase the likelihood that an intervention has important prerequisites

Figure 1.1 A model for planned health education and promotion[13,14]



for successful implementation, that possible problems during implementation are anticipated, and that solutions are found for barriers to successful implementation. Including potential users in a linkage group will increase the likelihood that the intervention is both attractive to the target population and meets its' needs. In addition, an implementation plan to guide the choice of strategies and methods for bringing the intervention to the attention of the target population and to maintain their involvement is ideally developed along with the intervention. Such a plan will further facilitate optimal implementation and dissemination of interventions.

Advantages of using the Internet for health education

Health risk behaviours associated with the diseases with the highest burden on public health (e.g., obesity, cardiovascular diseases, diabetes mellitus, and cancer) are highly prevalent in the Netherlands as well as in most other Western countries.[15-17] These diseases and conditions are associated with a limited group of health behaviours, particularly smoking, unhealthy eating habits, lack of physical activity, and excessive alcohol consumption. In the Netherlands, 27% of the population (12+) regularly smokes, 44% of the population (12+) does not meet the physical activity guidelines of at least thirty minutes of moderate to vigorous intensity physical activity on at least five days of the week, up to 90% of the population consumes too much saturated fat, 47% of the population (20+) is overweight, and an estimated 10% of the population (12+) are heavy drinkers.[1,18] These figures show that many people of the Dutch population need to be reached to promote healthy lifestyles and improve public health.

The provision of individually tailored information has found to be a promising strategy to modify complex health related behaviour. In the past, it was only possible to provide people with individually tailored information through individual or group counselling. However, this approach cannot achieve broad penetration at an acceptable cost. Computer-tailored interventions have made it possible to mimic individual counselling, but without the need for face-to-face contact, which makes it possible to reach large numbers of people. Kreuter and Skinner[19] defined 'tailoring' as: "*Any combination of information or change strategies intended to reach one specific person, based on characteristics that are unique to that person, related to the outcome of interest, and have been derived from an individual assessment*."

Computer-tailored interventions allow the provision of information adapted to the unique characteristics, circumstances, beliefs, motivation to change, and behaviour of an individual.[20,21] The first generation of computer-tailored interventions used computer-technology to provide printed materials, such as individually tailored letters, reports and pamphlets.[22,23] Second generation computer-tailored interventions are now available which provide people with personalized electronic feedback immediately after they completed individual assessment online.[24-26] Evidence indicates that personally tailored methods and information through

computer-tailoring are more effective than generic information.[22,27-29] The Internet is an excellent medium for the delivery of these second generation computer-tailored interventions to the large numbers of people that need to be addressed with health promotion information. Thus, the Internet makes it possible to combine an individual approach with a large reach.

The Internet has the potential to reach many people and Internet-based interventions have the advantage of offering health information that can be accessed quickly, at any time and many locations. Furthermore, unlike face-to-face interventions, once an Internet intervention has been developed, the cost of delivering it to a virtually unlimited number of people is minimal.[30,31] In addition, the ability to use an intervention program anonymously may appeal to people who may be reluctant to seek interpersonal help, such as smokers, alcohol users, or obese people.

Efficacy of Internet interventions

Many different Internet interventions have been developed in recent years, most of which have been evaluated in controlled settings. Several reviews have pooled the evidence of effectiveness of these Internet interventions that focused on physical activity, nutrition, weight management, and smoking cessation.[25,32-36] Both Vandelanotte et al.[34] and Van den Berg et al.[33] concluded that the physical activity Internet interventions were effective, but that the effect sizes were small and only short term.[34] Norman et al.[25] conducted a review of Internet interventions for both physical activity and dietary behaviour change and found that the results were mixed. Both Weinstein et al.[36] and Saperstein et al.[32] reviewed the evidence on the effectiveness of Internet-based interventions regarding weight loss and maintenance. They found evidence of effectiveness in relation to initial weight change, but not long term weight maintenance. Regarding smoking cessation, Walters et al.[35] reported that in half of the included studies, computer- and Internet-based interventions showed statistically significant or improved outcomes at the longest follow-up. Overall, these quantitative reviews report positive, albeit highly variable and often small effects for computer-tailored Internet interventions for different health behaviours.

Reach of Internet interventions

While research to establish the efficacy of Internet interventions and identifying active elements is still ongoing and there remains scope for improvements in efficacy, Internet interventions are currently being implemented in real life settings. This next step of disseminating and implementing effective interventions in real life settings, where reach and adoption become important, has not received much research attention, even though this is important to achieve an impact on public health.[37] An intervention can only influence public health when there is

a high reach of and sufficient exposure to the contents of an effective intervention. Greater understanding of the prerequisites for good reach and exposure of Internet interventions can improve overall impact. Given the high Internet penetration rates, it is expected that large numbers of people can be reached with Internet interventions.[38,39] Nevertheless, efficacy trials have shown that the actual reach of the target population is disappointingly low.[38,40-42] In addition, the actual use of the interventions has found to be quite low in study settings.[38,40,43] When these Internet interventions are implemented for use by the general public, it is expected that these exposure rates may be even lower,[44-46] which warrants systematic studies of this topic.

Exposure to an Internet intervention

While bringing people into contact with an Internet intervention is a prerequisite, ensuring they use the program, preferably to its full extent, is another challenge. Once aware that an Internet intervention exists, people have to decide if they want to actually visit it, to what extent they use it, and to revisit it if multiple visits are required to complete the whole program. Problems may occur at each of these decision points, potentially influencing visitor's exposure to the program content. For example, there is growing evidence that many visitors to Internet interventions get less program engagement than program developers anticipated.[47,48] Early attrition from sessions is an often reported problem.[34,42,48-50] It appears to be difficult to retain visitors over an extended period, as visitors tend to spend only a limited amount of time assessing the program contents. It is therefore important to investigate if and how intensely people use an intervention when it is implemented for use in real life, outside of a study setting. In addition, repeated use of an intervention is also important as there is growing evidence of a dose-response relationship between the number of visits to an intervention program and inducing and maintaining behaviour change.[51-53] To receive an optimal dose of an Internet intervention, it is reasoned that visitors need to use the intervention program at a sufficiently high frequency over a specified period of time.[25] In previous studies, it has been indicated that problems occur in attracting visitors to revisit an Internet intervention.[51-53] There is evidence that repeated use of an intervention program and login rates tend to decrease when multiple revisits are required during the intervention period.[52-55] However, Fry et al. report that the use of frequent prompts can be effective in improving the effectiveness of behaviour change interventions and that effectiveness is enhanced if prompts are frequent and personal contact with a counsellor is included.[56]

Thus, the evidence suggests that exposure to Internet interventions is often not optimal. However, little is known about underlying factors of reach of and exposure to Internet interventions. Therefore, an important first step in improving dissemination of and exposure to these interventions is to identify the important determinants of these factors, which will be the focus of this thesis.

Theories of dissemination and implementation

This thesis draws on a number of the existing theories and models of dissemination and implementation. A brief description is given of the Reach, Efficacy/efficiency, Adoption, Implementation, and Maintenance (RE-AIM) framework,[57,58] followed by a conceptual model of the 'reach' element. This conceptual model was further informed by the Diffusion of Innovations Theory,[59] the Source, Message, Channel, and Receiver (SMCR) model,[60,61] and the Theory of Planned Behaviour (TPB).[62]

RE-AIM framework

The RE-AIM framework highlights the role of intervention dissemination, reach, and exposure in addition to efficacy in explaining the impact of public health interventions.[57,58,63] The focus of this framework (see Table 1.1) is on five dimensions for evaluating public health interventions: reach, efficacy/efficiency, adoption, implementation, and maintenance.[63,64] The primary focus of this thesis will be on the dimension 'reach', rather than the other dimensions, as Internet interventions for the general population are not necessarily distributed through intermediaries.

Improving the reach of Internet interventions through higher exposure rates and increased use is important, as these are essential prerequisites for behaviour change and consequently public health improvements. It is, therefore, essential to know who visits these intervention programs and how visitors use the program: what content do they visit; do they go through all program contents; and, do they revisit the Internet intervention. Greater insight into the characteristics of users who are currently reached, including those who actually use and revisit a program, will elucidate what needs to change in the promotion of Internet interventions to increase the reach and what is needed to keep visitors engaged and encourage them to revisit.

Table 1.1 The RE-AIM framework[63,64]

Element		Meaning
R	Reach	The reach of the intervention: how many people within the target population are exposed to the intervention and to what extent are they exposed to the intervention
E	Efficacy/efficiency	The intended positive impact of the intervention and its possible unintended consequences on quality of life and related factors
A	Adoption	The proportion of potential settings and intervention agents that participate in a study and how representative they are of targeted settings/agents
I	Implementation	To what extend is the intervention implemented as intended by its providers
M	Maintenance	At individual level: the longer term efficacy/effectiveness of an intervention; at setting level: the institutionalization of a program, to what extend is the intervention part of fixed procedures, routines and programs

Conceptual model of reach

For this thesis, reach of Internet interventions is described as consisting of two elements: dissemination and exposure (see Figure 1.2). The first element relates to the activities of providers of Internet interventions and the second to the behaviour of potential users.

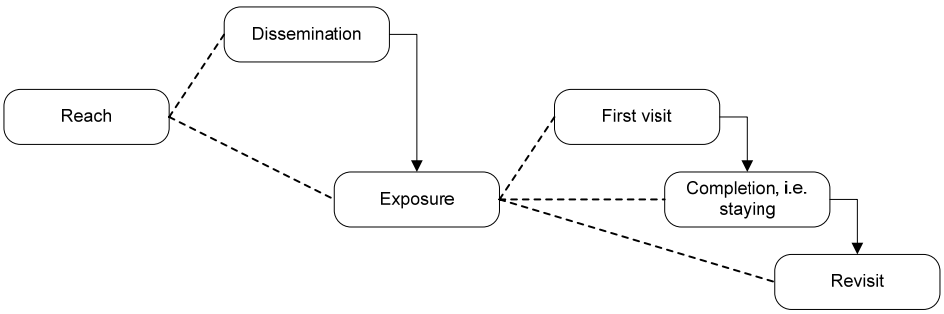
Dissemination

The term 'dissemination' is used for all the activities of developers or providers in bringing an Internet intervention to the attention of potential users. Providers of Internet interventions have a wide array of promotion strategies at their disposal to disseminate an intervention program. They range from conventional promotion methods such as advertisements in newspapers and on television, and recommendation by health professionals, to new electronic methods as SMS and banners on websites.

Exposure

After dissemination people can decide whether or not to use the program (i.e., adoption). The whole process of optimal use of and exposure to an Internet intervention can be divided into three phases (see Figure 1.2): (1) a first visit to an intervention website, in which the potential user makes the decision whether or not to go to the intervention website and access the program, (2) an extension of the first visit, in which the user has to decide whether or not to stay on the website and be exposed to (part of) the intervention content, and (3) a revisit to an Internet intervention, in which the user has to decide to make a return visit to the intervention website, e.g., for sustained intervention exposure, by completing the intervention, monitoring of progress, revisiting the content, or seeking new content. The latter only applies to interventions that are developed for multiple visits. Different factors may play a role in each of the three phases to attract people to these intervention programs and keep them engaged with the program content.

Figure 1.2 Conceptual model of reach



According the Diffusion of Innovations Theory by Rogers[59] and the SMCR model,[60,61] successful dissemination and exposure is expected to depend on the characteristics of (1) the potential users, (2) the source (i.e., the provider of the intervention), and (3) the Internet intervention itself. Furthermore, people are more likely to adopt and use new technology tools, such as Internet interventions, when they perceive the program and its content as being both useful and easy to use.[65,66] Relevant personal characteristics of users include sex and age, but also individual cognitions regarding use of Internet interventions, including attitudes, subjective norms, perceived behavioural control, and intention as derived from the TPB.[62] Perceived possibilities of and barriers to the use of an intervention may also play a role. The relevant characteristics of the provider may include their perceived credibility and reliability. Characteristics of the intervention include its complexity (i.e., the degree to which the Internet intervention is perceived as difficult to understand and use), the trialability (i.e., the degree to which it is possible to experiment with the intervention before adopting it completely), and the relative advantage of the intervention (i.e., the degree to which the intervention is perceived to be superior to the idea that it replaces).[48,59]

This integration of theories is used as the basis of studies described in this thesis.

Aim and outline of this thesis

It can be concluded that in principle a large population can be reached with Internet interventions, but the current relatively low reach and exposure to health behaviour change Internet interventions is a restricting factor in the eventual impact and success of Internet interventions. However, little is known about the underlying factors that are related to reach and exposure, especially when Internet interventions are implemented for use by the general public. Insight into these underlying factors and determinants is important to increase the reach, use and exposure of Internet interventions. Therefore, the aim of this thesis is to identify which determinants and strategies enhance dissemination and use of Internet interventions aimed at promoting healthful behaviours.

The two main questions addressed in this thesis are:

1. Which user and intervention characteristics are related to use of and therefore exposure to Internet interventions?
2. What are potential effective dissemination strategies that might enhance the exposure to Internet interventions?

This thesis comprises a series of studies conducted as part of a collaborative project of the Department of Public Health at the Erasmus University Medical Centre and the Department of Health Promotion at Maastricht University. This thesis focuses on adults only. Crutzen et al., at Maastricht University studied the same issues with regard to adolescents.[67]

This thesis consists of six studies. Two qualitative studies were conducted to identify potentially important determinants of dissemination and exposure. These were a Delphi study among international experts and focus group interviews with potential visitors. The purpose of the Delphi study (**Chapter 2**) was to investigate what national and international experts consider would be effective dissemination strategies, which factors they think are important for the exposure to Internet interventions and to what extent they agreed on the importance of these factors. **Chapter 3** describes a focus group study investigating the opinions and ideas of potential visitors regarding what would attract and motivate them to visit, engage in and revisit an Internet intervention. A systematic literature review was conducted (**Chapter 4**), investigating whether specific interactive characteristics of the intervention are associated with increased use and exposure to Internet interventions. Chapters 5 to 7 describe three empirical studies. **Chapter 5** investigates how many and what kind of people visited, registered and revisited the *Gezondlevencheck*, an online multi-risk behaviour intervention implemented by the Netherlands Heart Foundation. **Chapter 6** explores how many and what type of people visited an Internet-delivered physical activity promotion program, when a promotion flyer is distributed through three different promotion channels, namely through general practitioners, through door-to-door distribution, and through e-mail recommendations by family or friends. **Chapter 7** describes an observational study regarding demographic, behavioural and psychosocial correlates of use of an Internet intervention relating to physical activity and healthy nutrition in a worksite setting. **Chapter 8** provides a general discussion of the main findings of this thesis and considers suggestions for further research and implications for practice.

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2

An exploration of factors related to dissemination of and exposure to Internet-delivered behaviour change interventions aimed at adults: A Delphi study approach

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Abstract

Background The Internet is an attractive medium for delivering individualized, computer-tailored behaviour change interventions to large numbers of people. However, the actual numbers of people reached seem to fall behind the high expectations. Insight into factors that determine use of and exposure to these Internet interventions is important to be able to increase the reach and improve exposure.

Objective The aim was to identify potentially important factors that determine whether adults visit an Internet-delivered behaviour change intervention, extend their visit, and revisit the intervention.

Methods A systematic, three-round Delphi study was conducted among national and international experts from Internet intervention research and practice, e-marketing/e-commerce, web design, and technical website development. In the first round, 30 experts completed a structured, open-ended online questionnaire assessing factors that were, in their opinion, important for a first visit, an extended visit, a revisit and for effective promotion strategies. Based on the responses in this first questionnaire, a closed-ended online questionnaire was developed for use in the second round. A total of 233 experts were invited to complete this questionnaire. Median and interquartile deviation (IQD) scores were computed to calculate agreement and consensus on the importance of the factors. The factors for which no consensus was obtained (IQD>1) were included in the third-round questionnaire. Factors with a median score of six or higher and with an IQD≤1 were considered to be important.

Results Of the 62 experts invited for the first round, 30 completed the questionnaire (48% response rate); 93/233 experts completed the second-round questionnaire (40% response rate), and 59/88 completed the third round (67% response rate). Being motivated to visit an Internet intervention and perceiving the intervention as personally relevant appeared to be important factors related to a first visit. The provision of tailored feedback, relevant and reliable information, and an easy navigation structure were related to an extended visit. Provision of regular new content and the possibility to monitor personal progress towards behaviour change were identified as important factors to encourage a revisit. Primarily traditional promotion strategies, like word-of-mouth by family and friends, a publicity campaign with simultaneous use of various mass media, and recommendation by health professionals, were indicated as effective ways to encourage adults to visit an Internet intervention.

Conclusions This systematic study identified important factors related to the dissemination of and exposure to Internet interventions aimed at adults. In order to improve optimal use of and exposure to Internet interventions, potential users may need to be motivated to visit such an intervention and the information provided needs to be personally relevant. Furthermore, several (technical) aspects of the intervention itself need to be taken into account when developing Internet interventions.

Introduction

The Internet has dramatically changed the possibilities for communication, including communication about health behaviour and behaviour change.[1] The Internet is a very attractive medium for the delivery of behaviour change interventions since it provides the option of delivering sophisticated versions of individualized, computer-tailored interventions and holds the promise of reaching large numbers of people.[2-5] However, the actual reach of Internet-delivered behaviour change interventions seems to lag behind this high expectation.[6,7] Evidence from efficacy trials indicates that actual use of and exposure to the assigned intervention content is low,[8,9] and when implemented in real life, exposure rates may be even lower.[10,11] In addition, exposure to the intervention content is not always optimal. It has been demonstrated that it is difficult to sustain visitors' loyalty to an intervention over an extended period of time,[12,13] which may result in premature attrition from a session or in non-use of follow-up sessions. Furthermore, people tend to spend only a limited amount of time assessing the program,[14] which makes optimal exposure to the intervention content unlikely. Loyalty to the program over an extended period of time may not be necessary for all Internet interventions or for all people using them since not all Internet interventions require extensive or repeated use of all the offered content.[15,16] However, for all Internet interventions at least some exposure to the intervention content is needed to initiate a process of behaviour change. An increase in the number of people reached and improved exposure to Internet-delivered behaviour change interventions are needed to be able to achieve optimal implementation of interventions after they have been evaluated to be efficacious.[6,9]

The importance of focusing attention not only on intervention efficacy but also on dissemination, reach, and exposure in achieving public health impact is emphasized in the Reach, Efficacy, Adoption, Implementation, and Maintenance (RE-AIM) framework.[17] To be able to improve dissemination and exposure rates of Internet-delivered behaviour change interventions, it is important to identify factors that enhance or inhibit these rates since such factors have to be targeted when attempting to improve dissemination and exposure.[18] The present study investigates factors related to dissemination and use of and exposure to Internet-delivered behaviour change interventions among adults.

Access or use of the Internet is not likely to be a barrier to accessibility of Internet interventions these days since penetration rates of home Internet access and Internet use are high. Various factors have been related to Internet or Internet intervention use, for example, differences in motivation, skills, and availability of computer facilities.[9,19] It has been suggested that to increase the number of first time and extended visits, it is necessary to ensure reliability and credibility of the source or provider of the intervention.[20,21] The information structure has been found to be related to the use of information, with less structured websites tending to

prematurely lose visitors.[13,22,23] Also, the amount of detail and elaboration of the information has been related to the length of time people process the intervention information.[12] Furthermore, it has been suggested that a static website that does not change over time may not attract revisits to interventions designed for multiple visits.[4] The use of e-mail to encourage revisiting an intervention seemed to have some effect on revisits, but not on encouraging new users.[7,24] Even though some potentially important determining factors have been suggested in the literature, these factors have not been studied in a systematic way, which is the aim of the present study.

In this study we defined Internet-delivered behaviour change interventions (or Internet interventions) to include those interventions that are aimed at the primary prevention of chronic diseases by promoting healthful behaviours. Examples are interventions that promote healthful dietary, physical activity, and safe sex practices, discourage alcohol consumption, or encourage smoking cessation or sun protection behaviour. Although these are very different topics, similar issues regarding exposure to and use of the content are likely to apply for all these interventions.

Dissemination and use of Internet interventions can be considered a process of diffusion and adoption of the intervention. Therefore, we used the Diffusion of Innovations Theory proposed by Rogers as the theoretical background for this study.[18] According to this model, characteristics of the user, the source (i.e., the provider of the intervention), and the innovation (in this case the intervention) are important in the process of dissemination and adoption. Characteristics of the users include personal characteristics, such as gender and age, but also individual cognitions regarding use of Internet interventions, including attitudes, subjective norms, perceived behavioural control, and intention as derived from the Theory of Planned Behaviour.[25] Furthermore, perceived possibilities of and barriers to the use of an intervention may play a role. Potentially important characteristics of the source are the perceived credibility and reliability. Characteristics of the intervention include the complexity (the degree to which the Internet intervention is perceived as difficult to understand and use), the trialability (the degree to which it is possible to experiment with the intervention before adopting it completely), and the relative advantage of the intervention (the degree to which the intervention is perceived to be superior to the idea that it replaces).[14,18] In this study the term 'dissemination' was used for the activities that the developers or providers have to undertake to bring the intervention to the attention of potential users. Dissemination was regarded as being distinct from exposure since the first is more related to activities of providers and the latter to the behaviour of potential users. We conceptualized the process of visiting an Internet intervention and being optimally exposed to its educational content as consisting of three distinct phases that are potentially determined by different factors: (1) a first visit, in which a potential user has to decide to go to a website and see what it entails, (2) extending the visit, in which a

user has to decide whether to continue his or her visit and be exposed to (part of) the content, and (3) revisiting the Internet intervention, in which the user has to decide to make a return visit to the intervention.

To assess the potential factors related to use of and exposure to Internet interventions, we conducted a three-round Delphi study. The specific aims of this study were to identify (1) factors that are associated with dissemination of and exposure to (first visit, extended visit, and revisit) Internet interventions aimed at adults, and (2) the extent to which experts agree on the importance of these factors.

Methods

A three-round Delphi study was conducted with international experts from health promotion research, e-marketing/e-commerce, web design, and technical website development. A Delphi study is a technique particularly suited for generating ideas about topics on which scientific knowledge is scarce. The technique allows for including experts from all over the world, guarantees anonymity of responses that may make the experts respond more freely, and is aimed at reaching agreement on the important issues.[26-28] The first round of the Delphi study was aimed at identifying potential factors of dissemination, first visit, extended visit, and revisit of an Internet intervention. The aim of the second and third round was to determine the importance and achieve agreement on the importance of the factors identified in the first round. The Delphi study was conducted over the Internet using online questionnaires. It was part of a larger study in which factors of dissemination and use of Internet interventions in adolescents were also investigated. In the first round of the study, experts were asked to indicate factors that would be important for adults as well as for adolescents. In the second and third rounds, experts had to provide separate responses for adults and adolescents. The entire Delphi study was carried out within 3 months (October to December 2006). The results regarding adolescents are published elsewhere.[29]

Participants and procedure

A total of 62 prominent experts in Internet intervention research and practice, e-marketing/e-commerce, web design, and technical website development from around the world were invited for the first round of the Delphi study. The ratio of experts from each field was set to 30:10:10:10. The highest number of experts was chosen to be from health promotion research and practice since we expected that these experts would have the broadest insight into the effectiveness of dissemination strategies and the factors related to a first visit, an extended visit, and a revisit. Criteria for choosing key experts in the first round were the following: (1) they were first authors of key scientific publications in the area of eHealth and eHealth promotion, and (2) they had written multiple scientific articles regarding this topic. People were

also included if they were active members of editorial boards of leading journals in health promotion and the Internet and had published in these areas or journals. Representatives of e-marketing/e-commerce and ICT (information and communication technology) companies (e.g., web designers and developers) were selected on the basis of publications, our own network, and by asking the responders to provide names of other experts in their field.

This list of experts was extended to 233 persons (aim was 250) to be invited for participation in the second round of the study. The criterion for selection was being first author of a scientific paper or abstract on the topic of Internet interventions. Names of first authors were retrieved through a literature search in PubMed, PsycINFO, and Web of Science (between 2000 and 2006), and first authors of abstracts published in proceedings of relevant national and international conferences (e.g., Society for the Internet in Medicine [MEDNET 2005 and 2006] and International Society for Behaviour Nutrition and Physical Activity [ISBNPA 2004-2006]) were added to the list. Experts from the field of e-marketing/e-commerce and ICT were mainly found through our own network and by referral from experts in the first round. The experts who responded in the second round (N=88) were invited to participate in the third round.

The experts were invited to participate in the study and each subsequent round by means of an e-mail. In this e-mail, the purpose and procedure of the Delphi study was explained and a link to the questionnaire was provided. Invitees were reminded once by e-mail to complete the first-round questionnaire and twice to complete the second- and third-round questionnaires. The questionnaires were pre-tested by experts in the fields of health promotion research and e-marketing.

Measurements

First round

The first-round questionnaire was a structured questionnaire with an open-ended answer format. Participants were asked to list all the factors that, according to their expertise, (1) are essential for successful dissemination of Internet interventions, (2) determine whether a person will visit an intervention for the first time, (3) determine whether a person will stay long enough on a website to meaningfully engage in the educational content, and (4) determine whether a person will revisit a website. A sample question was "*What are, according to your expertise, factors that determine whether a person will visit an Internet-delivered behaviour change intervention for the first time?*" The respondents were asked to suggest factors related to the user, the source, the Internet intervention itself, the physical and social environment, and any other important factors. The questionnaire started with a definition of all concepts used (e.g., what we defined as factors, Internet-delivered interventions, behavioural topics addressed in these interventions, and dissemination).

Second round

The second-round questionnaire had a closed-ended answer format and included all the unique factors that had been mentioned by the experts in the first round, except for those that were general health education principles not unique to Internet interventions (e.g., the intervention is based on scientific knowledge, the information should be understandable) since these are basic principles for state of the art health communication interventions for which no rating of importance and consensus is needed. The questionnaire consisted of 82 statement items (see the Appendix) presenting factors related to the (potential) visitor, the source, and the Internet intervention itself for a first visit, extended visit, revisit and for dissemination. The experts were asked to indicate how important they thought each of the factors were on a 7-point Likert scale (1=not important, 7=extremely important) for adults and adolescents separately. Apart from determinants of dissemination, the experts in the first round mentioned many factors that were, in fact, ways to promote Internet interventions. Therefore, we included a list with 23 strategies for promoting an Internet intervention. The experts were asked to choose the five strategies they thought were most successful for promoting an intervention among adults. This list of promotion strategies appeared in random order for each of the respondents.

Third round

The third-round questionnaire contained the items (48 in total, see the Appendix) of the second-round questionnaire for which no consensus was obtained (interquartile deviation [IQD]>1). The answering scale for each item now included information on the median score and IQD for that item as determined in the second-round questionnaire. The experts were asked to re-rate their answers on the same 7-point Likert scale in the light of this new information.

Data analysis

All the responses to the first-round questionnaire were listed, and similar responses were grouped together to reduce the number of factors. The remaining list of potentially important factors was included in the questionnaire for the second and third round, except for the factors that were general health education principles.

In the second round, following the standards for analyzing data from a Delphi study, the median scores were calculated to determine agreement on the importance of the statements. Also, the IQDs were calculated to determine consensus among the experts on the importance of the statements.[26,30] On a 7-point Likert scale, an IQD≤1 can be considered as good consensus and means that more than 50% of all opinions fall within one point on the scale.[28] Items with a median ≥6 (very or extremely important) and an IQD≤1 were considered as important factors. The dissemination strategies were analyzed by means of multiple response analysis.

In the third round, median scores and IQDs were calculated for the items included in the third-round questionnaire. SPSS 11.0 (SPSS Inc, Chicago, IL, USA) was used for all the statistical analyses.

Results

Participants and response rates

In total, 30 of the 62 experts we approached completed the questionnaire in the first round (48% response rate; Table 2.1). Participants were primarily from health promotion institutes (64% response rate) and health promotion research (50% response rate); 93/233 respondents completed the second-round questionnaire (40% response rate), and 59/88 completed the third-round questionnaire (67% response rate). Three participants resigned from participation in the third round due to time constraints, and two could not be contacted again since they had not provided contact details in the previous questionnaire. Reasons for nonparticipation and dropout of the other experts are not known, although some reported lack of time or interest.

Table 2.1 Response Delphi study

Disciplines	First round			Second round			Third round		
	N invited	N resp.	%	N invited	N resp.	%	N invited	N resp.	%
Health promotion research	32	16	50	155	65	42	62	41	66
Health promotion institutes	11	7	64	20	10	50	10	8	80
E-marketing & communication	9	3	33	24	6	25	6	4	67
Technical implementation	10	4	40	34	10	29	10	6	60
Unknown	--	--	--	--	2	--	--	--	--
Total	62	30	48	233	93	40	88	59	67

Measurements

First round

All factors unique for Internet interventions identified in the first round are listed in the Appendix. This list is composed of factors that were mentioned by individual experts (e.g., using modular approach, an enjoyable and rewarding experience in the first visit), as well as factors that were brought up by several of the experts (e.g., tailored/individualized content, word-of-mouth by family and friends, the credibility of the source). More factors were mentioned for a first visit and an extended visit than for a revisit. The factors mentioned under dissemination were mainly ways to promote an intervention, such as word-of-mouth, commercials on TV and radio, and e-mail.

Second round

With respect to the first visit, 4 of 17 items pertaining to the potential visitor (sufficient Internet skills, experience with using the Internet, motivation to visit the intervention, perceived relevance of the intervention) and 2 of 9 items pertaining to the Internet intervention (instant use, easy navigation structure) had a median score ≥6 (Table 2.2). Consensus was reached for three of these items.

Regarding an extended visit, 5 of 9 items related to the visitor (e.g., wants to improve behaviour, experiences the use as rewarding, appreciates tailored feedback), 0 related to the source, and 12 of 23 items related to the Internet intervention (e.g., displays personal progress, provides brief registration procedure, free of charge) had a median score ≥6 (Table 2.2). Consensus was reached for 10 of these items.

With respect to revisiting an intervention, 4 of 5 items regarding the visitor (receiving a reminder, committed to revisit, wants to improve behaviour, positive experience with previous visit) and 5 of 10 items pertaining to the Internet intervention (new content, monitoring progress, experienced previous visit as easy, rewarding, and enjoyable) had a median score ≥6 (Table 2.2). Consensus was reached for all these items, indicating that the majority of experts agreed that these were important factors for revisiting.

None of the strategies for dissemination had a median score ≥6 (see the Appendix).

Overall, consensus (IQD≤1) was reached for 34 items in the second round. Most items that reached consensus were related to revisiting an intervention (10 of 15 items). The least consensus was achieved for dissemination of interventions (1 of 7 items).

The ways to disseminate Internet interventions that were indicated most often were word-of-mouth by family and friends (58.1%), a publicity campaign with the simultaneous use of various mass media (58.1%), and recommendation by health professionals (52.7%; Table 2.3).

Third round

The median scores of the items included in the third-round questionnaire did not differ from the second round. Consensus was achieved for 45 of the 48 items (IQD≤1; see Table 2.2 and Appendix). No consensus was achieved for positive expectations of behaviour change interventions delivered through the Internet (relating to first visit), whether the user has to provide sensitive information, or the option of a trial before starting the intervention (related to extended visit). These three factors had a median score <6.

Table 2.2 Results of the Delphi study per item (second and third round) with a median score of ≥6 (full list of results can be found in the Appendix)

Questionnaire item[a]	Second round			Third round		
	N	Mdn[b,c]	IQD[c]	N	Mdn[b,c]	IQD[c]
I. How important do you think each of the following factors are in determining whether a person will make a first visit to an Internet delivered behaviour change intervention?						
A. Whether the potential visitor						
- has sufficient skills to use the Internet	89	6	1.5	59	6	1
- has experience with using the Internet	88	6	1	--	--	--
- is motivated to visit a behaviour change intervention provided through the Internet	88	6	1	--	--	--
- perceives the Internet intervention as relevant for him/herself	84	6	1	--	--	--
B. Whether the Internet intervention						
- can be used instantly without downloading special software by the potential visitor	83	6	2	56	6	0
- has a navigation structure that appears to be easy to use at first sight	83	6	2	56	6	0
II. How important do you think each of the following factors are in determining whether a person will stay on an Internet delivered behaviour change intervention long enough to actively engage in and process the educational content provided in the intervention?						
A. Whether the visitor						
- knows in advance how long it will take to go through the whole intervention	80	6	2	56	6	1
- wants to improve his/her behaviour in relation to the topic of the Internet intervention	80	6	1	--	--	--
- perceives the topic and content of the entire Internet intervention as being personally relevant	79	6	2	56	6	0
- experiences the use of the Internet intervention as rewarding	80	6	1	--	--	--
- likes receiving (tailored) feedback on the answers he/she provided on questions	80	6	2	56	6	1
C. Whether the Internet intervention						
- displays personal progress through the program (e.g., progress bar page numbers)	78	6	1	--	--	--
- provides the opportunity for a visitor to stop at any moment and to proceed at a later time	79	6	1	--	--	--
- has an aim that is clear to the visitor	79	6	1	--	--	--
- provides information that appears reliable to the visitor	78	6	1	--	--	--
- provides information that is easy to understand for the visitor	79	6	1	--	--	--
- provides information that is perceived to be useful for the visitor to help him/her in changing behaviour	77	6	2	56	6	0
- has a tone of voice that is appealing to the visitor	78	6	1	--	--	--
- has an easy to follow navigation structure	78	6	2	56	6	0

Questionnaire item[a]	Second round			Third round		
	N	Mdn[b,c]	IQD[c]	N	Mdn[b,c]	IQD[c]
- provides tailored feedback	77	6	1	--	--	--
- provides tailored feedback which is perceived as relevant to the visitor	77	6	1	--	--	--
- provides behaviour change information that seems achievable to the visitor	77	6	2	56	6	0
- can be used free of charge	77	6	2	55	6	0
III. How important do you think each of the following factors are in determining whether a person will revisit an Internet delivered behaviour change intervention?						
A. Whether the visitor						
- receives a reminder to revisit the Internet intervention	76	6	1	--	--	--
- is committed to revisiting the Internet intervention	76	6	1	--	--	--
- wants to improve his/her behaviour in relation to the topic of the Internet intervention	76	6	1	--	--	--
- has a positive experience with the previous visit to the Internet intervention	76	6	1	--	--	--
B. Whether the Internet intervention						
- provides new content on a regular basis	76	6	1	--	--	--
- provides the possibility for a visitor to monitor his/her progress in changing a behaviour	76	6	1	--	--	--
- has previously been experienced as easy to use by the visitor	76	6	1	--	--	--
- has previously been experienced as rewarding by the visitor	76	6	1	--	--	--
- has previously been experienced as enjoyable by the visitor	76	6	1	--	--	--

[a] Dashes indicate that consensus was obtained on the item in the second round and for that was excluded from the third round questionnaire.

[b] All items ranged from 1 to 7

[c] Mdn=median score; IQD=interquartile deviation

Discussion

Summary of findings

This Delphi study is among the first systematic explorations of potentially important factors related to the dissemination of and exposure to Internet-delivered behaviour change interventions. The study is unique in its focus on factors related to a first visit, an extended visit, and a revisit and by taking into account the characteristics of the potential users (in this case, adults), the source, and the intervention itself. In particular, factors related to the potential user, such as motivation and perceived personal relevance, were identified as important factors (median score ≥6; IQD≤1) related to a first visit. With regard to an extended visit (i.e., staying on the intervention long enough to meaningfully process some of the content), many

Table 2.3 Strategies of dissemination (N=74)

Dissemination strategies	N	%
Word-of-mouth (e.g., by friends and family)	43	58.1
A publicity campaign with the simultaneous use of various mass media	43	58.1
Health professionals (e.g., GPs, physical therapist)	39	52.7
TV and radio programs, like talk shows or consumer programs	31	41.9
Commercials on TV and radio	28	37.8
Articles in magazines and newspapers	25	33.8
Links to the Internet intervention at other websites	20	27.0
The involvement of people who belong to the target group	20	27.0
Advertisements on websites visited by the target group	19	25.7
Face-to-face contact	18	24.3
E-mail	17	23.0
Banners of the Internet intervention at other websites	14	18.9
Non-medical professionals (e.g., worksite health promoter)	14	18.9
Advertisements in magazines and newspapers	12	16.2
Advertisements on relevant products (e.g., cigarette packs or milk cartons)	10	13.5
Free publicity (e.g., free postcards, in libraries, folders by GPs or in hospitals)	9	12.2
The use of virtual guides to direct people to an Internet intervention (e.g., in chat boxes)	8	10.8
Telephone calls	7	9.5
Forums on the Internet	4	5.4
Other ICT channels (e.g., MSN Messenger or AIM)	3	4.1
The distribution of flyers at exhibitions and other public events	2	2.7
The distribution of flyers door to door	1	1.4
SMS	0	0.0

more factors related to the intervention itself were identified as important. The intervention needs to provide tailored feedback, relevant and reliable information, and be clear and easy to use. The experience with the intervention in the previous visit, the inclination to change the behaviour targeted in the intervention, the provision of new content, and being reminded to visit the intervention were regarded as important factors for a revisit. Apart from the factors that were rated as very important or extremely important, most of the other factors that came out of the first round reached consensus and were rated as somewhat important or important (median score 4-5). This means that these factors (listed in the Appendix) also need to be taken into account when attempting to improve use and exposure to Internet interventions.

Interpretation of findings

The existing knowledge on factors that enhance or inhibit optimal use of and exposure to an Internet intervention mainly relate to characteristics of the intervention itself. In this

Delphi study we used the Diffusion of Innovations Theory[18] as a theoretical framework, and therefore, we also considered characteristics of the user and the source as potentially important factors associated with adoption. In contrast to previous studies, credibility and reliability of the source were not identified as very important factors for visiting an Internet intervention or extending a visit.[20,21] With respect to characteristics of the potential users, motivation to visit the intervention and perceived personal relevance of the intervention were identified as important factors. The finding that motivation is an important factor is intuitive since visiting an Internet intervention for the first time, extending the visit, and revisiting the intervention can be considered as specific behaviours that can be explained by the Theory of Planned Behaviour.[25] According to this theory, motivation is the determinant most proximal to behaviour. The present study did not, however, provide information about factors underlying the motivation to visit an Internet intervention, such as attitudes, subjective norms, or perceived behavioural control.[18] This is possibly due to the breadth of topics addressed in this study or that the study was performed among experts and not among the actual users of Internet interventions. Nevertheless, motivating people to visit an Internet intervention seems to be important.

The provision of personalized feedback seems to be a key element related to an extended visit to an Internet intervention. This finding underlines what has been previously suggested in the literature. Computer tailoring has been identified as a very promising health education technique and the Internet as a suitable medium for the delivery of computer-tailored interventions.[31,32] Furthermore, if the computer-tailored information is iterative and provides new information and information about the users' progress, it might also encourage people to revisit the intervention.[3,4,33-35]

Not only are motivation and personal feedback important, but the way in which the information is presented was also identified as an important factor for extending a visit and revisiting an Internet intervention. The navigation structure of the intervention must appear attractive and easy to use, as has been stressed before by Danaher et al.[22] Also, the intervention itself must look attractive at the very first encounter (within 50 ms since an opinion about visual attractiveness is formed that quickly).[23] Furthermore, the information obtained needs to be experienced as enjoyable and rewarding, but visitors must also find it usable and easy to understand.[36]

An important factor to encourage people to revisit an Internet intervention that is designed for multiple visits is the provision of new content on a regular basis as there may be no need to return if the website does not change over time.[4] To make a revisit attractive, different aspects can be added to make the intervention less static, such as providing iterative tailored feedback

or indicating what can be expected in a next visit. Another way to attract people to revisit the intervention is by reminding them, for example through e-mail.

The communication channels most often indicated as potentially effective dissemination strategies were the more traditional channels such as word-of-mouth by family and friends,[12] a publicity campaign with simultaneous use of various mass media, and recommendation by health professionals. Also, 'old fashion' promotion strategies such as a publicity campaign, TV and radio commercials and programs, and articles in newspapers were seen as effective. The more novel channels, such as SMS, instant messaging, and banners on other websites, were hardly selected as important channels for dissemination.

Limitations

There are some limitations to the study that need to be mentioned. We tried to incorporate experts from several disciplines as well as technical and marketing backgrounds. However, experts from technical and marketing backgrounds were underrepresented and responded less in the second and third round. Thus, the factors that were identified are more strongly based on the expert opinion of health educators and health promoters, and important factors from the technical and marketing field may have been missed. However, consensus was reached for most of the factors, which indicates that there were hardly any differences in the responses of experts from the various fields. Response rates in the various rounds ranged between 40% and 67%. Even though these response rates seem quite low, they are comparable to those found in other Delphi studies.[26] The low response rates may be due to the time investment that was required from the experts. They were asked to complete two or three questionnaires within 3 months. The low response rates may have resulted in the inclusion of a select group of experts, which may have introduced bias. We expect, however, that potential bias due to this selected sample is limited since the experts who participated provided a large variety of potentially important factors and saturation seemed to have been reached. Nevertheless, we cannot completely rule out the possibility that potentially important factors may have been missed. Most non-respondents did not give a reason for not responding, but those who did mostly reported lack of time.

The Diffusion of Innovations Theory[18] and, within that, the Theory of Planned Behaviour[25] that we used as a framework may not have been a complete fit for the present study and may have prevented us from looking at other potentially important factors. Another limitation may be that we tried to get information about various aspects of the process of visiting and revisiting an intervention. This breadth of topics may have been at the expense of the depth of information. The fact that mainly general factors were identified, such as 'motivation' or 'a rewarding experience', and not factors that constitute motivation or a rewarding experience, may be an indication of this. However, the aim of the present study was to gain a broad insight.

The results of the present study provide information about important factors for a first visit, extended visit, and a revisit that apply to most Internet-delivered behaviour change interventions but that are not really intervention specific. Furthermore, not all factors identified in the present study may be equally applicable to all Internet interventions aimed at the primary prevention of chronic diseases. That is because there is huge variety in the type of Internet intervention (low-intensity interventions without follow-up to very intensive interventions with up to 1 year follow-up), behaviour targeted in the intervention, behaviour change strategies applied, and so on. Therefore, for each intervention, the most applicable factors have to be chosen.

Conclusion

In this systematic exploration of potentially important factors determining whether adults visit an Internet-delivered behaviour change intervention for the first time, extend a visit, and revisit the intervention, a number of factors were identified that can be taken into account when developing new Internet interventions. Further determinant research is needed to confirm the findings of this study and to identify important exposure-related factors from the perspective of the potential users.

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Appendix

Results of the Delphi study per item (second and third round)

Questionnaire item[a]	Second round			Third round		
	N	Mdn[b,c]	IQD[c]	N	Mdn[b,c]	IQD[c]
I. How important do you think each of the following factors are in determining whether a person will make a first visit to an Internet delivered behaviour change intervention?						
A. Whether the potential visitor						
1. *has sufficient skills to use the Internet*	*89*	*6*	*1.5*	*59*	*6*	*1*
2. *has experience with using the Internet*	*88*	*6*	*1*	--	--	--
3. has access to the Internet at a private location (e.g., home work)	89	5	1	--	--	--
4. has positive expectations of behaviour change interventions delivered through the Internet	89	5	2	57	5	2
5. *is motivated to visit a behaviour change intervention provided through the Internet*	*88*	*6*	*1*	--	--	--
6. wants to improve his/her behaviour in relation to the topic of the Internet intervention	88	5	2	58	5	1
7. is curious about what the Internet intervention has to offer	84	5	1	--	--	--
8. is willing to spend time on visiting an Internet intervention	84	5	1	--	--	--
9. has a positive attitude regarding the use of behaviour change interventions delivered through the Internet	83	4	1	--	--	--
10. receives an incentive for visiting the Internet intervention	84	3	3	57	3	1
11. is referred to the Internet intervention by a health professional (e.g., GP, physical therapist, dietician)	83	5	2	56	5	1
12. gets a positive recommendation about the Internet intervention by word of mouth (e.g., friends, family)	84	5	1	--	--	--
13. receives a reminder to visit the Internet intervention	85	5	2	57	5	1
14. *perceives the Internet intervention as relevant for him/herself*	*84*	*6*	*1*	--	--	--
15. knows that the Internet intervention is effective	85	5	2	57	5	1
16. perceives the source (the organization that provides the intervention) of the Internet intervention as credible	85	5	1	--	--	--
17. perceives the source (the organization that provides the intervention) of the Internet intervention as reliable	85	5	2	57	5	1
B. Whether the Internet intervention						
1. has an easy to remember domain name (URL)	83	5	3	56	5	1
2. has a high search engine ranking (e.g., Google, Yahoo!, AltaVista)	83	5	3	55	5	1
3. can be used with all types of Internet connections like dial-up DSL cable and fibreglass	83	5	3	56	5	1

Questionnaire item[a]		Second round			Third round		
		N	Mdn[b,c]	IQD[c]	N	Mdn[b,c]	IQD[c]
4.	*can be used instantly without downloading special software by the potential visitor*	*83*	*6*	*2*	*56*	*6*	*0*
5.	has an attractive interface at first sight	83	5	1	--	--	--
6.	*has a navigation structure that appears to be easy to use at first sight*	*83*	*6*	*2*	*56*	*6*	*0*
7.	is created by experts in health behaviour change	82	4	3	56	4	1
8.	is endorsed by health professionals	82	5	1.5	56	5	0
9.	is based on scientific knowledge	83	5	2	56	5	1
II. How important do you think each of the following factors are in determining whether a person will stay on an Internet delivered behaviour change intervention long enough to actively engage in and process the educational content provided in the intervention?							
A. Whether the visitor							
1.	can associate him/herself with the look and feel of the Internet intervention	80	5	2	56	5	1
2.	*knows in advance how long it will take to go through the whole intervention*	*80*	*6*	*2*	*56*	*6*	*1*
3.	has to provide sensitive information to register (e.g., home address)	78	5	2	54	5	2
4.	*wants to improve his/her behaviour in relation to the topic of the Internet intervention*	*80*	*6*	*1*	--	--	--
5.	*perceives the topic and content of the entire Internet intervention as being personally relevant*	*79*	*6*	*2*	*56*	*6*	*0*
6.	*experiences the use of the Internet intervention as rewarding*	*80*	*6*	*1*	--	--	--
7.	experiences the use of the Internet intervention as challenging	80	4	2	56	4	1
8.	experiences the use of the Internet intervention as enjoyable	80	5	1.75	56	5	0
9.	*likes receiving (tailored) feedback on the answers he/she provided on questions*	*80*	*6*	*2*	*56*	*6*	*1*
B. Whether the source of the Internet intervention (the organization that provides the intervention)							
1.	is identifiable as credible by the visitor (e.g., through a logo link to the website of the source or a disclaimer etc.)	80	5	2	56	5	1
2.	is identifiable as reliable by the visitor (e.g., through a logo link to website of the source or a disclaimer etc.)	78	5	2	56	5	0
C. Whether the Internet intervention							
1.	provides the option of a trial before starting for real	78	4	3	56	4	2
2.	uses visual materials (e.g., graphs videos pictures)	79	5	2	56	5	0
3.	provides interactive features (e.g., tests forums games etc.)	79	5	1	--	--	--
4.	*displays personal progress through the program (e.g., progress bar page numbers)*	*78*	*6*	*1*	--	--	--

Questionnaire item[a]	Second round			Third round		
	N	Mdn[b,c]	IQD[c]	N	Mdn[b,c]	IQD[c]
5. *provides the opportunity for a visitor to stop at any moment and to proceed at a later time*	*79*	*6*	*1*	--	--	--
6. uses a virtual guide to guide a visitor through the Internet intervention	79	4	3	56	4	1
7. is attractive for the visitor to use	79	5	1	--	--	--
8. has a brief registration procedure (e.g., the registration of login name and password)	79	5	3	56	5	1
9. *has an aim that is clear to the visitor*	*79*	*6*	*1*	--	--	--
10. provides testimonials of successes of previous visitors	79	5	3	56	5	1
11. *provides information that appears reliable to the visitor*	*78*	*6*	*1*	--	--	--
12. *provides information that is easy to understand for the visitor*	*79*	*6*	*1*	--	--	--
13. *provides information that is perceived to be useful for the visitor to help him/her in changing behaviour*	*77*	*6*	*2*	*56*	*6*	*0*
14. *has a tone of voice that is appealing to the visitor*	*78*	*6*	*1*	--	--	--
15. *has an easy to follow navigation structure*	*78*	*6*	*2*	*56*	*6*	*0*
16. provides brief textual information (i.e., does not involve a lot of reading)	78	5	1	--	--	--
17. uses a short questionnaire for providing tailored feedback	77	5	2	56	5	1
18. does not take much time to complete entirely	77	5	1.5	56	5	1
19. *provides tailored feedback*	*77*	*6*	*1*	--	--	--
20. *provides tailored feedback which is perceived as relevant to the visitor*	*77*	*6*	*1*	--	--	--
21. provides tailored feedback in sequence of brief questionnaires and brief feedback sections	76	5	2	56	5	1
22. *provides behaviour change information that seems achievable to the visitor*	*77*	*6*	*2*	*56*	*6*	*0*
23. *can be used free of charge*	*77*	*6*	*2*	*55*	*6*	*0*
III. How important do you think each of the following factors are in determining whether a person will revisit an Internet delivered behaviour change intervention?						
A. Whether the visitor						
1. *receives a reminder to revisit the Internet intervention*	*76*	*6*	*1*	--	--	--
2. *is committed to revisiting the Internet intervention*	*76*	*6*	*1*	--	--	--
3. *wants to improve his/her behaviour in relation to the topic of the Internet intervention*	*76*	*6*	*1*	--	--	--
4. *has a positive experience with the previous visit to the Internet intervention*	*76*	*6*	*1*	--	--	--
5. has a chance to receive an incentive by revisiting the Internet intervention	76	5	2	56	5	1

Questionnaire item[a]	Second round			Third round		
	N	Mdn[b,c]	IQD[c]	N	Mdn[b,c]	IQD[c]
B. Whether the Internet intervention						
1. *provides new content on a regular basis*	*76*	*6*	*1*	--	--	--
2. *provides the possibility for a visitor to monitor his/her progress in changing a behaviour*	*76*	*6*	*1*	--	--	--
3. includes the option for the visitor to communicate with others (e.g., chat rooms, blogs, forums)	76	5	1	--	--	--
4. makes clear what the visitor can expect during a revisit (e.g., by a preview)	75	5	2	56	5	0
5. provides the possibility to post questions for professionals (e.g., GP, physical therapist, dietician)	76	5	2	56	5	1
6. uses a modular approach in which a new visit provides access to the next module	76	4.5	2.75	55	5	1
7. *has previously been experienced as easy to use by the visitor*	*76*	*6*	*1*	--	--	--
8. *has previously been experienced as rewarding by the visitor*	*76*	*6*	*1*	--	--	--
9. has previously been experienced as challenging by the visitor	76	4	2	55	4	1
10. *has previously been experienced as enjoyable by the visitor*	*76*	*6*	*1*	--	--	--
IV. How important do you think each of the following strategies are in achieving successful dissemination of Internet interventions?						
1. Provide the Internet intervention in a controlled setting e.g., worksites (for adults) or school curriculum (for adolescents)	74	4	2	56	4	1
2. Instruction of executives (e.g., workshops for employees or nurses) before using it in a controlled setting	74	5	2.25	55	5	1
3. Embed the Internet intervention in the social context (e.g., at a sport club or at work)	73	5	3	56	5	1
4. Give the Internet intervention an appealing name	74	5	1	--	--	--
5. Assure a high search engine ranking of the Internet intervention (in e.g., Google, Yahoo!, AltaVista)	75	5	3	56	5	1
6. Embed the Internet intervention in other (health) programs	74	5	2	56	5	1
7. Co-operate with commercial partners (e.g., supermarkets related products soaps) for promotion of the Internet intervention	74	5	3	55	5	1

[a] All items of the questionnaire are included. Dashes indicate that consensus was obtained on the item in the second round and for that was excluded from the third round questionnaire. Items on which consensus (IQD≤1) was obtained and which had a median score ≥6 are printed in italics

[b] All items ranged from 1 to 7

[c] Mdn=median score; IQD=interquartile deviation

3

What makes people decide to visit and use an Internet-delivered behaviour change intervention? A qualitative study among adults

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Abstract

Purpose The purpose of this study is to explore adults' cognitive deliberations in deciding to visit an Internet intervention, to extend the visit to use and process the intervention's content, and to revisit the intervention.

Methods A qualitative study was conducted consisting of five focus group interviews (N=29; 25-69 years). The interview transcriptions were subjected to systematic content analysis.

Findings The results indicate that being motivated to change a health behaviour and curiosity about the content were important factors in the decision to visit an Internet intervention. To extend a visit, mainly intervention aspects were considered such as visual appeal, the number of questions needed to complete within the program, and the existence of a registration procedure. To induce revisits, regularly updated content and the possibility to monitor behaviour change were important.

Practical implications These findings suggest that activities to promote use of Internet interventions need to be directed at motivating adults to think about potential behaviour change. Furthermore, intervention aspects need to meet various criteria, such as a professional appearance, concise and easy to understand texts and an explanation for the use of a registration procedure.

Originality/value The results of this explorative study can be used as a basis for further studies aimed at improving dissemination and use of Internet-delivered behaviour change interventions.

Introduction

In recent years many behaviour change interventions have become available through the Internet. The Internet is considered an interesting medium for such interventions since it provides the option of delivering sophisticated versions of individualized, computer-tailored interventions at any time and place. There have been encouraging reports about the efficacy of Internet-based interventions for increasing physical activity, dietary behaviour change, and weight loss.[1-3] However, although the Internet holds the promise of reaching large numbers of people,[4,5] the actual reach of behaviour change Internet interventions seems to lag behind these expectations.[6,7] Efficacy trials have indicated that the actual use of and exposure to these Internet interventions are quite low,[5,8] and when they are implemented in real life, these exposure rates may be even lower.[9,10] Previous studies have also shown that it is not only difficult to reach people, but also to keep them on the intervention website. This early disconnection from an Internet intervention seems to be common and is likely to result in insufficient exposure to the intervention content.[2,11-14] Furthermore, it has been reported that Internet interventions encounter problems with attracting revisits[15] which are often necessary for inducing and maintaining behaviour changes.

Improving use and exposure rates of Internet-delivered behaviour change interventions is important, since these are crucial prerequisites for behaviour change and consequent public health effects, as is stressed in the Reach, Efficacy, Adoption, Implementation and Maintenance (RE-AIM) framework.[16] This study aims to contribute to the improvement of use of and exposure to Internet-delivered behaviour change interventions by examining factors that may explain why or when adults do or do not visit and use these interventions in an optimal way. The focus of this study is on gaining insight into these factors from the perspective of potential users.

In the present study our definition of an Internet-delivered behaviour change intervention (from now on termed 'Internet intervention') is an intervention aimed at the primary prevention of chronic diseases by promoting healthful behaviours, such as smoking cessation, healthful nutrition, sufficient physical activity, low to moderate alcohol consumption, safe sex practices, and sun protection behaviours. We distinguished three phases of exposure: (1) the first visit, (2) the extension of the visit, i.e., to continue the visit long enough to actively use and process the intervention content, and (3) the revisit of the intervention. In each of these phases, (potential) visitors have to make decisions whether or not to start or continue with using the intervention.

Hierarchical models (e.g., McGuire[17]) suggest that to enhance intervention effectiveness, interventions should be adapted to individual characteristics. For instance, from McGuire's Persuasion Communication Matrix[17] four elements can be derived that need to be taken into account for successful communication: the content of the message, characteristics of the target

population, the source that delivers the message, and the communication channel. McGuire[17] postulates that each of these components needs to be adapted and the communication may differ at each stage, such as exposure to the message, paying attention to the message, and liking the message. The Diffusion of Innovations Theory[18] is another model that accounts for different phases of innovations adoption, ranging from awareness of the innovation, adoption, use, and continuation of an intervention. Additionally, however, the Diffusion of Innovations Theory[18] also suggests that different communication strategies may be needed for different program adopters. In other words, in accordance with both the Persuasion Communication Matrix[17] and the Diffusion of Innovations Theory,[18] characteristics of the user, the innovation (in this case the Internet intervention), and the source (the developer or disseminating agency) may influence decision-making regarding use and continuous use of an intervention. Characteristics of the potential user may include personal characteristics (such as gender, age), and individual cognitions such as attitudes, perceived behavioural control and intention to use an intervention,[19] as well as the motivation and ability to elaborate a message (see for instance the Elaboration Likelihood Model [ELM][20]). Characteristics of the source may include their perceived credibility and reliability.[17] Possible characteristics of the Internet intervention may include the complexity of the intervention, its trialability, and the relative advantage of the intervention.[18]

To date there is little empirical insight into the personal considerations of potential users and which factors they consider to decide about visiting, extending a visit and revisiting an Internet intervention. A previously conducted study among experts suggested that, in particular, factors related to the person, such as motivation and perceiving the intervention as personally relevant, might be important factors in deciding to visit an Internet intervention.[21] With regard to extending a visit, not only attraction at first sight,[22] but also design features, navigation structure, interactivity and content have been suggested as important aspects in the literature.[21,23,24] Furthermore, a static website that does not change over time has been identified as being one of the reasons for not returning to a website,[21,25] along with a lack of interactivity and little maintenance.[23] These findings provide some initial evidence that different attributes may play a role for various stages of innovation use and highlight the need for further insight into factors that might improve exposure to and use of Internet interventions.

The specific aims of our study were to explore factors that play a role in adults' decisions about:
- paying a first visit to an Internet intervention;
- extending their stay on the intervention long enough to be able to actively process the educational content; and
- revisiting an Internet intervention.

Dissemination strategies that might by effective to attract adults to Internet interventions, according to potential visitors, were also explored.

Methods

Design

A qualitative study was carried out using focus group interviews. A total of five interviews were conducted with five to six adult respondents (N=29) per focus group (Table 3.1). Two interviews were held with people with a relatively low education level (lower vocational education or less), two with people with a relatively high education level (medium level professional training or higher), and one mixed group.

Table 3.1 Focus group participant demographics (N=29)

Demographic variable	Number of participants
Female	18
Participants age	
Mean [range]	46 [25 – 69]
Education	
Low	9
Average	11
High	9
Occupation	
Employed	15
Unemployed	4
Homemaker/housewife	6
Retired	4
Currently smoking	8
BMI>25	16

Participants and recruitment

A mixed method approach was used for the recruitment of participants. Participants were eligible for this study if they were 25 years or older and had some experience of using the Internet. The study was announced through e-mails and leaflets with information about the study and a question to participate in a focus group interview. Leaflets were distributed through a public library with a special health information point in Rotterdam (N=100), and by handing out to parents of children at a primary school in the north of the Netherlands (N=90). E-mails (N=200) were sent to family members and friends of employees of Erasmus University Medical Centre (Department of Public Health). People could express their interest in participating by telephone, answering the e-mail or returning the reply slip of the leaflet. As the responders showed skewed distribution as they were more often female, moderate to highly educated, and employed, an agency specialized in recruiting people for qualitative studies was contacted.

From a pool of 750 persons who had indicated willingness to participate in a qualitative study, a selection was made in order to reach a broader and more representative sample.

A total 29 people participated in this study (Table 3.1), their ages ranging from 25 to 69, with a mean of 46. Eighteen of the participants were female and about half were employed. Nearly a quarter (N=8) reported to be smokers, and 16 were overweight (body mass index [BMI]>25; based on self-reported weight and height).

Procedure of the focus groups

People who had expressed their interest in participating received either an e-mail or a letter to confirm their participation and explain the procedure of the focus groups. The focus group interviews were held at Erasmus University Medical Centre and at a primary school in the north of the Netherlands, and lasted about two hours. Before the start of the interviews, participants were asked to complete a short questionnaire on demographic and personal characteristics such as age, gender, level of education, occupation, smoking status, height and weight.

One of the researchers (author WB) moderated the interviews and was supported by an assistant. At the start of each interview, the topic and goal of the group interview was introduced and the procedure explained. It was emphasized that there were no right or wrong answers, and that everyone's opinion was to be respected. Each focus group was recorded with a voice recorder and fully transcribed later. At the end of the discussion, participants received a gift-voucher (15 to 35 Euro) and were financially reimbursed for their travel expenses.

The interview guide

The focus group interviews were conducted according to a structured interview guide using the 'funnel approach',[26] beginning with broad questions and moving to more focused questions as the discussion continued (Table 3.2). The interview guide was developed on the basis of the findings of a Delphi study conducted among international experts.[21] The Diffusion of Innovations Theory,[18] Persuasion Communication Matrix,[17] and the Theory of Planned Behaviour[19] were used as the theoretical framework for the interview guide. The interview guide was composed in such a way that general topics were introduced by a direct question and then the group focused in on discussion of underlying motives for using or not using an Internet intervention such as attitudes, beliefs, social influences, motivation and perceived barriers.

Analysis

All statements from the interview transcripts were coded, analyzed for their content, and grouped into pre-determined categories that were relevant for answering the research questions. Statements were organized as referring to a characteristic of the user, the source or the intervention, and related to a first visit, extended visit, or revisit. Patterns arising from this

Table 3.2 Topics covered to lead focus group interviews

Topics	Discussion points
1. General opinions of visiting Internet	- What are important reasons to visit the Internet? - Do you look what the source of the website is?
2. General opinions of Internet interventions	- Are you familiar with Internet interventions and can you name examples of it?
3. First visit to an Internet intervention	- What would determine or what would your personal considerations be that make you decide to visit an Internet intervention for the first time? Probes: - personal characteristics: people's attitude, perceived behaviour control, social environment - source characteristics: reliability, credibility - intervention characteristics: name, topic
4. Extending a visit on an Internet intervention	- What determines or what are your personal considerations to stay on an intervention website for a continued period of time, in order to read the information or complete tests? Probes: - personal characteristics: people's attitude, perceived behaviour control, social environment - source characteristics: reliability, credibility - intervention characteristics: topic, information, lay-out, registration, language, length
5. Revisiting an Internet intervention	- What determines or what are your personal considerations to revisit an Internet intervention? Probes: - personal characteristics: people's attitude, perceived behaviour control, social environment - source characteristics: reliability, credibility - intervention characteristics: renewal, registration, monitoring behaviour change
6. Dissemination	- What are, according to your opinion, ways that we can get people to visit an Internet intervention? Probes: - ways of publication - the content of publication

organization in categories were retrieved and interpreted. Furthermore, in doing the analyses special attention was given to identifying differences in patterns of important factors according to education level. One researcher (author WB) conducted the coding and organized the statements and this was checked by another researcher (author AO). Disagreements were resolved by discussion between these two researchers. Nvivo software (version 7) was used for analyzing the data.

Results

Use of the Internet in general

All participants regularly (daily or every other day) used the Internet for e-mailing, searching for information, downloading music and surfing. Those with a higher educational level indicated to use the Internet more as a news source, whereas those with a lower level were more involved in Internet auction sites (e.g., eBay) and instant messaging (e.g., Windows Live Messenger). Only a few participants had heard of Internet interventions related to healthful behaviour. One lower educated participant mentioned that she had visited an intervention related to quitting smoking.

First visit to an Internet intervention

With respect to a first visit, in all focus groups a discussion arose around the importance of being motivated, being curious about the intervention and its content, and feeling a need for change as important drivers in deciding whether to visit an Internet intervention for the first time. Most participants shared the opinion that being made curious about the existence of an Internet intervention and its topic, and having prior knowledge about what to expect on the website would be important in making a decision to visit an Internet intervention. Nearly all participants agreed that not being interested in the topic, or not being aware of a health or health behaviour problem would prevent them from going to an Internet intervention. "*I think you need to be interested before it sticks in your mind. If [the Internet intervention] is offered at a time when you don't want to know that you live unhealthily, you simple don't go [online]*." It appeared that participants, who said that they were already health conscious, were more interested in visiting an intervention; they wanted a confirmation on their healthful lifestyle. More highly educated participants in particular indicated that they knew how to live healthfully, and that they considered Internet interventions as more relevant for others, but not for themselves. "*I know how to live healthily so there is no need for me to visit such a website, but there are many people on the street for which such a website might be useful, but they won't be interested*."

Positive word-of-mouth recommendation from family or friends was also thought to increase the likelihood that someone would visit an intervention. "*Oral publicity is always good, it will make you curious*." Other than that, nearly all participants reported that the influence of their social network was very limited.

Although most of the participants had reported in a previous phase of the discussion that the source of other websites was unimportant, the more highly educated participants indicated that, in case of an Internet intervention, it would be essential to mention its source, which

ought to be reliable and independent. "*A health insurance company isn't independent. They will earn money if you have fewer complaints*."

Staying on an Internet intervention

Individual considerations such as curiosity, interest in the topic and appeal of the intervention program, were considered important by all groups for deciding whether or not to stay on the website. Most participants agreed that the first two minutes need to be interesting enough to make it worth carrying on with the program. The more highly educated participants in particular indicated that a website should arouse curiosity at first sight. The Internet intervention also needed to bring the users something new. "*If you start with two portions of vegetables and two portions of fruit, then we'll all pull out, because we already know that*." For deciding to prolong their visit, participants said they would consider whether the content was appealing and interesting enough to carry on.

After the initial few minutes, factors related to the intervention itself were seen as more important factors in their decision to prolong their time on the intervention website. These intervention factors included the length of the program and of assessment questionnaires, the existence of a registration procedure, the design and navigation structure of the website, the language used, and the loading time of the webpage. It was felt that neither the whole program nor the questionnaire used to generate tailored feedback should take too long to complete (10-15 minutes). As suggested in two separate discussions, participants said they would prefer to start with completing a short general questionnaire, on the basis of which they could choose to fill out a longer questionnaire to receive more detailed tailored feedback. The participants thought that in this way most people would make a more conscious decision to proceed and finish the program.

Having to register before accessing the website was mentioned as a barrier for continuing the visit in all groups, even though some persons did not see this as a problem. "*I'm worried about usernames and passwords. My protection is fine, but I simply do not like them. I shall never start with something if I have to register*." "*If I can change my lifestyle by logging on, registering won't stop me*." A clear explanation of the necessity of registration, the intervention options available after registration and what the registration details provided would be used for might make registration less of a barrier to some of them.

The appearance of the website, such as an orderly and professional design with a clear navigation structure, logical keywords, the use of concise texts on which you can click for more information, readable character size, and the use of colour, pictures or drawings were mentioned as factors that make a website more attractive and therefore more enjoyable to stay on. Participants also indicated that the text needed to be easily readable at an average level, and

that the language should not be pedantic, childish or popular. The use of difficult or specialized words should be avoided at all times. "*The language of science needs to be translated into the language of ordinary people*." For nearly all participants, slow loading of a website would be an important reason to stop immediately, as they found this extremely irritating.

Finally, several features such as the availability of healthy recipes, the provision of previous users' experiences or success stories, and a forum to exchange experiences and to motivate and support each other, were considered as factors that would make an Internet intervention more interesting to stay on.

Revisiting an Internet intervention

Whether participants would revisit an Internet intervention would depend on the experience of the previous visit and also the achievability of the given advice. "*If your visit gave you the information you actually wanted, then you'd be more inclined to return, otherwise there'd be no need*." Other individual considerations mentioned were motivation and being reminded to revisit the intervention. Some of the less educated participants might be motivated to revisit an intervention when they would receive information on how to maintain a new behaviour change for a longer period. "*[The intervention] needs to provide information on how to maintain it. If I want to lose weight, the first two weeks are OK, but in the third week it'll go wrong*." A reminder by e-mail could encourage some – but certainly not all – to revisit an intervention. To keep visitors engaged in the program, participants recommended that a reminder should be combined with a regular newsletter. It was important to most of the participants that they were free to decide whether they wanted to receive a reminder or newsletter. "*It depends how often you'd receive a reminder, if it were only once I would revisit the website, but I wouldn't want to receive one every week or month. That would be annoying*."

With regard to the intervention itself, participants agreed that it was essential for the website to be up-to-date and to provide new information on a regular basis. Some participants thought it would also be good and stimulating to see – for example by means of a small follow-up questionnaire – whether they had made progress in their behaviour change. Other features that could encourage a revisit were the possibility to ask questions to an expert, to keep a diary to monitor behaviour change, the provision of a list with frequently asked questions (FAQ), the provision of tasteful and healthy recipes, or the provision of a forum to exchange experiences and to motivate and support each other.

Dissemination of an Internet intervention

The participants agreed that the promotion of an Internet intervention should be attractive and should not be pedantic. "[*The promotion*] *needs to be appealing, catchy and to attract your attention; it needs to catch your eye*." Various promotion strategies came to the fore in

all the focus groups, such as advertisements in free and local newspapers, editorial articles in newspapers and magazines for specific target groups, commercials on TV and radio, and banners on various websites. But also the distribution of flyers by general practitioners, through libraries or to their homes were mentioned (the latter being suggested especially by less educated participants). Also a mailing by health insurance companies (mainly suggested by less educated participants) and newsletters by e-mail from newspapers (mainly suggested by higher educated participants) might be good ways to promote an intervention. No single strategy was favoured by all participants, who agreed that a combination of different strategies would be most useful to attract as many people as possible to visit an intervention. Finally, the participants suggested giving the website a short name which would be easy to remember. "*To be memorable, the name needs to be ear-catchy*."

Discussion

The present study was conducted to gain further and deeper insight into factors that may determine whether people decide to visit and use an Internet intervention. The results of this focus group study suggest that motivation to change a health behaviour, curiosity about the intervention and its content were important factors in the decision of adults whether to visit an Internet intervention. Interest in the topic, and various aspects of the intervention itself such as visual appeal, the structure of the website, the length of the program, and the existence of a registration procedure were all mentioned as factors of importance in the decision to continue the visit. The experience of the previous visit, the inclination to change behaviour, being able to monitor progress in behaviour change, new content and provision of attractive features such as recipes came out as factors of relevance for the decision to revisit an intervention.

The findings of this study are mainly in line with those of other studies, but also add new information. McGuire's Persuasion Communication Matrix[17] indicates that there are four communication elements that need to be taken into account, the source, the content, the receiver and the channel. This study showed that in each of the phases of exposure one or more elements were more important than the other, as for the first phase (i.e., first visit) the target group and source were more predominantly important. The present study confirmed the findings of a previous study among experts in which determinants of use of and exposure to Internet intervention were assessed.[21] In this expert study, motivation for changing a behaviour and motivation to use an Internet intervention as a means to accomplish that were identified as important factors for a first visit to an intervention. In the current study the participants were quite clear in their statements that they would only consider visiting an Internet intervention when they were curious about what the intervention would be about, thought the intervention would be relevant to them and when they felt they needed to change. Awareness of a 'need to change' as an important step in the health behaviour change process has been found in many

studies.[27-29] In terms of promoting a first visit to an intervention, this would mean that adults have to be motivated, even before they visit an intervention. Persuasive communication, based on the ELM,[20] can be used to establish attention on an Internet intervention, to indicate the personal relevance for each potential visitor, and to indicate what a visitor will gain by visiting the intervention website. Furthermore, many computer-tailored interventions are designed to increase awareness of risk behaviours and creating a need of change. However, the findings of this and previous studies[27-30] indicate that awareness of risk behaviours, personal relevance, curiosity and thinking about change have to be created, i.e., already in any prior promotion material and strategy.

Most of the more highly educated participants indicated, with regard to a first visit, that the source ought to be reliable and independent, although less educated participants did not care too much about this. This may indicate that a credible and reliable source matters, even though it may not be the most important factor. In the previous expert study, credibility and reliability were not identified as very important factors.[21] In a study by Eysenbach et al.,[31] people in focus groups indicated that the source would be important, but during observations of searching for health information, none of the participants actually looked for the origin of the information. Users indicated that they relied only on the name of the website for credibility and reliability. The findings in our study indicate that people will be more likely to stay on a website when it has a 'professional' appearance, expressed in a professional design and clear navigation structure. This may suggest that more indirect cues are used for determining reliability and credibility of an intervention website.

It has been mentioned in previous studies that an early exit from a website is a serious concern for Internet interventions.[11-14,32] Exposure, or paying attention to the intervention content as well as active use and elaboration of the interventions components, is necessary because attention is a prerequisite to establish desired behaviour change.[17] The motivation of the visitor to change behaviour and interest in the topic of the intervention were stated as important factors, but on the whole it were the characteristics of the Internet intervention itself that were named as important contributors in deciding to prolong a visit. In the Persuasion Communication Matrix,[17] this can be seen as the content and channel. In accordance with studies from Ferney et al.[24] and Danahar et al.,[12] the participants indicated that a quick loading time, a professional appearance of the website, a clear navigation structure and concise texts were important in deciding to prolong a visit. It is recommended to pre-test each of these aspects under potential users before an Internet intervention is implemented, as a disorganized navigation structure and technical language may hinder users to carry on with their visit.[23] Furthermore, the existence of a registration procedure was indicated by many participants as one of the most important reasons to pull out of the intervention program, even though not all participants saw a registration procedure as a barrier. Previous literature shows mixed findings regarding

this aspect. One study[33] stated the registration procedure as a barrier, specifically when there were concerns about the trustworthiness of a website, while another study[34] found that sites that require registration before obtaining all the available information were seen as being of higher quality. Results of our study may indicate that a registration procedure does not need to be a barrier, as long as a clear explanation is given about why this procedure is necessary, what will be done with the registration details and what program components will be accessible after registering. Another important aspect mentioned was that the whole program and in particular assessment questionnaires should not take too much time to complete. Computer-tailored interventions by definition include a validated questionnaire to assess behaviour and its determinants in order to enable feedback and advice tailored to such personal characteristics.[35] Even though assessments in computer-tailored interventions should in general be brief to reduce user burden, longer questionnaires provide the opportunity to provide more refined and detailed tailored feedback, which may increase intervention efficacy. However, for Internet interventions it seems important to make a trade-off between the use of longer and shorter questionnaires. With longer questionnaires it is possible to give feedback in more detail, but the attrition rate might be higher. Whereas the attrition rate with the use of shorter questionnaires might be lower, but the feedback will also be less detailed. To make evidence based decisions about which questionnaire to use, good insight into efficacy and use of Internet interventions using shorter and longer questionnaires is needed.

To revisit an Internet intervention, the previous visit should have been worthwhile and there should be a continued inclination to change the targeted behaviour. These findings are consistent with our earlier expert study.[21] Furthermore, reminders by e-mail may be suitable for some particular subgroups, as some were in favour while others did not like the idea. We also found that the possibility of monitoring behaviour progress by means of a small follow-up questionnaire and the provision of information about how to maintain a new behaviour for a longer period, might stimulate previous users to revisit an Internet intervention.[9,24] To change the fact that repeated website use is rapidly declining over time,[6,32] further research is needed to determine if one or more of these factors can contribute to that change.

Limitations

Our study was conducted among a small and convenience sample of the general population. Even though this is a common procedure in conducting qualitative studies, the findings have to be interpreted in that context. This qualitative study provided insight into potentially important factors and can deepen or confirm the findings of previous studies. To assess the importance of the concepts identified, quantitative studies among representative samples of men and women with different educational and socio-economic backgrounds would be needed.[36]

The participants in this study were all regular Internet users, but none, except one, had ever used or knew about an Internet-delivered behaviour change intervention. It should be noted that the discussion about the Internet interventions were therefore hypothetical and that the findings therefore only apply to people who have never used and Internet intervention. This is, however, a very important group to target when aiming to promote the use of and exposure to Internet intervention.

An extensive range of topics was talked over in the focus group interviews, which might have been at the expense of the depth in which the various topics were discussed. This may be reflected by the fact that, even though we aimed to specifically gain insight into cognitive factors such as attitudes, subjective norms, perceived behavioural control, intentions and barriers for visiting an Internet intervention, we only gained information about intentions and motivation and not about the underlying constructs.

Conclusion

The findings of this focus group study suggest that, for adults to decide to visit an Internet intervention, promotion activities have to be directed at making them interested in the topic of the intervention and motivating them to think about potential behaviour change. A mix of communication channels should be used to promote the interventions. Keeping interest in the topic and an appropriately designed professionally looking intervention website that does not take too long to complete may induce a prolonged visit. To induce a revisit, there should be a reason to do so, such as the option to monitor progress in the behaviour change process, or the availability of attractive features such as recipes. Furthermore, reminders may be helpful in inducing revisits.

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4

Which intervention characteristics are related to more exposure to Internet-delivered healthy lifestyle promotion interventions? A systematic review

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Abstract

Background The Internet has become a popular medium for the delivery of tailored healthy lifestyle promoting interventions. The actual reach of Internet-delivered interventions seems, however, lower than expected, and attrition from interventions is generally high. Characteristics of an intervention, such as personally tailored feedback and goal setting, are thought to be among the important factors related to of use of and exposure to interventions. However, there is no systematic overview of which characteristics of Internet-delivered interventions may be related to more exposure.

Objective The present study aims to identify (1) which potentially exposure-promoting methods and strategies are used in existing Internet interventions, (2) which objective outcome measures are used to measure exposure to Internet interventions, and (3) which potentially exposure-promoting methods and strategies are associated with better exposure.

Methods A systematic review of the literature was conducted based on the Cochrane guidelines. Papers published between 1995 and 2009 were searched in the PubMed, PsycINFO, and Web of Science databases. In total, 64 studies were included that reported objective exposure measures such as completion of an initial visit, number of logins, and time spent on the website. Information about intervention-related characteristics (i.e., interactive behaviour change strategies, interactive elements for fun, peer or counsellor support, e-mail/phone contact, and regular updates of the website) that could potentially contribute to better exposure and objective exposure outcomes were abstracted from the studies and qualitative systematic descriptive analyses were performed.

Results The results showed that a large variety of behaviour change techniques and other exposure-promoting elements were used in the interventions and that these methods and strategies varied for the various lifestyle behaviours. Feedback, interactive elements, and e-mail/phone contact were used most often. In addition, there was a large variety and a lack of consistency in the exposure measures that were reported. Of all the categories of intervention characteristics that may be associated with better exposure, there were indications that peer and counsellor support result in a longer website visit and that e-mail/phone contact and updates of the website result in more logins.

Conclusions Results of this qualitative systematic review indicate that of all intervention characteristics that could potentially enhance exposure, only peer support, counsellor support, e-mail/phone contact with visitors, and updates of the intervention website were related to better exposure. The diversity of intervention methods used and the inconsistency in the report of exposure measures prevented us from drawing firmer conclusions. More research is needed to identify whether other characteristics of intervention interventions can be associated with better exposure.

Introduction

The Internet has become a primary source for obtaining health information by the public[1-3] making it an interesting medium for providing interventions aimed at promoting healthful behaviours. In the last decade, the number of behaviour change interventions that have become available through the Internet has greatly expanded. An advantage of using the Internet as a channel for delivery is the opportunity for health professionals to provide interactive, individualized interventions to large numbers of people[4-8] that match each visitor's unique characteristics, circumstances, beliefs, motivation to change, and behaviour.[5,9] Furthermore, a large part of the population can potentially be reached since so many people now have Internet access.[10] The Netherlands is one of the countries with the highest Internet penetration rates, together with Australia, the United States, the United Kingdom, and the Scandinavian countries.[10] Further advantages of the Internet are the easy and constant accessibility of interventions; visitors can access the intervention program at any time and location, can work through the program at their own pace, and can be more anonymous than in face-to-face contacts.

The evidence for efficacy of Internet interventions indicates that Internet-delivered interventions can be effective in changing behaviours even though effect sizes are mostly small.[11-15] However, earlier efficacy studies have indicated that the use of and exposure to the content of Internet interventions may often not be optimal.[7,16-18] Furthermore, visitor engagement in Internet interventions has been found to be lower than initially intended,[19] that is, visitors tend to leave the intervention website before completing it.[19-21] This hampers them from being optimally exposed to the intervention content. Many Internet interventions consist of multiple visits, and there is growing evidence that repeated website visits are necessary to achieve sustainable changes.[22-24] Vandelanotte et al.,[13] for example, reported in a review that better outcome measures regarding improvement of physical activity were identified when participants visited the intervention website more than five times. However, other studies reported that only a minority of participants visited an intervention more than once.[4,23]

These findings indicate that large improvements can be made with regard to exposure to Internet-delivered interventions, which may contribute to improved intervention efficacy and improved overall impact of an intervention. According to the Diffusion of Innovations Theory,[25] characteristics of an innovation (e.g., an Internet-delivered intervention) are important in the process of implementation and adoption of an intervention, next to characteristics of users, such as personal characteristics and individual cognitions. In previous, mainly qualitative studies, a number of intervention-related characteristics have been indicated as potential exposure-enhancing factors.[26-31] Interactive behaviour change strategies, such as the provision of individualized computer-tailored feedback and goal setting, may enhance

engagement in the intervention content and completion of the program.[26-28,31] Furthermore, intervention elements that make the intervention more attractive to use, such as quizzes, small movies, and other multimedia features, may enhance an extended stay on the website.[26,28] In addition, social support by peers and professionals may enhance an extended stay on the website and may encourage a revisit to an intervention website.[26-28,31] Furthermore, the possibility to monitor progress toward behaviour change, the provision of regular new content, and periodic prompts and reminders may improve revisits.[26-31] Even though there is some evidence for intervention characteristics that may enhance exposure, there is no systematic overview of which intervention characteristics are associated with more exposure to Internet interventions. With respect to objective exposure measures, various relevant exposure measures have been suggested in previous studies,[4,32] such as accessing the intervention content, number of modules or sessions completed during single or multiple visits, webpage viewing, visit duration, frequency of website visits, and use of specific elements in the intervention (e.g., use of self-monitoring tool or bulletin board). The aim of the present study was to conduct a systematic review of the literature and to provide an overview of which characteristics of an intervention are related to better use of and exposure to an Internet intervention. Three specific research questions guided our systematic review:

1. Which potentially exposure-promoting methods and strategies are used in existing Internet interventions?
2. Which objective outcome measures are used to measure exposure to Internet interventions?
3. Which potentially exposure-promoting methods and strategies are associated with better exposure?

Methods

The review was conducted using a review protocol that was developed based on the Cochrane guidelines for systematic reviews.[33]

Search strategy

A structured electronic database search of PubMed, PsycINFO, and Web of Science was conducted for Internet intervention studies published from January 1, 1995, through February 8, 2009. The following search terms were used: "Internet" or "web" or "online" and "health promotion" or "health education" or "health communication" or "health planning" or "prevention" or "intervention" or "behavio* change" or "behavio* modification". The search was limited to the interventions among adults (18 years and older) and English-language peer-reviewed publications. This search strategy was optimized for all consulted databases.

Inclusion and exclusion criteria

A study was eligible for inclusion if it described an Internet intervention that aimed at the primary prevention of physical chronic diseases among the general public from the age of 18. Relevant behaviours included physical activity, nutrition, weight management, smoking cessation, alcohol consumption, or a combination of these behaviours. Furthermore, the Internet interventions needed to be developed for use among the general public. Next, objective quantitative exposure measures (e.g., number of logins, number of pages visited, completion of the entire intervention or parts of the intervention, time spent on the intervention website, number of visits to the intervention) needed to be reported. Finally, studies evaluating an intervention in a randomized controlled trial (RCT), a quasi-experimental design, or describing use of an intervention only in a single group study could be included.

Review procedure

The selection of studies took place in three phases based on title (author WB), abstract (authors WB and WK), and full publication (WB and WK). Title and abstract screening were done blinded for author, journal, and date of publication. If in doubt about suitability of a study in one phase, the study was included in the next phase. Disagreements on inclusion in the third phase were discussed with a third reviewer (author AO) until consensus was reached.

Data extraction and analysis

Data from the included studies were extracted by a team of reviewers and then verified and tabulated for this review by WB, WK, and AO. Based on a standardized extraction form, descriptive key elements and objective exposure measures of all included studies were summarized and presented in tables (Table 4.1, 4.2 and the Appendix). For this extraction, we relied on the information about the study and intervention provided in the published literature (i.e., the selected publication, publications that evaluated and reported on the same intervention [see Table 4.2 for applicable studies], and references to additional design papers or appendices).

Methods and strategies that have been indicated in previous studies as potential exposure-improving elements were divided into the following categories: (1) interactive behaviour change strategies, which include methods and strategies delivered in an interactive format (e.g., tailored feedback, goal setting tools, action planning tools, or self-monitoring tools), (2) interactive elements, which include elements of the program that are more for fun to improve the attractiveness of the intervention or to provide the option for more information (e.g., quizzes, searchable databases, or audio/video), (3) peer support (e.g., forum, bulletin board, or chat), 4) counsellor support (e.g., ask-the-expert, e-mail/phone contact, or counsellor-led chat sessions), (5) e-mail and/or phone contact, which may include e-mail/phone messages providing intervention content (e.g., personal feedback or newsletters) or e-mail/phone prompts

to remind users to revisit the intervention, (6) update of the information on the intervention website, which include, for example, new tools, information, or news, and (7) intervention incentives, which refer to incentives that are related to using the Internet intervention and not related to taking part in a study.

For consistency and comparability among studies, the taxonomy of Abraham and Michie was used for the description of interactive behaviour change strategies.[34] Within computer-tailored feedback, various types of feedback can be distinguished, such as feedback on performance, cognitive constructs, barrier identification and solutions, and cognitive and behavioural processes. In this study, we considered tailored feedback as one interactive behaviour change strategy. Feedback on progress was included separately as this kind of feedback can only be given during a revisit.

Due to the significant heterogeneity between the studies and the variation in the reported exposure measures, the data could not be pooled for quantitative analysis. Therefore, qualitative systematic, descriptive analyses were performed. This method has been proven to be suitable for systematic reviews.[35]

To gain insight into which intervention characteristics may result in better exposure, the studies were listed in a matrix (Table 4.3), linking the potential exposure-promoting intervention elements with the outcome measures. The objective exposure measures used in the different studies (see Table 4.2) were very diverse and presented in different statistics. Therefore, only those objective exposure measures that are used frequently and presented in the same statistic value are presented in the Table 4.3. A division was made between interventions that offered <3 versus ≥3 interactive behaviour change strategies, and that offered interactive elements (yes vs. no), peer support (yes vs. no), counsellor support (yes vs. no), e-mail/phone contact (yes vs. no), update of the intervention website (yes vs. no), and intervention incentive (yes vs. no). From this matrix, patterns could emerge indicating that the existence of certain intervention characteristics could result in more exposure to the intervention. Criteria for determining that an exposure-promoting element is probably related to an exposure outcome were that at least 50% of the Internet interventions that included the specific exposure-promoting element should be in the highest exposure category and that the number of studies in the highest category differed substantially (at least 35% difference) from the number of interventions without that element in the highest category of exposure. Only when there was a good balance in the number of interventions that did or did not have a specific exposure-promoting element, inferences about a relation between exposure-promoting elements and exposure could be made.

Results

Study selection

The initial cross-database search yielded 7764 unique publications (Figure 4.1). After reviewing titles, abstracts, and full publications, 70 publications describing 64 studies were eligible for inclusion in the review. In total, 192 publications were excluded based on abstract and full publication. The most common reason for exclusion in this phase was that a publication did not describe an Internet intervention aimed at the primary prevention of physical chronic diseases (N=112). Other publications were excluded because they focused on persons below the age of 18 (N=11), were not targeted at the general public as end users (N=3), or did not describe the evaluation of an Internet intervention (N=37). Finally, 29 publications were excluded as they did not include objective exposure outcome measures.

Figure 4.1 Flow chart review procedure

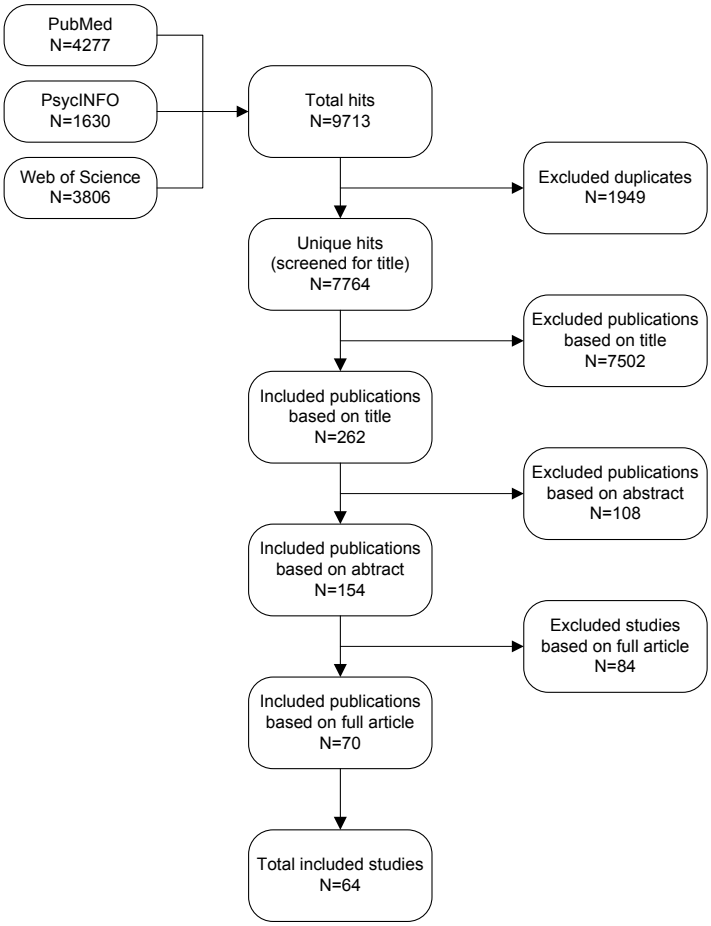

Table 4.1 Potential exposure improving methods and strategies applied in the Internet interventions for the various health related behaviours

	Physical activity (N=12)		**Nutrition** (N=4)		**Weight management** (N=14)		**Smoking cessation** (N=18)		**Alcohol consumption** (N=9)		**Multiple behaviours** (N=7)		**Total** (N=64)	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
IBCs														
Feedback[a]	8	67	1	25	7	50	15	83	9	100	7	100	47	73
Goal setting	7	58	0	0	5	36	0	0	1	11	3	43	16	25
Action/activity planning	8	67	0	0	2	14	12	67	0	0	3	43	25	39
Self-monitoring	8	67	0	0	11	79	6	33	5	56	3	43	33	52
Feedback on progress	7	58	0	0	6	43	2	11	3	33	5	72	23	36
Interactive elements[b]	9	75	4	100	8	57	10	56	8	89	5	72	44	69
Peer support	5	42	1	25	9	64	10	56	5	56	1	14	31	48
Counsellor support	4	33	1	25	10	71	9	50	0	0	0	0	24	38
E-mail/phone contact	9	75	3	75	12	86	14	78	2	22	3	43	43	67
Update	5	42	2	50	8	57	6	33	3	33	2	29	26	41
Intervention incentive	2	17	2	50	6	43	1	6	0	0	0	0	11	17

[a] Feedback includes feedback on performance, cognitive constructs, barrier identification and solutions, and cognitive and behavioural processes

[b] Interactive elements are, for example, quizzes, searchable databases or libraries, heart rate/BMI calculator, and website links

Characteristics of selected studies

Of the 64 included studies, 39 were conducted in the United States, six in Australia, six in the United Kingdom and Ireland, four in the Netherlands, two in Belgium, two in Canada, two in Norway, and one in Switzerland. In all, twelve studies described in fourteen publications (hereafter, the number of publications referenced may exceed the number of studies to which they refer) targeted physical activity,[16,28,36-47] four targeted nutrition (e.g., fruit, vegetable, or saturated fat consumption),[48-53] fourteen targeted weight management (e.g., weight loss/reduction, or weight maintenance/control),[21,54-66] eighteen targeted smoking cessation,[22,31,32,67-82] nine targeted alcohol reduction,[83-92] and seven studies targeted multiple behaviours.[23,93-98] Most studies had an RCT design and fourteen studies were observational one-group studies evaluating use of the Internet intervention. The length of the interventions varied from a one-time visit to 18 months with multiple visits. The majority of the Internet interventions were explicitly informed by one or more behavioural theories. The Social Cognitive Theory,[99] the Transtheoretical Model,[100] or the Stages of Change concept from this model only[100] were used most often. A more detailed description of the study characteristics can be found in the Appendix.

Characteristics of study populations

The Appendix shows that the number of study participants ranged from 32 to 67,324 with an overall mean of 3367 participants and a median of 408. The mean age varied from 32 to 52 years and the percentage of female participants ranging from 2% to 100%. The percentage of participants with education at a level higher than high school (if reported) varied from 41% to 100%.

Exposure improving methods and strategies

Table 4.1 lists the potential exposure-improving methods and strategies used in the interventions. If two or more Internet interventions were described in one publication, the most extended intervention or the intervention that delivered the content mostly through the Internet is taken into account. Table 4.2 provides a more detailed description of the methods and strategies applied in each Internet intervention.

The provision of tailored feedback (e.g., on performance, cognitive constructs, barrier identification and solutions, and cognitive and behavioural processes) was the most often used behaviour change strategy across the behaviours except for nutrition and weight management interventions. Goal setting was offered more often in physical activity interventions, action/activity planning was most often used in the physical activity and smoking cessation interventions and self-monitoring in the physical activity and weight management interventions. Feedback on progress was most often used in the multiple behaviour interventions, followed by physical activity. The majority of the interventions in all behavioural domains,

Table 4.2 Overview of study and Internet characteristics, and objective outcome measures of exposure to Internet interventions presented to behaviour

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
A. Physical activity			
1. Carr (2008),[36] USA	**Target behaviour:** physical activity **Target group:** sedentary overweight non-smoking adults (N=32) with a BMI between 18-40	**IBC:** 1. goal setting; 2. activity planning; 3. self-monitoring; 4. feedback on progress **IE:** virtual partner stories, quizzes, website links **PS:** - **CS:** weekly/bi-weekly e-mail/phone contact with facilitator **EP:** - **UD:** provision of new lessons **II:** -	**Login:** every 11th day login during the intervention **IBC:** avg. 13 of 44 online journal activities (30%)
2. Dunton (2008),[37] USA	**Target behaviour:** physical activity **Target group:** healthy and racially/ethnically-diverse females (N=156) aged 21-65	**IBC:** 1. feedback on performance, cognitive constructs, and barrier identification and solution **IE, PS, CS:** - **EP:** 10 weekly follow-up e-mail newsletters with generic PA promotion information **UD, II:** -	**Login:** 0 times 5%; 1-2 times: 21%; 3-5 times: 37%; 6-10 times: 29%; >10 times: 8% **EP:** avg. 7.44 out of 10 ± 4.1 e-mails opened; 6.65 out of 25 ± 6.33 website links embedded in e-mails were opened (27%)
3. Ferney (2008),[28] Australia	**Target behaviour:** walking and overall physical activity **Target group:** adults (N=106) aged 45-60 who did not meet current PA guidelines	**a. IBC:** 1. goal setting; 2. self-monitoring **IE:** target heart rate calculator, searchable database of local PA opportunities, website links **PS:** bulletin board **CS:** possibility to e-mail counsellor **EP:** weekly/bi-weekly/maintenance e-mails with tailored feedback **UD:** bi-weekly updated news items **II:** -	[d]**Login:** avg. 8.2 logins ± 9.0 **IBC:** 13% used self-monitoring tool; 52% completed at least 1 tailored quiz, avg. 2.2 ± 1.4 quizzes **PS:** 1 participant posted message on bulletin board **CS:** 25% e-mailed counsellor
		b. IBC, IE, PS, CS: - **EP:** e-mail with non-tailored advice **UD, II:** -	[d]**Login:** avg. 2.8 logins ± 2.4

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
4. Herman (2006),[38] USA	**Target behaviour:** physical activity **Target group:** employees of multinational information technology company (N=67,324)	**IBC:** 1. goal setting; 2. self-monitoring; 3. feedback on progress **IE, PS:** - **CS:** ask the expert **EP:** e-mails with educational and motivational content **UD:** - **II:** mementos and cash rebate	**Access program content:** 53%
5. Hurling (2007),[39] UK	**Target behaviour:** total and moderate to vigorous physical activity **Target group:** adults (N=77) aged 30-55 with a BMI of 19-30 who were not vigorously active	**IBC:** 1. feedback on performance, cognitive constructs, and barrier identification and solutions; 2. activity planning; 3. self-monitoring; 4. feedback on progress **IE:** information library **PS:** message board **CS:** - **EP:** e-mail and/or mobile phone prompts (optional), e-mail and/or mobile phone messages with motivational content (optional) **UD, II:** -	[d]**Visit duration:** avg. 7.5 min ± 0.9 [d] **Login**: avg. 2.9 logins ± 0.5 per week resulting in avg. 26.1 logins for 9 weeks **IBC:** use of activity charts (showing the accelerometer feedback data), schedule (weekly exercise planner) by at least 33% **PS:** use of chat-room style message board by at least 33%
6. Hurling (2006),[40] UK	**Target behaviour:** physical activity/ exercise **Target group:** adult employees (N=66) aged 23-54 years	**a. IBC:** 1. feedback on performance, cognitive constructs, and barrier identification and solutions; 2. activity planning; 3. self-monitoring; 4. feedback on progress **IE:** information library **PS:** message board **CS:** - **EP:** e-mail and/or mobile phone prompts (optional), e-mail and/or mobile phone messages with motivational content (optional) **UD, II:** -	[d]**Login:** avg. 1.4 logins per week resulting in avg. 14 logins for 10 weeks [d]**Completion whole intervention:** 75%
		b. IBC: 1. feedback on barrier identification and solution; 2. self-monitoring; 3. feedback on progress **IE, PS, CS, EP, UD, II:** -	[d]**Login:** avg. 1.0 logins per week; avg. 10 logins for 10 weeks [d]**Completion whole intervention:** 43%

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
7. Lewis (2008),[41] Marcus (2007),[42] USA	**Target behaviour:** physical activity and exercise **Target group:** healthy sedentary adults (N=249) aged 18 and older who were ≤ 90 minutes per week physical active	**IBC:** 1. feedback on performance and cognitive constructs; 2. goal setting; 3. self-monitoring; 4. feedback on progress **IE:** website links **PS, CS:** - **EP:** e-mail as prompts **UD:** monthly tailored feedback reports, daily update with tip of the day **II:** -	[d]**Duration visit:** avg. 7.1 min per session; total avg. 356 min in one year **Login:** median 50 logins
		b. IBC: 1. self-monitoring **IE:** website links **PS, CS:** - **EP:** e-mail as prompts **UD, II:** -	[d]**Duration visit:** avg. 6.8 min per session; total avg. 260 min in one year **Login:** median 38 logins
8. Leslie (2005),[16] Australia	**Target behaviour:** physical activity and exercise **Target group:** academic and general staff of medium-sized university (N=655)	**IBC:** 1. feedback on cognitive constructs; 2. goal setting; 3. activity planning **IE:** target heart rate calculator, rotating photo images of PA options **PS, CS:** - **EP:** 4 bi-weekly personalized stage-targeted e-mails **UD:** daily update with tip of the day **II:** -	**Landing website:** 4114 hits **Access program content:** 46% [d]**Duration visit:** avg. 9 min [d]**Pages visited:** avg. 18 pages **IBC:** 66% completed at least on stage-based quiz
9. Plotnikoff (2006),[43] Canada	**Target behaviour:** raise awareness for physical activity **Target group:** general national population (N=3175)	**IBC:** 1. goal setting; 2. activity planning; 3. self-monitoring; 4. feedback on progress **IE, PS, CS, EP, UD, II:** -	[d]**Revisit website:** 15%
10. Spittaels (2006),[44] Belgium	**Target behaviour:** physical activity **Target group:** visitors (N=55) of a university hospital aged 20 to 55	**IBC:** 1. feedback on performance, cognitive constructs, and barrier identification; 2. activity planning **IE:** website links **PS:** forum **CS, EP, UD, II:** -	**Access program content:** 28% (46% distributed with personal contact, 7% without personal contact) [d]**Completion intervention first visit:** 90% (89% distributed with personal contact, 100% without personal contact) **IBC/IE:** 22% of the visitors used one or more supplementary parts

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
11. Spittaels (2007),[45] Belgium	**Target behaviour:** physical activity **Target group:** adults aged 20 to 55 (N=434)	**a. IBC:** 1. feedback on performance and cognitive constructs; 2. activity planning; 3. feedback on progress **IE:** website links **PS:** forum **CS:** - **EP:** 7 non-tailored e-mails as prompts to revisit **UD:** new tailored advice **II:** -	[d]**Revisit website:** 31% to receive second tailored advice
		b. IBC: 1. feedback on performance and cognitive constructs; 2. activity planning **IE:** website links **PS:** forum **CS, EP, UD, II:** -	
12. Steele (2007),[46,47] Australia	**Target behaviour:** moderate intensity and lifestyle physical activity **Target group:** inactive adults (N=192) aged 18 and older being functionally mobile	**a. IBC:** 1. feedback on cognitive constructs; 2. goal setting; 3. activity planning; 4. self-monitoring **IE:** quizzes, multimedia video clips **PS:** - **CS:** access to online support person **EP:** weekly e-mail as prompts **UD:** weekly modules **II:** opportunity to receive incentives	[d]**Login:** avg. 11.8 logins [range 2-90]
		b. IBC: 1. feedback on cognitive constructs; 2. goal setting; 3. activity planning; 4. self-monitoring **IE:** multimedia video clips **PS:** - **CS:** access to online support person **EP:** weekly e-mail as prompts **UD:** weekly modules **II:** -	[d]**Login:** avg. 11.5 logins [range 2-102]

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
B. Nutrition			
13. Buller (2008),[48] Woodall 2007,[49] USA	**Target behaviour:** fruit and vegetable consumption **Target group:** adults (N=755) living in specific area for at least 6 months and being older than 18 years	**IBC:** - **IE:** website links, community directory **PS:** - **CS:** community outreach trainer for questions/problems website **EP:** e-mail as prompts **UD:** new or updated information **II:** every 2 months small gift	**Access intervention content:** 51% [d]**Duration visit:** avg. of 22.2 minutes total time [range 0-322.7] meaning avg. of 6.7 min per login [d]**Login:** avg. of 3.3 logins [range 1-39] **E-mail**: 23% responded to at least one of the e-mails by logging in within 5 days of e-mail was sent; 6 participants responded to all of the messages; those who responded to at least one e-mail, 51% responded to half or more of the messages, while 49% responded to fewer than half.
14. Huang (2006),[50] Australia	**Target behaviour:** purchases with saturated fat **Target group:** adult consumers (N=497) using a commercial online Internet supermarket shopping site	**IBC:** feedback on performance **IE:** point of purchase decision making **PS, CS, EP, UD, II:** -	**Landing website:** total of 11% for both interventions [d]**Completing first visit:** 89% **Login:** median of 3 shopping episodes [range 1-20]
		IBC, IE, PS, CS, EP, UD, II: -	[d]**Completing first visit:** 94%
15. McNeill (2007),[51] USA	**Target behaviour:** fruit and vegetable consumption **Target group:** adults (N=52) residing in low-income multiethnic neighbourhoods	**IBC:** - **IE:** recipes database **PS, CS:** - **EP:** e-mail as prompt, and e-mail with feedback on performance and tips on increasing consumption **UD:** - **II:** raffle for a small incentive	**Access website content:** 75% [d]**Pages visited:** avg. 24.5 pages out of 192 distinct pages [d]**Login:** avg. 3.8 logins **E-mail:** 56% login after first reminder; 27% after second reminder; 56% after final reminder

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
16. Papadaki (2005),[52] Papadaki (2006),[53] Scotland	**Target behaviour:** Consumption of four key components of the Mediterranean diet **Target group:** healthy females university employees (N=72) aged 25 to 55	**IBC:** - **IE:** self-assessment quizzes, recipe section **PS:** bulletin board **CS:** - **EP:** 6 e-mails with feedback letters on performance, cognitive constructs, barrier identification and solution, progress, and progress; weekly e-mails as prompts including tips for relevant sections at the website with respect to goal **UD:** regular updates with tip of the day and new recipes **II:** -	**Landing website:** avg. 150 hits each month [d]**Login**: avg. 15.5 logins
C. Weight management			
17. Cussler (2008),[54] USA	**Target behaviour:** weight maintenance through diet, physical activity and weight gain prevention **Target group:** premenopausal women (N=135) aged 40 to 55 with BMI between 25 and 38, non smokers	**IBC:** 1. self-monitoring; 2. feedback on progress **IE:** communication tools, website links **PS:** self-organized support groups meeting online, bulletin board, chat rooms **CS:** optional counsellor support through e-mail, bulletin board and chat **EP:** e-mail as intervention content **UD:** new added information/articles **II:** several web-based incentive programs	**IBC:** diet log: 90%, avg. 53.4 ± 62.3 [range 0-299]; weekly weight log: 100%, avg. 26.9 ± 19.9 [range 1-69]; physical activity log: 84%, avg. 67.5 ± 76.3 [range 0-294]; 'your week' log: 71%, avg. 9.2 ± 12.2 [range 0-42] **PS:** 81%; avg. 84.3 ± 157.1 [range 0-835]
18. Glasgow (2007),[21] USA	**Target behaviour:** weight loss through nutrition and physical activity **Target group:** health plan members (N=2311) with BMI < 30 for general membership and < 25 for those with chronic disease	**a. IBC:** 1. feedback on performance, cognitive constructs, and barrier identification and solution; 2. goal setting; 3. action planning **IE, PS, CS:** - **EP:** 6 e-mail as prompt to view follow-up action plans and tailored newsletters **UD:** 6 tailored newsletters **II:** -	**Access program content:** 13% accessed initial program content; 6% accessed extended program content

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
		b. IBC: 1. feedback on performance, cognitive constructs, barrier identification and solution; 2. goal setting; 3. action planning **IE, PS, CS:** - **EP:** 3 e-mails as prompt to view follow-up action plans **UD:** 3 tailored newsletters **II:** -	**Access program content:** 62% accessed initial program content; 25% accessed extended program content
		c. IBC: 1. feedback on performance, cognitive constructs, barrier identification and solution; 2. action planning **IE, PS, CS:** - **EP:** 6 e-mails as prompt to view follow-up action plans and tailored newsletters **UD:** 6 tailored newsletters **II:** -	**Access program content:** 19% accessed initial program content; 8% accessed extended program content
		d. IBC: 1. feedback on performance, cognitive constructs, barrier identification and solution; 2. action planning **IE, PS, CS:** - **EP:** 3 e-mails as prompt to view follow-up action plans **UD:** 3 tailored newsletters **II:** -	**Access program content:** 90% accessed initial program content; 49% accessed extended program content

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
19. Gold (2007),[55] USA[c]	**Target behaviour:** weight loss through reducing calorie intake and increase aerobic activity **Target group:** adults (N=124) aged 18 and older with a BMI between 25 and 39.9	**a. IBC:** 1. feedback on performance; 2. goal setting; 3. self-monitoring; 4. feedback on progress **IE:** contests, menu/recipe planner, food and exercise-calorie database, target heart rate, BMI calculator **PS:** bulletin boards, e-mail possibilities with peers **CS:** weekly/bi-weekly therapist-led chat meetings; weekly/bi-weekly e-mails from therapist with feedback on completed assignments **EP:** weekly/biweekly e-mails with intervention content from counsellor **UD:** weekly new lesson; weekly updated story, new flashes and tips; periodically updated motivation page and local events guide **II:** periodically contests with prizes	**Login:** median 193/0-6 [range 120-309]; 90/6-12 months [range 21-154] **IBC:** self-reported weight median 24/0-6 months [range 20-25]; 8/6-12 months [range 2-12] **CS**: attendance online meeting median 21/0-6 months [range 19-23]; 11/6-12 months [range 6-14]
		b. IBC: 1. feedback on cognitive constructs; 2. self-monitoring; 3. feedback on progress **IE:** FAQ with expert responses **PS:** chat-rooms, discussion boards, mentor section to team up with more experienced member **CS:** professional facilitated online meetings **EP, UD, II:** -	**Login:** median 47/0-6 months [range 25-65]; 14/6-12 months [range 8-23] **IBC:** self-reported weight median 16/0-6 months [range 8-22]; 8/6-12 months [range 2-13] **CS:** attendance online meeting median 1/0-6 months [range 0-3]; 0/6-12 months [range 0-0]
20. Harvey-Berino (2002),[56] USA	**Target behaviour:** weight loss maintenance through modification of eating and exercise habits **Target group:** overweight adults (N=122) aged 18 and older with a BMI >25	**IBC:** 1. self-monitoring **IE:** short videos from group therapist **PS:** self-initiated chat room meetings, bulletin board **CS:** counsellor support through bi-weekly chat sessions and e-mails **EP:** bi-weekly e-mails from group therapist **UD:** - **II:** participation in weekly $25-lottery and opportunity to earn points for lottery tickets	**IBC:** submitting online date 19% **CS:** attendance chat sessions 39%

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
21. Hunter (2008),[57] USA	**Target behaviour:** weight gain prevention and weight loss through restricting calorie intake and fat intake and increasing physical activity **Target group:** air force personnel (N=446) aged 18 to 65 with a BMI > 25 for women and > 27.5 for men and remain in local area for 1 year	**IBC:** 1. goal setting; 2. self-monitoring **IE:** quizzes **PS:** - **CS:** Internet counsellor provided weekly feedback on performance and progress **EP:** Internet counsellor made two brief motivational interviewing telephone calls **UD:** weekly lessons **II:** -	[d]**Login:** avg. 49.1 logins [range 1-707]
22. McConnon (2007),[58] UK	**Target behaviour:** Weight loss through dietary and physical activity **Target group:** adults (N=221) aged 18 to 65 with a BMI > 30	**IBC:** 1. feedback on performance; 2. self-monitoring; 3. feedback on progress **IE, PS, CS:** - **EP:** e-mails as prompts **UD, II:** -	[d]**Login:** avg. 15.8 times ± 15.2 [range 1-77]
23. McCoy (2005),[59] Australia	**Target behaviour:** weight loss through changing physical activity and dietary behaviour **Target group:** adults (N=808) of the general population	**IBC:** 1. feedback on cognitive constructs; 2. action planning **IE, PS, CS, EP, UD, II:** -	**Access program content:** 68% **Pages visited:** participants viewed in total 83,111 pages **Login:** participants used the program in total 6058 times with avg. 29 homepage visits per participant **IBC:** participants used in total the wellness record page 1792 times, the exercise planner 2487 times, and the diet planner 1344 times

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
24. Micco (2007),[60] USA[c]	**Target behaviour:** weight loss through changing eating and exercise behaviour **Target group:** Adults (N=123) aged 18 and older with a BMI between 25 and 39.9, non-smoking	**a. IBC:** 1. feedback on performance; 2. goal setting; 3. self-monitoring; 4. feedback on progress **IE:** contests, menu/recipe planner, food and exercise-calorie database, target heart rate, BMI calculator **PS:** bulletin boards, e-mail possibilities with peers **CS:** weekly/bi-weekly therapist-led chat meetings; weekly/bi-weekly e-mails from therapist with feedback on completed assignments **EP:** weekly/biweekly e-mails with intervention content from counsellor **UD:** weekly new lesson; weekly updated story, new flashes and tips; periodically updated motivation page and local events guide **II:** periodically contests with prizes	**Login:** 0-6 months total of 223 hits; 7-12 months total of 99 hits **IE:** use BMI calculator avg. 2.6 times ± 3.0 **CS:** attendance online meetings 0-6 months 76% ± 21%; 7-12 months: 58% ± 33%
		b. IBC: 1. feedback on performance; 2. goal setting; 3. self-monitoring; 4. feedback on progress **IE:** contests, menu/recipe planner, food and exercise-calorie database, target heart rate, BMI calculator **PS:** bulletin boards, e-mail possibilities with peers **CS, EP:** - **UD:** weekly new lesson; weekly updated story, new flashes and tips; periodically updated motivation page and local events guide **II:** periodically contests with prizes	**Login:** 0-6 months total of 206 hits; 7-12 months total of 90 hits **IE:** use BMI calculator avg. 1.0 times ± 1.5 **CS:** attendance online meetings 0-6 months 54% ± 14%; 7-12 months: 55% ± 34%

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
25. Petersen (2008),[61] USA	**Target behaviour:** weight management by creating life long habits **Target group:** Employees of a multinational information technology company (N=7743)	**IBC:** 1. feedback on performance; 2. goal setting; 3. self-monitoring; 4. feedback on progress **IE:** interactive tools, e.g., meal planners, grocery lists, serving size calculator, information library **PS:** message boards **CS:** expert assistance **EP:** weekly e-mail newsletters, e-mails individualized to visitors' goals **UD:** - **II:** 'fictive' points that can be earned in interaction with website features	**Access program content:** 6% **Login:** 0-2 days 42%; 3-11 days 36%; ≥12 days 22%
26. Tate (2001),[62] USA	**Target behaviour:** weight loss through calorie restriction and increased physical activity **Target group:** Overweight hospital employees (N=91) aged 18 to 60 with a BMI of 25 to 36	**a. IBC:** 1. self-monitoring **IE:** website links **PS:** bulletin board **CS:** weekly e-mail from therapist with feedback on progress, recommendations and strategies for improvement, answers on questions and encouragement **EP:** weekly behavioural weight loss lesson, and personal e-mail to motivate to continue for participants not sending log **UD, II:** -	**IBC:** mean submission of 13.65 ± 6.4 self-monitoring diaries **PS:** 28% posted a note on bulletin board [range 1-7] [d]**Login:** avg. 19 logins ± 10.9
		b. IBC: 1. self-monitoring **IE:** website links **PS, CS, EP, UD, II:** -	[d]**Login:** avg. 8.5 logins ± 10.4
27. Tate (2006),[63] USA	**Target behaviour:** weight loss through calorie restriction and increased physical activity **Target group:** overweight adults (N=192) aged 20 to 65 with a BMI of 27 to 40, willing to use meal replacements	**a. IBC:** 1. feedback on performance; 2. self-monitoring; 3. feedback on progress **IE:** - **PS:** e-buddy network system, message board **CS:** - **EP:** 2 weekly e-mails with prompts, behavioural lessons and weight loss tips **UD, II:** -	**Login:** median 20 logins on both public and study website (median 2 logins to public website) **IBC:** avg. 11.4 ± 9.2 online diary submissions

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
		b. IBC: 1. self-monitoring **IE:** - **PS:** e-buddy network system, message board **CS:** counsellor support containing feedback on progress through weekly e-mails **EP:** 2 weekly e-mails with prompts, a behavioural lesson and weight loss tips, weekly e-mail from counsellor with feedback on performance, progress and overcoming barriers, motivation and answers to questions **UD, II:** -	**Login:** median 32.5 logins on both public and study website (median 9 logins to public website) **IBC:** avg. 17.2 ± 8.7 online diary submissions
		c. IBC: 1. self-monitoring; 2. feedback on progress **IE:** - **PS:** e-buddy network system **CS:** - **EP:** weekly e-mails with prompts and weight loss tips **UD, II:** -	**Login:** median 34 logins on both public and study website (median 20 logins to public website)
28. Webber (2008),[64] USA	**Target behaviour:** weight loss through physical activity and dietary habits **Target group:** adult women (N=66) aged 22 to 65 with a BMI of 25 to 40	**a. IBC:** 1. self-monitoring **IE:** website links **PS:** message board **CS:** counsellor support through weekly moderated online chat group sessions **EP:** - **UD:** weekly lessons **II:** -	[d]**Login:** avg. 42.8 logins **IBC:** avg. 7.5 completed weekly self-monitoring diaries **PS:** avg. 2.4 postings on message board **CS:** avg. 8 attended chat sessions
		b. IBC: 1. self-monitoring **IE:** website links **PS:** message board **CS, EP:** - **UD:** weekly lessons **II:** -	[d]**Login:** avg. 39.7 logins **IBC:** avg. 9.1 completed weekly self-monitoring diaries **PS:** avg. 7.2 postings on message board

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
29. Van Wier (2009),[65] Netherlands	**Target behaviour:** weight loss through sustainable lifestyle changes (reduction of calories through fat, sugar and alcohol and increasing physical activity) **Target group:** employees (N=1386) aged 18 years and older with a BMI of 25 or higher	**IBC, IE, PS:** - **CS:** counsellor support through e-mail by commenting on homework assignments and answering of additional questions **EP:** counsellor e-mail with intervention content, e-mail/phone prompt max twice a week by not logging on **UD:** weekly modules **II:** -	**Access program content:** 86% [d]**Completion first visit:** 74% completed at least first module **CS:** median 5 counselled sessions [IQR 1 to 10]
30. Wing (2006),[66] USA	**Target behaviour:** weight gain prevention with emphasis on daily self-weighing and self-regulation **Target group:** adults (N=314) with a loss of at least 10% of their body weight during prior 2 years	**IBC:** 1. self-monitoring **IE:** - **PS:** message board, **CS:** counsellor-led weekly chat sessions (1st month), monthly chat sessions (2-18 months), counsellor support through e-mail depending on weight gain during program **EP:** e-mail with intervention content in case of weight gain during program **UD:** weekly tips **II:** small gifts by maintaining weight	**IBC:** reporting weight 82%/baseline to 6 months, 69%/7-12 months, 55%/13-18 months **CS:** attendance chat room sessions 66%/ baseline to 6 months, 41%/7-12 months, 34%/13-18 months
D. Smoking cessation			
31. Balmford (2008),[67] Australia	**Target behaviour:** smoking cessation **Target group:** general smoking population (N=23,656)	**IBC:** 1.feedback on cognitive and behavioural processes; 2. feedback on progress **IE, PS, CS:** - **EP:** e-mail prompts **UD, II:** -	[d]**Revisit website:** 27%; revisit before prompt 20%; revisit after prompt 80%
32. Brendryen (2008),[68] Norway	**Target behaviour:** smoking cessation **Target group:** adults (N=290) aged 18 and older, willing to quit without NRT	**IBC:** 1. action planning; 2. self-monitoring **IE, PS, CS:** - **EP:** e-mail prompts, mobile phone text messages and voice response messages (reactive log-on calls), and post-quitting, support phone calls (proactive log-off calls) **UD:** daily, during first phase of intervention **II:** -	**Landing website:** 0.3% out of 947,059 times the banner was displayed [d]**Login:** avg. 26 logins ± 13 (59%) [range 0-44] [d]**Completion whole intervention:** 60% **EP:** avg. 26 ± 16 (62%) log-on calls [range 0-42]; avg. 53 ± 37 (52%) log-off calls [range 0-102]

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
33. Brendryen (2008),[69] Norway	**Target behaviour:** smoking cessation **Target group:** adults (N=396) aged 18 and older, smoking 10 or more cigarettes daily who were willing to quit	**IBC:** 1. action planning; 2. self-monitoring **IE, PS, CS:** - **EP:** e-mail prompts, mobile phone text messages and voice response messages (reactive log-on calls), and post-quitting, support phone calls (proactive log-off calls) **UD:** daily, during first phase of intervention **II:** -	[d]**Login:** avg. 30 logins ± 13 (68%) [range 0-44] [d]**Completion whole intervention:** 77% **EP:** avg. 30 ± 16 (71%) log-on calls [range 0-42]; avg. 69 ± 35 (66%) log-off calls [range 0-104]
34. Cobb (2005),[70] USA	**Target behaviour:** smoking cessation **Target group:** adult smokers (N=1501)	**IBC:** 1. feedback on cognitive and behavioural processes; 2. setting quit date; 3. self-monitoring **IE:** money and 'life saved' calculator, real time notification of forum/chat/internal e-mail messages, identification of quitting buddies, and searchable list of smoking cessation resources **PS:** forums, internal e-mail system, chat rooms, and buddy system **CS:** individual counselling support by online counsellors, and ask the expert in online forum **EP:** tailored e-mail support messages **UD, II:** -	**Duration visit:** quitters median 12 min per session [range 7-20]; smokers median 14.5 min [range 8-23]; quitters median 103 min total online [range 33-339]; smokers median 33 min [range 17-82.5] **Pages visited:** quitters median 128 pages [range 31-366]; smokers median 34 pages [range 17-87] **Login:** quitters median 9 logins [range 1-42]; smokers median 2 [range 1-5] [d]**Revisit website:** 53% **PS:** 19% quitters and 5% smokers posted on forum; 19% quitters and 10% smokers with at least one buddy; 25% quitters and 9% smokers sent e-mail to at least one person; 41% quitters and 21% smokers received e-mail from at least one person
35. Danaher (2006),[32] USA	**Target behaviour:** cessation of smokeless tobacco **Target group:** adult smokeless tobacco users (N=2375)	**a. IBC:** 1. feedback on cognitive and behavioural processes; 2. planning to quit **IE:** video based testimonials, and website links **PS:** support forum **CS:** ask the expert forum **EP:** e-mails prompts, and support e-mails **UD:** new information in stay quit part **II:** -	**Access program content:** 96% **Visit duration:** median overall 28.99 min [d]**Completion first visit:** 64% continued on day of enrolment **Login:** median 2 logins **IBC:** 63% setting quit date **IE:** 18% used outside links; 68% video testimonial **PS:** 38% posted message **CS:** 5% posted message

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
		b. IBC: - **IE:** website links **PS, CS, EP, UD, II:** -	**Access program content:** 93% **Visit duration:** median overall 12.50 min [d]**Completion first visit:** 39% continued on day of enrolment **Login:** median 1 logins **IE:** 32% used outside links
36. Feil (2003),[71] USA	**Target behaviour:** smoking cessation **Target group:** adults (N=606) aged 18 and older in at least contemplator stage of quitting	**IBC:** 1. planning to quit **IE:** anti-tobacco entertainment, e.g., puzzles and video's, and website links **PS:** bulletin board, and chat room **CS:** ask the expert **EP:** e-mail messages as intervention component **UD, II:** -	[d]**Login:** avg. 7.9 logins ± 38.8; women 8.3 logins ± 39.2; men 6.7 logins ± 41.5 **IBC:** 63% accessed personalized quit-plan segment **PS:** avg. 3.7 posting ± 30.3; women 4.4 postings ± 34.6; men 1.8 postings ± 14.2
37. Graham (2007),[72] USA	**Target behaviour:** smoking cessation **Target group:** smoking employees of a multinational information technology company (N=1776)	**IBC:** 1. feedback on cognitive and behavioural processes; 2. setting quit date; 3. self-monitoring **IE:** money and 'life saved' calculator, real time notification of forum/chat/internal e-mail messages, identification of quitting buddies, and searchable list of smoking cessation resources **PS:** forums, internal e-mail system, chat rooms, and buddy system **CS:** individual counselling support by online counsellors, and ask the expert in online forum **EP:** tailored e-mail support messages **UD:** - **II:** benefits premium discount of $11 per month to a maximum of $132 for the year, for use of intervention	[d]**Visit duration:** avg. 15 min per visit ± 10.3 min, median 12 min; avg. 205 min in total ± 2161, median 23 min [d]**Pages visited:** avg. 95 pages ± 518; median of 18 pages [d]**Login:** avg. 12 logins ± 89.7; median 2 logins [range 0-1846] [d]**Revisit:** 53%; never accessed program <1%, 1 time 46%, 2 times 19%; 3 times 10%, 4 or more times 24% **IBC:** 62% used expert system for quit date; 18% used medication expert system **PS:** 7% quitters and 0.4% continued smokers posted on forum; 8% quitters and 4% continued smokers had a buddy; 9% quitters and 2% continued smokers belonged to club; 12% quitters and 6% continued smokers sent e-mail to other members
38. Houston (2008),[73] USA	**Target behaviour:** smoking cessation **Target group:** current smokers (N=231)	**a. IBC:** 1. feedback on cognitive constructs; 2. planning to quit **IE:** small games and quizzes, decisional balance calculator, and library **PS:** forum **CS:** ask the expert **EP, UD, II:** -	**Duration visit:** median 18 min; <3 min 24%, 3-10 min 13%, >10-25 min 31%, >25 min 32% ***Remark:*** *16% of both phases used forum; 4% of both phases used ask the expert; 1% (3 participants)j of both phases revisited the website* **IBC:** 69% used self-management strategies; 50% used family help module; 56% used talking to your doctor module

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
		b. IBC: 1. feedback on cognitive constructs; 2. planning to quit **IE:** small games and quizzes, decisional balance calculator, and library **PS:** forum **CS:** ask the expert **EP, UD, II:** -	**Duration visit:** median 8 min; <3 min 31%, 3-10 min 30%, >10-25 min 15%, >25 min 23% **IBC:** 58% used self-management strategies; 29% used family help module; 33% used talking to your doctor module
39. Lenert (2003),[22] USA	**Target behaviour:** smoking cessation **Target group:** smokers (N=49) who had completed a previous web-based survey on cessation needs and who had failed to quit but were ready to quit	**IBC:** 1. feedback on behaviour; 2. self-monitoring **IE, PS, CS:** - **EP:** e-mail prompts **UD, II:** -	**Access program content:** 86% [d]**Completing first visit:** 25% completed all modules; avg. 2 of 8 modules were completed **Login:** median 2 logins **IBC:** 82% set quit date
40. McKay (2008),[74] USA	**Target behaviour:** a. smoking cessation; b. smoking cessation, through improving physical activity **Target group:** current smokers (N=2328) aged 18 and older interested in quitting in next 30 days and willingness to engage in moderate PA	**a. IBC:** 1. feedback on cognitive and behavioural processes; 2. planning to quit **IE:** - **PS:** forum **CS:** ask the expert forum **EP, UD, II:** -	[d]**Duration visit:** avg. 8.4 min per visit; total avg. 18.04 min ± 22.18 [d]**Login:** avg. 2.14 logins ± 3.66
		b. IBC: 1. feedback on performance; 2. goal setting; 3. action planning; 4. self-monitoring; 5. feedback on progress **IE:** - **PS:** forum **CS, EP, UD, II:** -	[d]**Duration visit:** avg. 8.1 min per visit; total avg. time 14.02 min ± 17.09 [d]**Login:** avg. 1.74 logins ± 2.43

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
41. Saul (2007),[75] USA	**Target behaviour:** smoking cessation **Target group:** adult (N=607) aged 18 and over who accessed the site as a current smoker and had not already quit at the time of registration	**IBC:** 1. feedback on cognitive constructs; 2. setting quit date; 3. self-monitoring **IE:** money and 'life saved' calculator, real time notification of forum/chat/internal e-mail messages, identification of quitting buddies, and searchable list of smoking cessation resources **PS:** forums, internal e-mail system, chat rooms, and buddy system **CS:** individual counselling support by online counsellors, ask the expert in online forum **EP:** tailored e-mail support messages **UD, II:** -	**Login:** in past 6 month never logged in: 52%; 1-3 logins: 29%; 4 or more logins: 19% [d]**Revisit website:** 48%; 32% of non-responders and 53% of responders
42. Severson (2008),[31] USA	**Target behaviour:** smoke free tobacco cessation **Target group:** adult smokeless tobacco users (N=2523) aged 18 and over who were thinking of quitting	**a. IBC:** 1. feedback on cognitive and behavioural processes; 2. planning to quit **IE:** video's and website links **PS:** forum **CS:** ask the expert forum **EP:** e-mail support and e-mail prompts **UD:** new information in stay quit part **II:** -	**Access program content:** 95% [d]**Duration visit:** avg. 11.1 min per visit; total avg. 37.51 min; median 27.59 min [range 0.01-439] [d]**Login:** avg. 3.39 logins; median 2 logins [range 1-37] **PS:** avg. 2.91 posts on forum; median 1 post [range 1-106] **CS:** avg. 0.33 posts on expert forum; median 1 post [range 1-17]
		b. IBC: - **IE:** website links and FAQ **PS, CS, EP, UD, II:** -	**Access program content:** 93% [d]**Duration visit:** avg. 8.3 min per visit; total avg. 15.77 min; median 11.62 min [range 0.04-186] [d]**Login:** avg. 1.9 logins; median 1 logins [range 1-25]
43. Stoddard (2005),[76] USA	**Target behaviour:** smoking cessation **Target group:** smokers (N=538) aged 18 and over who smoked 1 or more cigarettes daily	**IBC:** 1. feedback on nicotine dependency and depressive symptoms **IE:** website links **PS, CS, EP, UD, II:** -	**Landing website:** 0.5% of direct mail [d]**Completion first visit:** 91%

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
44. Stoddard (2008),[77] USA	**Target behaviour:** smoking cessation **Target group:** adult federal employees and contractors (N=1375) aged 18 and over who were willing to quit smoking	**a. IBC:** 1. feedback on cognitive processes **IE:** - **PS:** bulletin board/forum **CS:** online counselling **EP:** e-mail support and prompt messages **UD, II:** -	[d]**Duration visit:** avg. 18.0 min **IBC:** hits various tools varied from 242 to 437 hits **PS:** 12% used bulletin board
		b. IBC: 1. feedback on cognitive processes **IE, PS:** - **CS:** online counselling **EP:** e-mail support and prompt messages **UD, II:** -	[d]**Duration visit:** avg. 11.1 min **IBC:** hits various tools varied from 240 to 413 hits
45. Strecher (2005),[78] England and Ireland	**Target behaviour:** smoking cessation among nicotine patch users **Target group:** adult smokers (N=3971) aged 18 and older smoking more than 10 cigarettes a day, who purchased nicotine patches and target quit date within 7 days	**a. IBC:** 1. feedback on cognitive and behavioural processes **IE, PS, CS:** **EP:** e-mail support messages **UD:** three sequential newsletters via website **II:** -	**Access program content:** 88%
		b. IBC, IE, PS, CS: - **EP:** e-mail support messages **UD, II:** -	**Access program content:** 88%
46. Strecher (2008),[79,80] USA	**Target behaviour:** smoking cessation **Target group:** adult smokers (N=944) aged 21-70, smoked at least 100 cigarettes in lifetime and currently smoking at least 10 cigarettes a day, who were seriously considering quitting in next 30 days	**a. IBC:** 1. feedback on cognitive and behavioural processes, and on barrier identification and solutions; 2. setting quit date **IE:** success stories **PS, CS:** - **EP:** e-mail prompts **UD:** weekly new opened sections **II:** -	**IBC:** avg. 2.6 opened sections

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
		b. IBC: 1. feedback on cognitive and behavioural processes, and on barrier identification and solutions; 2. setting quit date **IE:** success stories **PS, CS, EP, UD, II:** -	**IBC:** avg. 3.1 opened sections
47. Swartz. (2006),[81] USA	**Target behaviour:** smoking cessation **Target group:** smokers (N=351) aged 18 and older, currently smoking daily, willing to make quit attempt in the next 30 days	**IBC:** 1. feedback on cognitive and behavioural processes and barrier identification; 2. planning to quit **IE:** video segments, and audio segments in combination with animated graphics **PS, CS, EP, UD, II:** -	**IBC:** 56% viewed quit plan module and set actual quit date; 49% viewed overcoming barriers; 42% viewed voiding situations that prompt cravings; 42% viewed dealing with cravings; 35% viewed benefits of quitting smoking; 70% viewed at least one optional section within modules
48. Wang (2004),[82] Switzerland	**Target behaviour:** smoking cessation **Target group:** smokers in general (N=18,361)	**IBC:** 1. feedback on cognitive and behavioural processes; 2. feedback on progress **IE:** - **PS:** forum **CS:** - **EP:** bi-monthly e-mail prompts **UD, II:** -	[d]**Revisit website:** 20%
E. Alcohol reduction			
49. Cloud (2001),[83] USA	**Target behaviour:** abstaining or controlled drinking **Target group:** adult problem drinkers (N=2813) aged 18 and older	**IBC:** 1. feedback on performance and cognitive constructs **IE:** FAQ and website links **PS, CS, EP, UD, II:** -	**Landing website:** 10,253 hits during 172 study period **Access program content:** 27% [d]**Pages visited:** avg. 1.4 additional webpages
50. Cunningham (2000),[84] Canada	**Target behaviour:** problem drinking, drinking habits **Target group:** NR (N=214)	**IBC:** 1. feedback on performance **IE, PS, CS, EP, UD, II:** -	**Landing website:** more than 500 hits each month **Accessed program content:** 14% [d]**Completion first visit:** 88%
51. Lieberman (2006),[85] USA	**Target behaviour:** alcohol abuse **Target group:** adults (N=288)	**a. IBC:** 1. feedback on cognitive constructs **IE:** online guide **PS, CS, EP, UD, II:** -	**Access program content:** 89% [d]**Completion first visit:** 90% completed all 4 modules; 0% 1 module; 0% 2 modules; 10% 3 modules
		b. IBC: 1. feedback on cognitive constructs **IE, PS, CS, EP, UD, II:** -	[d]**Completion first visit:** 83% completed all 4 modules; 5% 1 module; 4% 2 modules; 9% 3 modules

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
52. Linke (2004),[86] Linke (2005),[87] UK	**Target behaviour:** excessive alcohol consumption **Target group:** adults (N=1319) with a FAST score of 3 of above	**IBC:** 1. feedback on performance and cognitive constructs; 2. self-monitoring **IE:** quizzes, recreational area, blood alcohol concentration calculator, FAQ about heavy drinking, mouse-overs **PS:** discussion group **CS:** - **EP:** e-mail/SMS as intervention content, e-mail as prompt **UD:** new consecutive intervention modules **II:** -	**Landing website:** 7581 hits during 6-month study period **Accessed program content:** 17% [d]**Completion first visit:** 62% [d]**Completion whole intervention:** 6% completed all 6 modules (1 module 62%, 2-5 modules 32%, 3 modules 20%, 4 modules 14%, 5 modules 10%)
53. Linke (2007),[88] UK	**Target behaviour:** promotion of sensible drinking **Target group:** adults (N=10,000) with a FAST score of 3 of above	**IBC:** 1. feedback on performance and cognitive constructs; 2. self-monitoring **IE:** quizzes, recreational area, blood alcohol concentration calculator, FAQ about heavy drinking, mouse-overs **PS:** discussion group **CS:** - **E-mail/Phone:** e-mail/SMS as intervention content, e-mail as prompt **Update:** new consecutive intervention modules **II:** -	[d]**Completion first visit:** 89% [d]**Completion whole intervention:** 17% completed all 6 weeks (89% week 1, 40% week 2, 30% week 3, 24% week4, 19% week 5)
54. Matano (2007),[89] USA	**Target behaviour:** reduction of alcohol consumption **Target group:** employees at a worksite (N=229) with low or moderate risk for alcohol-related problems	**a. IBC:** 1. feedback on performance, stress levels, and cognitive constructs; 2. self-monitoring; 3. feedback on progress **IE:** mini-workshop, animations, website links **PS:** forum **CS, EP, UD, II:** -	**Access program content:** 72% [d]**Duration visit:** avg. 16.7 min ± 12.3 for moderate-risk, avg. 19.7 min ± 16.0 for low-risk [d]**Login:** avg. 1.3 logins ± 0.5 for moderate-risk, avg. 1.3 logins ± 0.5 for low-risk

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
		b. IBC: 1. feedback on stress levels and cognitive constructs; 2. self-monitoring; 3. feedback on progress **IE:** mini-workshop, animations, website links **PS:** forum **SC, EP, UD, II:** -	[d]**Duration visit:** avg. 18.9 min ± 16.4 for moderate-risk, avg. 16.8 min ± 12.9 for low-risk [d]**Login:** avg. 1.4 logins ± 0.9 for moderate-risk, avg. 1.4 logins ± 0.9 for low-risk
55. Riper (2008),[90] Netherlands	**Target behaviour:** reduction of alcohol consumption **Target group:** excessive and hazardous drinkers (N=261) aged 28-65 without professional help	**a. IBC:** 1. feedback on behaviour and cognitive constructs; 2. goal setting; 3. self-monitoring; 4. feedback on progress **IE:** animations, website links **PS:** discussion forum **CS, EP:** - **Update:** tip of the day **II:** -	**Access program content:** 45%
		b. IBC, IE, PS, CS, EP, UD, II: -	**Access program content:** 51%
56. Saitz (2004),[91] USA	**Target behaviour:** Alcohol use **Target group:** adult website visitors (N=39,842) aged 18 and above who complete screening about their own drinking	**IBC:** feedback on performance **IE:** online information library, searchable national database, website links **PS, CS, EP, UD, II:** -	[d]**Duration visit:** average of 5.25 min **IBC:** after receiving results 19% chose the 'Learn More' or 'Get Help' option
57. Westrup (2003),[92] USA	**Target behaviour:** reduction of alcohol consumption **Target group:** highly educated workforce (N=187)	**a. IBC:** 1. feedback performance, stress levels and cognitive constructs; 2. self-monitoring; 3. feedback on progress **IE:** mini-workshop, animations, website links **PS:** forum **CS, EP, UD, II:** -	***Remark:*** *no distinction was made between Internet interventions regarding visit duration and login* **Duration visit:** avg. 19.9 min ± 14.2 [range 3-68]; high risk avg. 19.9 min ± 13.3, moderate risk avg. 14.6 min ± 10.8, low risk avg. 14.8 ± 10.7) **Login:** 1 login 78%, 2 logins 16%, 3 logins 4%, 4 or 5 logins 3%
		b. IBC: 1. feedback on stress levels and cognitive constructs: 2. self-monitoring; 3. feedback on progress **IE:** mini-workshop, animations, website links **PS:** forum **CS, EP, UD, II:** -	

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
F. Combination of behaviours			
58. Cook (2007),[93] USA	**Target behaviour:** nutrition/weight management, fitness/physical activity, and stress management **Target group:** employees of human resources company (N=419)	**IBC:** 1. feedback on performance and cognitive constructs; 2. goal setting; 3. action planning; 4. self-monitoring; 5. feedback on progress **IE:** BMI and target heart rate calculator, video testimonials and skills training, interactive exercises and videos, FAQ, website links **PS, CS, EP, UD, II:** -	**Access program content:** 10% **IBC:** 14% never used nutrition module, 45% one time, 25% twice, 15% more than twice; 20% never used physical activity module, 55% one time, 16% twice, 9% more than twice
59. Cowdery (2007),[94] USA	**Target behaviour:** Smoking cessation, weight management, nutrition, physical activity, alcohol, injury prevention, mental health, skin protection **Target group:** university staff (N=90)	**IBC:** 1. Feedback on performance and cognitive constructs **IE:** website links **PS, CS, EP, UD, II:** -	[d]**Completing first visit:** 13% of eligible participants
60. Oenema (2008),[95] Netherlands	**Target behaviour:** saturated fat intake, physical activity, smoking cessation **Target group:** adult participants (N=2159) of an online research panel aged 30 and older	**IBC:** 1. feedback on performance and cognitive constructs; 2. action planning; 3. feedback on progress **IE, PS, CS, EP, UD, II:** -	**Access program content:** 81% [d]**Completing first visit:** 93% completed at least one module **IBC:** 72% visited saturated fat module, 72% physical activity module, 60% of the smokers visited smoking module
61. Verheijden (2007),[23] Netherlands	**Target behaviour:** health promotion through several lifestyle behaviours aimed at physical activity as core behaviour, and dietary habits, alcohol intake, smoking, work, cardio-respiratory fitness, and muscle strength **Target group:** general adult population (N=6272)	**IBC: 1**. feedback on performance; 2. feedback on progress **IE:** self-tests on anthropometrics, cardio-respiratory fitness, and muscle strength **PS, CS:** - **EP:** e-mail as prompt **UD:** availability of follow-up modules **II:** -	[d]**Revisit website:** 10%; 2 times 8%, 3 times 2%, 4 times <1%

Study[a], country	Target behaviour, target group (N)	Potential exposure promoting elements, within main categories[b]	Objective outcome measure regarding exposure to Internet intervention[b]
62. Ware (2008),[96] UK	**Target behaviour:** Weight loss, weight maintenance, physical activity **Target group:** office and manufacturer workers (N=265)	**IBC:** 1. feedback on performance and barrier identification; 2. goal setting; 3. action planning; 4. self-monitoring; 5. feedback on progress **IE:** - **PS:** community message boards, discussion forums **CS:** - **EP:** e-mail and/or mobile phone reminder messages **UD, II:** -	**Access program content:** 88% [d]**Duration visit:** avg. 11.6 min week 1, avg. 8.6 min week 2, avg. 7 min weeks 3-12, resulting in avg. 7.5 min per week [d]**Login:** week 1-2 avg. 6 logins per week, week 3-12 avg. 2 logins per week, resulting in 32 logins during intervention period [d]**Completion whole intervention:** 22%
63. Winett (2007),[97] USA	**Target behaviour:** fat, fibre, and fruit and vegetable intake, physical activity **Target group:** adult church members (N=1071)	**a. IBC:** 1. feedback on cognitive constructs; 2. goal setting; 3. self-monitoring; 4. feedback on progress **IE:** audio narrator 'guide', virtual restaurant **PS, CS, EP:** - **UD:** weekly new modules **II:** -	**Access program content:** 80% [d]**Completion whole intervention:** 50% **IBC:** avg. 7.0 modules were viewed; 50% viewed all modules
		b. IBC: 1. feedback on cognitive constructs; 2. goal setting; 3. self-monitoring; 4. feedback on progress **IE:** audio narrator 'guide', virtual restaurant **PS, CS, EP:** - **UD:** weekly new modules **II:** -	**Access program content:** 57% [d]**Completion whole intervention:** 25% **IBC:** avg. 4.6 modules were viewed; 25% viewed all modules
64. Woolf (2006),[98] USA	**Target behaviour:** healthy diet, physical activity, smoking cessation, and reduced problem drinking **Target group:** adults (N=273) with unhealthy behaviours	**IBC:** 1. feedback on performance and cognitive constructs **IE:** website links, resource library **PS, CS:** - **EP:** e-mail prompts **UD, II:** -	**Landing website:** 932 hits of 25,488 unique patients visited practice during study period **Access program content:** 29% [d]**Completion first visit/intervention:** 94%
		b. IBC, IE, PS, CS, EP, UD, II: -	

Notes: NR=not reported; BMI=body mass index; NRT=nicotine replacement therapy; FAST=fast alcohol screening test

[a] Information of publications that evaluated and reported on the same interventions but were separate studies were combined. This applies to the following studies: both studies of Hurling,[39,40] Gold[55] and Micco,[60] both studies of Brendryen,[68,69] Cobb[70] with Graham[72] and Saul,[75] Danahar[32] and Severson,[31] both studies of Linke,[86-88] and Matano[89] and Westrup[92]

[b] The main categories of potential exposure promoting elements are abbreviated as: IBC=interactive behaviour change strategy; IE=interactive elements; PS=peer support; CS=counsellor/therapist support; EP=e-mail and/or phone contact; UD=update intervention website; II=intervention incentive

[c] Both Internet interventions a. from Gold[55] and Micco[60] are identical as they come from the same study but are compared in two publications to a another intervention

[d] Indication that these exposure measures are incorporated in Table 4.3

included interactive elements such as quizzes, searchable databases or libraries, heart rate/BMI calculator, and website links, with less use of these elements in weight management and smoking cessation interventions. Peer support was most often used in the weight management, smoking cessation, and alcohol consumption interventions, while counsellor support was most common in the weight management interventions, followed by the smoking cessation interventions. E-mail/phone contact was frequently used in most interventions except for the alcohol consumption and multiple behaviour interventions. Regular updates of the intervention website or provision of an incentive for using the intervention were not often used, but when they were, they were used most in the weight management, nutrition and PA interventions.

Objective exposure outcome measures

A large variety of exposure measures were used in the included studies (see Table 4.2). The frequency of visits by means of login rates was the most commonly used exposure outcome measure (N=33), although the way in which the data were presented was not consistent across studies as different statistics were used (e.g., mean or median). There were also several studies that did not present login rates but did present the percentage of users that revisited the intervention (N=9). Other often used outcome measures were how many people landed on the website, which was mostly registered by 'hits' on the website (N=10), the number of visitors that accessed the program content (N=24), the number of pages visited (N=6), completion of the first visit or module (N=13), and completion of the whole intervention (N=8). Furthermore, use of intervention methods and/or strategies were also presented as exposure measures, such as use of specific intervention components (interactive behaviour change strategies and interactive elements [N=26], use of peer support [N=12], and use of counsellor support [N=10]).

Combining outcome measures with potential exposure-promoting methods and strategies

In Table 4.3, the studies are listed in a matrix combining the objective outcome measures that were mostly presented and the potential exposure-promoting elements. Of all the potential exposure-promoting elements listed in Table 4.3, indications were found for peer support, counsellor support, e-mail and/or phone contact with visitors, and updates of the intervention website to be related with more exposure. The provision of peer and counsellor support appears to have had a positive influence on the time visitors spent on the website. This can be deduced from the finding that at least 50% of the studies evaluating interventions that included peer or counsellor support were listed in the higher category of average time spent on the website compared with the lower percentage of studies evaluating interventions that did not include peer or counsellor support, and that the difference in number of interventions listed in the higher category was at least 35%. Both e-mail/phone contact with visitors and

Table 4.3 Listing of studies by potential exposure-promoting elements and the result of exposure measures[a]

Exposure measures	Interactive behaviour change strategies (IBC)				Interactive elements (IE)				Peer support (PS)				Counsellor support (CS)				E-mail/phone contact (EP)				Update (UD)				Intervention incentive (II)			
	0-3 strat.		≥ 3 strat.		Yes		No		Yes		No		Yes		No		Yes		No		Yes		No		Yes		No	
	N	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.
Percent of participants completing modules/intervention during first visit (N=16)																												
N	*15*		*1*		*10*		*6*		*4*		*12*		*3*		*13*		*6*		*10*		*4*		*12*		*0*		*16*	
- < 70%	*5*	35a, 35b, 39, 52, 59			*4*	35a, 35b, 52, 59	*1*	39	*2*	35a, 52	*3*	35b, 39, 59	*2*	35a, 39	*3*	35b, 52, 59	*3*	35a, 39, 52	*2*	35b, 59	*2*	35a, 52	*3*	35b, 39, 59			*5*	35a, 35b, 39, 52, 59
- 70-90%	*6*	14a, 29, 50, 51a, 51b, 53			*3*	14a, 51a, 53	*3*	29, 50, 51b	*1*	53	*5*	14a, 29, 50, 51a, 51b	*1*	29	*5*	14a, 50, 51a, 51b, 53	*2*	29, 53	*4*	14a, 50, 51a, 51b	*2*	29, 53	*4*	14a, 50, 51a, 51b			*5*	14a, 50, 51a, 51b, 53
- > 90%	*4*	10, 14b, 43, 64a	*1*	60	*3*	10, 43, 64a	*2*	14b, 60	*1*	10	*4*	14b, 43, 60, 64a			*5*	10, 14b, 43, 60, 64a	*1*	64a	*4*	10, 14b, 43, 60			*5*	10, 14b, 43, 60, 64a			*6*	10, 14b, 29, 43, 60, 64a

Exposure measures	Interactive behaviour change strategies (IBC)				Interactive elements (IE)				Peer support (PS)				Counsellor support (CS)				E-mail/phone contact (EP)				Update (UD)				Intervention incentive (II)			
	0-3 strat.		≥ 3 strat.		Yes		No		Yes		No		Yes		No		Yes		No		Yes		No		Yes		No	
	N	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.
Average duration of visits in minutes (N=16)																												
N	*8*		*8*		*11*		*5*		*9*		*7*		*6*		*10*		*10*		*6*		*4*		*12*		*2*		*14*	
- < 10 min	*5*	7b, 13, 40a, 42b, 56	*5*	5, 7a, 8, 40b, 62	*7*	5, 7a, 7b, 8, 13, 42b, 56	*3*	40a, 40b, 62	*4*	5, 40a, 40b, 62	*6*	7a, 7b, 8, 13, 42b, 56	*2*	13, 40a	*8*	5, 7a, 7b, 8, 40b, 42b, 56, 62	*6*	5, 7a, 7b, 8, 13, 62	*4*	40a, 40b, 42b, 56	*3*	7a, 8, 13	*7*	5, 7b, 40a, 40b, 42b, 56, 62	*1*	13	*9*	5, 7a, 7b, 8, 40a, 40b, 42b, 56, 62
- 10-20 min	*3*	42a, 44a, 44b	*3*	37, 54a, 54b	*4*	37, 42a, 54a, 54b	*2*	44a, 44b	*5*	37, 42a 44a, 54a 54b	*1*	44b	*4*	37, 42a, 44a, 44b	*2*	54a, 54b	*4*	37, 42a, 44a, 44b	*2*	54a, 54b	*1*	42a	*5*	37, 44a, 44b, 54a, 54b	*1*	37	*5*	42a, 44a, 44b, 54a, 54b
Average number of pages visited (N=4)																												
N	*2*		*2*		*4*		*0*		*1*		*3*				*3*		*3*		*1*		*1*		*3*		*2*		*2*	
- < 10 pages	*1*	49			*1*	49					*1*	49			*1*	49			*1*	49	*1*	8	*1*	49			*1*	49
- 10-50 pages	*1*	15	*1*	8	*2*	8, 15					*2*	8, 15	*1*	37	*2*	8, 15	*2*	8, 15					*1*	15	*1*	15	*1*	8
- > 50 pages			*1*	37	*1*	37			*1*	37							*1*	37					*1*	37	*1*	37		

Exposure measures	Interactive behaviour change strategies (IBC)				Interactive elements (IE)				Peer support (PS)				Counsellor support (CS)				E-mail/phone contact (EP)				Update (UD)				Intervention incentive (II)			
	0-3 strat.		≥ 3 strat.		Yes		No		Yes		No		Yes		No		Yes		No		Yes		No		Yes		No	
	N	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.
Average number of logins on website (N=27)																												
N	*16*		*11*		*19*		*8*		*15*		*12*		*11*		*16*		*18*		*9*		*11*		*16*		*5*		*22*	
- 1-5 times	*6*	3b, 13, 15, 40a, 42a, 42b	*3*	40b, 54a, 54b	*6*	13, 15, 42a, 42b, 54a, 54b	*3*	3b, 40a, 40b	*5*	40a, 40b, 42a, 54a, 54b	*4*	3b, 13, 15, 42b	*3*	13, 40a, 42a	*6*	3b, 15, 40b, 42b, 54a, 54b	*4*	3b, 13, 15, 42a	*5*	40a, 40b, 42b, 54a, 54b	*2*	13, 42a	*7*	3b, 15, 40a, 40b, 42b, 54a, 54b	*2*	13, 15	*7*	3b, 40a, 40b, 42a, 42b, 54a, 54b
- 5-10 times	*3*	3a, 26b, 36	*1*	6b	*3*	3a, 26b, 36	*1*	6b	*2*	3a, 36	*2*	6b, 26b	*2*	3a, 36	*2*	6b, 26b	*2*	3a, 36	*2*	6b, 26b	*1*	3a	*3*	6b, 26b, 36			*4*	3a, 6b, 26b, 36
- >10 times	*7*	16, 21, 26a, 28a, 28b, 32, 33	*7*	5, 6a, 12a, 12b, 22, 37, 62	*10*	5, 6a, 12a, 12b, 16, 21, 26a, 28a, 28b, 37	*4*	22, 32, 33, 62	*8*	5, 6a, 16, 26a, 28a, 28b, 37, 62	*6*	12a, 12b, 21, 22, 32, 33	*6*	12a, 12b, 21, 26a, 28a, 37	*8*	5, 6a, 16, 22, 28b, 32, 33, 62	*12*	5, 6a, 12a, 12b, 16, 21, 22, 26a, 32, 33, 37, 62	*2*	28a, 28b	*8*	12a, 12b, 16, 21, 28a, 28b, 32, 33	*6*	5, 6a, 22, 26a, 37, 62	*3*	12a, 16, 37	*11*	5, 6a, 12b, 21, 22, 26a, 28a, 28b, 32, 33, 62
Percent of participants who revisited website (N=8)																												
N	*3*		*5*		*5*		*3*		*5*		*3*		*3*		*5*		*7*		*1*		*1*		*7*		*1*		*7*	
- <20%	*2*	48, 61	*1*	9	*1*	61	*2*	9, 48	*1*	48	*2*	9, 61			*3*	9, 48, 61	*2*	48, 61	*1*	9	*1*	61	*2*	9, 48			*3*	9, 48, 61
- 20-50%	*1*	31	*2*	11a, 41	*2*	11a, 41	*1*	31	*2*	11a, 41	*1*	31	*1*	41	*2*	11a, 31	*3*	11a, 31, 41					*3*	11a, 31, 41			*3*	11a, 31, 41
- >50%			*2*	34, 37	*2*	34, 37			*2*	34, 37			*2*	34, 37			*2*	34, 37					*2*	34,37	*1*	37	*1*	34

Exposure measures	Interactive behaviour change strategies (IBC)				Interactive elements (IE)				Peer support (PS)				Counsellor support (CS)				E-mail/phone contact (EP)				Update (UD)				Intervention incentive (II)			
	0-3 strat.		≥ 3 strat.		Yes		No		Yes		No		Yes		No		Yes		No		Yes		No		Yes		No	
	N	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.	*N*	study nr.
Percent of participants who completed all modules in multiple visits (N=10)																												
N	*4*		*6*		*6*		*4*		*5*		*5*		*1*	*9*	*9*		*7*		*3*		*6*		*4*		*1*		*9*	
- <20%	*2*	52, 53			*2*	52, 53			*2*	52, 53					*2*	52, 53	*2*	52, 53			*2*	52, 53					*2*	52, 53
- 20-50%			*4*	6b, 62, 63a, 63b	*2*	63a, 63b	*2*	6b, 62	*1*	62	*3*	6b, 63a, 63b			*4*	6b, 62, 63a, 63b	*1*	62	*3*	6b, 63a, 63b	*2*	63a, 63b	*2*	6b, 62			*4*	6b, 62, 63a, 63b
- >50%	*2*	32, 33	*2*	6a, 37	*2*	6a, 37	*2*	32, 33	*2*	6a, 37	*2*	32, 33	*1*	37	*3*	6a, 32, 33	*4*	6a, 32, 33, 37			*2*	32, 33	*2*	6a, 37	*1*	37	*3*	6a, 32, 33

Note The numbering of studies corresponds with the numbering of studies in Table 4.2 and the Appendix: physical activity study numbers 1-12, nutrition 13-16; weight management 17-30, smoking cessation 31-48, alcohol consumption 49-57, multi-behaviours 58-64; the letters a and b are used when in a study different Internet interventions are described.

[a] The main categories of potential exposure promoting elements are abbreviated as: IBC=interactive behaviour change strategy; IE=interactive elements; PS=peer support; CS=counsellor/therapist support; EP=e-mail and/or phone contact; UD=update intervention website; II=intervention incentive

updates of the intervention website were related to more average logins on the intervention websites, indicated by the higher number of studies on interventions that included these elements listed in the higher average login categories, as compared with interventions without these elements.

Discussion

Non-optimal exposure to Internet interventions has been indicated as a major concern in the field of development, evaluation, and implementation of Internet interventions. According to the Diffusion of Innovations Theory,[25] characteristics of (potential) users and characteristics of an intervention (i.e., the innovation) are associated with adoption and implementation of interventions. The present review is one of the first to systematically investigate which specific characteristics of an Internet intervention can be associated with better exposure to the intervention and its contents. The study was qualitative in nature and allowed us to point out indications of possible patterns in associations between intervention characteristics and exposure. Of the categories of potential exposure-improving intervention elements that we distinguished in the review (the number of interactive behaviour change strategies used, and whether the intervention included interactive elements, peer support, counsellor support, e-mail and/or phone contact, update of the intervention website, and intervention incentives), peer and counsellor support were related to a longer visit duration, and e-mail/phone contact and update of the intervention website were related to a higher frequency of website logins. There were a large variety of potentially exposure-increasing elements applied in the various interventions, and there was a large variety and little consistency in the exposure measures that were reported.

In previous studies, interactively delivered educational content, such as the provision of computer-tailored feedback and goal setting, has been indicated as a potentially exposure improving element.[26-28,31] The active involvement required for using interactive elements, the personal relevance of feedback, and goals generated may result in more involvement in and better exposure to an intervention program. In this study, however, we did not find an association between the number of interactive behaviour change strategies and exposure. This may be due to the fact that there was little variability in the use of these elements. For example, in about three quarters of the interventions, some type of tailored feedback was provided. What this review showed is that there was a marked difference in the use of other interactive educational content between the interventions for the various target behaviours. This may reflect differences in the importance of the underlying determinants and change methods needed to facilitate effective and maintained change in the various behaviours. It may also reflect that Internet applications are more advanced for the promotion of some of the health

related behaviours (e.g., promotion of physical activity, weight management, and smoking cessation) than for others.

Peer support was offered more often in weight management, alcohol and smoking cessation interventions as compared with the other behaviours. Based on our criteria, peer support was related to more time spent on the intervention website. This does not necessarily mean, however, that visitors are exposed to and actively engaged in the intervention content, but they may at least be chatting about their target behaviour, for example, in a forum or a chat room. Furthermore, it should be noted that previous studies reported that peer support is used to a limited extent and that not all visitors may use peer support.[26,27,31] Peer support was, for example, more often sought by smoking quitters than by visitors that continued smoking,[70,72] and women have been found to be more likely to post more messages than men on a message board about smoking cessation.[71]

Counsellor support was more often a distinct part of the weight management and smoking cessation interventions. The results indicate that counsellor support was related to a longer website visit. Although there were an insufficient number of interventions in our study to draw any conclusions about the potential relation between counsellor support and revisiting intervention websites, there may be a positive relation. These findings may add positively to the results of previous single studies where inconsistent findings were reported for the relation of counsellor support and submission of dietary reports. Tate et al.,[63] for example, showed that additional human e-mail counselling resulted in higher online diary submissions, whereas Webber et al.[64] found the opposite.

Nearly half of the interventions sent e-mail/phone prompts to encourage revisits. Next to that, weight management interventions made more use of e-mails sent by counsellors, whereas physical activity and smoking cessation interventions used automatically generated e-mails to send intervention content. This review shows that e-mail/phone contact might indeed be useful in promoting repeated visits as has already been indicated in single studies addressing this topic. Furthermore, the postulation that regular updates of the intervention website would be related to repeated visits seems to be supported by the findings of this review. There is growing evidence that repeated website visits are necessary to achieve sustainable changes.[22-24] However, disappointing results regarding revisiting have been published, as website visits tend to decrease sharply after the initial weeks of participation.[4,23,39] It is, therefore, promising that e-mail prompts and regular updates of intervention content may contribute to more visits, since these are relatively easy to implement exposure-promoting strategies.

Another important finding in this review is that there was a large variety in the report of objective exposure measures but also that many studies that did not report exposure data

at all. We had to exclude 29 publications solely because they did not present any objective exposure measures. The number of logins on the intervention website was the most frequently reported exposure measure, but this measure was presented in different ways, which limited the options of pooling the data. Other often presented exposure measures were completion of the initial visit, visit duration, and completion of the intervention program in case revisits were required. It is not only important that objective exposure measures (e.g., starting intervention, completing modules/intervention, frequency of visiting, and duration of visit) are presented in studies evaluating Internet interventions,[32,101] but it is also important that these measures are presented in a standardized way. Furthermore, for the purpose of systematic reviews it is very important that accurate and complete descriptions of intervention content and interactive applications are provided in the future. This would make it possible to compare and pool different studies and enlarge the strength of the conclusions that can be drawn. In addition, objective exposure measures should be linked to visitor characteristics to get a more thorough impression about who is reached with what kind of intervention and to what extent. Furthermore, this registration on the individual level would also make it possible to study possible mediating effects of exposure to these objective exposure outcome measures.

To be able to relate the potentially exposure-improving intervention characteristics with exposure measures, we developed a matrix containing both elements. We listed all studies in this matrix by categorizing them according to, for example, the number of interactive behaviour change strategies used and the presence of peer or counsellor support, and the result of the exposure outcome. From this qualitative integrative approach, we derived that peer support was associated with a longer stay on the website, whereas e-mail/phone contact and update of the intervention website were related to more logins on the intervention website. We did not find an indication of better exposure to the intervention for the other categories of potential exposure-enhancing intervention characteristics, even if these have been indicated as such in previous studies.[26-31] This is also in contrast with the findings of individual studies in which a more extensive version of an intervention with more interactive characteristics was compared with a more basic version. A more interactive intervention resulted, for example, in a longer visit to the intervention[31,77] and in more logins on the intervention website.[28,31,62] One possible reason for not finding differences in exposure according to the use of more as compared with fewer interactive behaviour change strategies is the way in which we divided the interventions (<3 or ≥3 interactive behaviour change strategies) and that we pooled all the interventions targeting different health-related behaviours together.

The findings of our study are partly in line with the only other study that investigated the same topic among adolescents and young adults.[102] Similar to our study, they also found a heterogeneity of exposure measures and identified different exposure-increasing methods and strategies, such as tailored feedback, use of interactive elements, e-mail support, and

reminders. Furthermore, single studies showed that more interactive interventions resulted in a higher exposure to the intervention content than a basic version. Nevertheless, we have to keep in mind that younger people use the Internet differently than adults.[3,103]

Limitations

There are some limitations to this review study that need to be mentioned. The search strategies were limited to include only peer-reviewed English language publications. Therefore, we could have missed important 'grey literature' and publication in languages other than English. Next, for this review we relied on the information that was provided in the published literature regarding the description of the intervention and identification of potentially exposure-promoting methods and strategies. Some of the intervention descriptions were very brief, and even the more extensive descriptions available in the literature may not always have been complete. Therefore, we may have missed some of the potential exposure-promoting elements that an intervention contained. In addition, this review can be qualified as a qualitative review as the extracted data from the included studies were summarized and not statistically pooled, which limits the strength of the conclusions that can be drawn. Finally, the used cut-off points for making a ranking within the categories of potential exposure-promoting interventions elements (i.e., <3 or ≥3 interactive behaviour change strategies, and yes vs. no interactive elements) may not have been sensitive enough to detect differences in exposure.

Conclusion

The studies included in this review showed that in the Internet interventions currently available, a wide variety of potentially exposure-improving methods and strategies were used. These methods and strategies were markedly different for the healthy lifestyle behaviours that were studied. Also, a large variety of objective exposure outcome measures were used and there was a lack of consistency in exposure measures reported. Peer support, counsellor support, e-mail/phone contact with visitors through sending intervention content and prompts and updates of the intervention website were indicated to result in a longer visit and more logins on the website, respectively. More research is needed to gain insight into how intervention characteristics can be used to improve exposure to Internet interventions. More accurate and consistent description of intervention content and more consistency in the report of objective exposure outcomes are recommended. This will enable researchers to better assess associations between intervention characteristics and exposure to health behaviour change Internet interventions in the future.

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Appendix Summary of studies included in this review: target behaviour, study characteristics, brief description of Internet intervention content and duration, theory, number of study participants and characteristics of study population

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
A. Physical activity						
					Mean: 6,043 **Median:** 174	
1. Carr (2008),[36] USA	Physical activity	**Design:** RCT **Recruitment:** advertisements and e-mail solicitation **Conditions:** a: Internet-delivered intervention; b: delayed intent-to-treat control group	**Intervention:** interactive 16-lessons program providing feedback on cognitions and processes of change, goal setting, activity planning and self-monitoring tools, and weekly/bi-weekly e-mail/phone contact with facilitator; an additional print workbook was provided **Name:** Active Living Every Day – Internet (ALED-I) **Duration intervention:** 16 weeks with multiple visits	SCT TTM	32 (a: 14; b: 18)	**% female**: 81 **Age (SD)**: 45.9 ± 2.7 **% > high school:** NR
2. Dunton (2008),[37] USA	Physical activity	**Design:** RCT **Recruitment:** posters, flyers, and e-mails **Conditions**: a. tailored website with weekly e-mails; b. waiting list control group **Incentive:** $25 after completing 4 assessments (baseline, 1, 2, 3 months)	**Intervention:** interactive program providing individualized, stage tailored feedback on performance, cognitions and perceived barriers, 10 weekly follow-up e-mail newsletters **Name:** Women's Fitness Planner **Duration intervention:** accessible during 10 weeks	HBM TTM	156 (a: 85; b: 71)	**% female**: 100 **Age (SD)**: 42.8 ± 11.6 **% > high school:** 97
3. Ferney (2008),[28] Australia	Walking and overall physical activity	**Design:** RCT **Recruitment:** advertisements community newspapers, letterbox drop **Conditions**: a. neighbourhood environment-focused website; b. motivational-information website (minimal interactivity)	**a. Intervention:** website providing information about cognitive behavioural strategies in fact sheets, interactive goal setting tool, social support, information on physical activity facilities and walking trails in the local environment and individualized tailored e-mail advice **Name:** Get Up & Go **Duration intervention:** accessible during 26 weeks	EM SCT	106 (a: 52; b:54)	**% female**: 72 **Age (SD)**: 52.0 ± 4.6 **% > high school:** 71

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
			b. Intervention: website with minimal interactivity with 4 main sections based on motivational stages of change and non-tailored e-mail advice **Name:** Active Living Online **Duration intervention:** accessible during 26 weeks	TTM		
4. Herman (2006),[38] USA	Physical activity	**Design:** pretest-posttest **Recruitment:** NR **Condition:** Internet-based program **Incentive:** $150 cash rebate for participating in program	**Intervention:** online program providing goal setting and activity logging, containing feedback on progress and providing e-mail support; in addition participation in in-company sports teams and competitions was promoted **Name:** Virtual Fitness Center Program **Duration intervention:** 12 months with multiple visits	NR	67,324 participants	**% female**: 35 **Age (SD)**: 44.0 ± NR **% > high school:** NR
5. Hurling (2007),[39] UK	Total and moderate to vigorous physical activity	**Design:** RCT **Recruitment:** through market research recruitment agency **Conditions:** a. Internet and mobile phone based program combined with wearing physical activity monitors; b. wearing physical activity monitors without feedback and access **Incentive:** £30 for attending screening, £140 for mobile phone costs, and £290 at closeout	**Intervention:** multi-media (website, e-mail and mobile phone) program, providing tailored feedback on behaviour, cognitions, and progress, including goal setting, self-monitoring and weekly activity planning tools and option for social support **Name:** Get active! **Duration intervention:** 9 weeks with multiple visits	DB ELM SCPT	77 (a: 47; b: 30)	**% female**: 66 **Age (SD)**: 40.4 ± 7.6 **% > high school:** NR
6. Hurling (2006),[40] UK	Physical activity/ exercise	**Design:** RCT **Recruitment:** advertisement **Conditions:** a. Internet-based exercise motivation and action support system; b: less interactive version of same system; c. reference group with no intervention	**a. Intervention:** support system requiring weekly logins for self-monitoring and activity planning, providing feedback on progress and cognitions, automated dialogue system for barrier identification, option for e-mail or text message reminders of planned activities. **Name:** NR **Duration intervention:** 10 weeks with multiple visits	DB ELM SCPT	66 (a. 28; b. 24; c. 14)	**% female**: 74 **Age (SD)**: 35 ± NR **% > high school:** NR

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
			b. Intervention: Support system requiring weekly logins for self-monitoring and feedback on progress, less interactive than above **Name:** NR **Duration intervention:** 10 weeks with multiple visits	DB ELM SCPT		
7. Lewis (2008),[41] Marcus (2007),[42] USA	Physical activity and exercise	**Design:** RCT **Recruitment:** newspaper advertisements **Conditions:** a. motivationally tailored Internet intervention; b. 6 researcher selected websites available to the public; c. motivationally tailored print intervention **Incentive:** $10 each month to complete the online questionnaires and activity logs	**a. Intervention:** website providing motivational and educational materials, monthly tailored feedback reports on performance, cognitions and progress, containing goal setting and self-monitoring tools, regular e-mail prompts to revisit the website **Name:** NR **Duration intervention:** 12 months with multiple visits	SCT TTM	249 (a. 81; b. 82; c. 86)	**% female**: 83 **Age (SD)**: 45.1 ± 9.3 **% college graduate:** 67
			b. Intervention: website containing 6 links to general physical activity websites and self-monitoring tool; regular e-mail prompts to log onto the website **Name:** NR **Duration intervention:** accessible during 12 months	NR		
8. Leslie (2005),[16] Australia	Physical activity and exercise	**Design:** RCT **Recruitment:** university e-mail list **Conditions:** a. stage-targeted website program; b. stage-targeted print program	**Intervention:** website providing stage-targeted information on cognitive constructs, containing goal setting and activity planning tools; personalized stage-targeted weekly e-mails were used to attract visitors to the website **Name:** Active Living **Duration intervention:** accessible during 8 weeks	TTM	655 (a: 327; b: 328)	**% female**: 50 **Age (SD)**: 43 ± NR **% secondary school or higher:** 72

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
9. Plotnikoff (2006),[43] Canada	Raise awareness for physical activity	**Design:** observational **Recruitment:** advertisement cereal package, media, links website, word of mouth (self-reported) **Condition:** Internet-based intervention	**Intervention:** website providing goal setting, self-monitoring (of steps counted through pedometer), activity planning, and containing brief visual feedback on progress **Name:** Canada on the Move **Duration intervention:** NR (one-time users vs. multi-time users)	NR	3175 registrations	**% female**: 77 **% Age:** <24: 10.1; 25-44: 46.7; 45-64: 38.5; 65-80+: 4.6 **% >- high school:** 98
10. Spittaels (2006),[44] Belgium	Physical activity	**Design:** quasi-experimental **Recruitment:** flyers with and without personal contact **Condition**: interactive tailored Internet program (*remark: intervention a and b are identical, only the way of promotion differed*)	**Intervention:** website providing feedback on performance, perceived barriers and cognitions, including activity planning, and social support **Name:** NR **Duration intervention:** accessible during 2 months with single exposure	SCM TPB	52 (a: 46; b: 6)	**% female**: 51 **Age (SD)**: 38 ± 11 **% > high school:** 66
11. Spittaels (2007),[45] Belgium	Physical activity	**Design:** RCT **Recruitment:** brochures plus e-mail as prompt for first visit **Conditions:** a. Internet advice with repeated feedback; b. Internet advice without repeated feedback; c. waiting list control group	**a. Intervention:** website providing feedback on performance, cognitive constructs and progress, containing activity planning and social support, 7 non-tailored e-mails were used to prompt visits to specific website sections, one to prompt revisiting the intervention for new tailored advice **Name:** NR **Duration intervention:** accessible during 6 months with multiple visits	SCM TPB	434 (a: 173; b: 129; c: 132)	**% female**: 66 **Age (SD)**: 41.4 ± 5.6 **% > high school:** 67
			b. Intervention: website providing feedback on performance and cognitive constructs, including activity planning and social support **Name:** NR **Duration intervention:** accessible during 6 months with single exposure	SCM TPB		

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
12. Steele (2007),[46,47] Australia	Moderate intensity and lifestyle physical activity	**Design:** RCT **Recruitment:** advertisements local newspapers **Conditions:** a. Internet-only intervention; b. Internet-mediated intervention; c. face-to-face intervention **Incentive:** gift vouchers, water bottles, and sport socks	**a. Intervention:** website consisting of weekly modules aimed at improving self-management skills; program provides feedback on cognitive constructs, goal setting, self-monitoring (using pedometer information), barrier identification, activity planning and including options for online counsellor support and 2 face-to-face support sessions **Name:** Health-eSteps (Internet only) **Duration intervention:** 12 weeks with multiple visits	SCT SMM	192 (a: 62; b: 65; c: 65)	**% female**: 83 **Age (SD)**: 38.7 ± 12.0 **% > high school:** NR
			b. Intervention: website consisting of weekly modules aimed at improving self-management skills; program provides feedback on cognitive constructs, including goal setting, self-monitoring (using pedometer information), barrier identification, activity planning and including option for online counsellor support **Name:** Health-eSteps (Internet with online counsellor support) **Duration intervention:** 12 weeks with multiple visits	SCT SMM		
B. Nutrition						
					Mean: 344 **Median:** 285	
13. Buller (2008),[48] Woodall (2007),[49] USA	Fruit and vegetable consumption	**Design:** RCT **Recruitment:** in person by community outreach trainers **Conditions:** a. Internet intervention with immediate access to website; b. control group with delayed access after post-test	**Intervention:** website providing generic information to promote fruit and vegetable intake; e-mail prompts to announce new and updated information **Name:** 5 a day, the Rio Grande Way **Duration intervention:** accessible during 4 month study period with multiple visits	DIT SCT	755 (a: 380; b: 375)	**% female**: 88 **% age**: <30: 34; 30-39: 17; 40-49: 18; 50-59: 14; >59 14; missing 3 **% > high school:** 63

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
14. Huang (2006),[50] Australia	Purchases of saturated fat	**Design:** RCT **Recruitment:** online pop-up message **Conditions:** a: Internet intervention with tailored advice; b: generic information on static webpage	**a. Intervention:** website providing tailored feedback on selected items with the opportunity to retain or swap purchased item; provided as part of supermarket website **Name:** NR **Duration intervention:** accessible during 5 month study period for multiple shopping episodes	NR	497 (a: 251; b: 246)	**% female**: 88 **Age (SD)**: 40.0 ± 10 **% university:** 62
			b. Intervention: website that provided generic non-specific advice about how to choose a diet lower in saturated fat; intervention provided on supermarket website **Name:** NR **Duration intervention:** NR	NR		
15. McNeill (2007),[51] USA	Fruit and vegetable consumption	**Design:** observational **Recruitment:** NR, drawn from sample of larger study of health centres **Condition:** Internet-based intervention	**Intervention:** website providing non-tailored information on overcoming barriers, setting goals, social support and maintaining healthy behaviour, supplemented with an e-mail with feedback on intake and suggestions how to increase consumption **Name:** NR **Duration intervention:** accessible during 6 weeks	NR	52 enrolled	**% female**: 73 **Age (SD)**: 46 ± 9 **% > high school:** 77
16. Papadaki (2005),[52] Papadaki (2006),[53] Scotland	Consumption of four key components of the Mediterranean diet	**Design:** quasi-experimental **Recruitment:** advertisements in newsletters, flyers, postings on Intranet and e-mail advertisements **Conditions:** a. tailored Internet intervention; b. minimal dietary feedback and general healthy-eating brochures	**Intervention:** website providing generic information and recipes, supplemented with tailored feedback letters through e-mail containing feedback on performance, barriers, social cognitions and progress towards goal achievement **Name:** Mediterranean Eating Website **Duration intervention:** 6 months accessible with multiple visits	HBM PAPM SCT TPB TTM	72 (a: 53; b. 19)	**% female**: 100 **Age (SD)**: 40.5 ± 7.0 **% > high school:** 100

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
C. Weight management						
					Mean: 1006 **Median:** 207	
17. Cussler (2008),[54] USA	Weight maintenance through diet, physical activity and weight gain prevention	**Design:** RCT **Recruitment:** advertisement newspaper and TV **Conditions:** a. Internet intervention; b. self-directed (no intervention) control	**Intervention:** weight maintenance website (after following weight loss intervention) with tools for monitoring progress, peer support and optional counsellor support **Name:** NR **Duration intervention:** 12 months with multiple visits	NR	135 (a. 66; b. 69)	**% female**: 100 **Age (SD)**: 48.2 ± 4.4 **% > high school:** NR
18. Glasgow (2007),[21] USA	Weight loss through nutrition and physical activity	**Design:** RCT **Recruitment:** personal letters through medical leaders or notices in general member communications **Conditions:** a. online tailored weight management program with nutrition component and goal setting; b. online tailored weight management program with goal setting; c. online tailored weight management program with; nutrition component; d. online tailored weight management program **Incentive:** US $10 gift certificate by completing follow-up questionnaire	**a. Intervention:** website providing feedback on performance, cognitions and tailored action plans including a goal setting module and additional tailored newsletters regarding nutrition **Name:** Balance Program (goal + nutrition) **Duration intervention a:** 14 weeks with multiple visits	NR	2311 (a. 559; b. 584; c. 596; d. 572)	**% female**: 53 **% < 60 years:** 53.5 **% > high school:** NR
			b. Intervention: website providing feedback on performance, cognitions and tailored action plans, including a goal setting module **Name:** Balance Program (goal) **Duration intervention:** 6 weeks with multiple visits	NR		

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
			c. Intervention: website providing feedback on performance, cognitions and tailored action plans with additional tailored newsletters regarding nutrition **Name:** Balance Program (nutrition) **Duration intervention:** 14 weeks with multiple visits	NR		
			d. Intervention: website providing feedback on performance, cognitions and tailored action plans **Name:** Balance Program **Duration intervention:** 6 weeks with multiple visits	NR		
19. Gold (2007),[55] USA[b]	Weight loss through reducing calorie intake and increase aerobic activity	**Design:** RCT **Recruitment:** advertisements in local newspaper **Conditions:** a. structured behavioural weight loss program; b. commercial weigh loss website	**a. Intervention:** weekly online lessons with homework assignment and goal setting, providing exercise schedule, facilitator provided weekly/bi-weekly feedback on behaviour and self-monitoring, weekly chat sessions with facilitator **Name:** VTrim Program **Duration intervention:** 12 months with multiple visits	NR	124 (a. 62; b. 62)	**% female**: 84 **Age (SD)**: 47 ± 9 **% > high school:** 98
			b. Intervention: commercial program consisting of feedback on cognitions, self-monitoring, and feedback on progress, providing peer support and professional online meetings **Name b:** eDiets.com **Duration intervention:** 12 months with multiple visits	NR		
20. Harvey-Berino (2002),[56] USA	Weight loss maintenance through modification of eating and exercise habits	**Design:** RCT **Recruitment:** newspaper advertisements **Conditions:** a. Internet support; b. frequent in-person support; c. minimal in-person support **Incentive:** chance to enter a lottery to win $50 for attending scheduled assessment meetings	**Intervention:** website providing self-monitoring forms accompanied by bi-weekly Internet chat meetings facilitated by group therapist and introduced with short videos; bi-weekly e-mails from group therapist with feedback on behaviour and self-monitoring **Name:** NR **Duration intervention:** 12 months with multiple visits	NR	122 (a. 40; b. 41; c. 41)	**% female**: 85 **Age (SD)**: 48.4 ± 9.6 **% > high school:** 90

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
21. Hunter (2008),[57] USA	Weight gain prevention and weight loss through restricting calorie and fat intake, and increasing physical activity	**Design:** RCT **Recruitment:** e-mail advertisements and flyers **Conditions:** a. behavioural Internet therapy; b. usual care	**Intervention:** Internet-based program containing weekly interactive lessons and self-monitoring tool, feedback from an Internet counsellor on performance and progress, including two brief motivational interviewing telephone calls **Name:** Behavioral Internet Therapy (BIT) **Duration intervention:** 24 weeks with multiple visits	MI	446 (a. 224; b. 222)	**% female**: 50 **Age (SD)**: 33.9 ± 7.3 **% high school or some college:** 63
22. McConnon (2007),[58] UK	Weight loss through dietary and physical activity	**Design:** RCT **Recruitment:** posters and flyers in GPs waiting rooms/practices **Conditions:** a. Internet group; b. usual care	**Intervention:** website providing feedback on performance, self-monitoring tool, and feedback on progress, including e-mails prompts for revisiting website **Name:** UK weight control site **Duration intervention:** 12 months with multiple visits	NR	221 (a. 111; b. 110)	**% female**: 77 **Age (SD)**: 45.8 ± 10.6 **% > high school:** NR
23. McCoy (2005),[59] Australia	Weight loss through changing physical activity and dietary behaviour	**Design:** Observational **Recruitment:** promotional interviews on radio stations **Condition**: Internet-based program	**Intervention:** Internet service delivering tailored plans for behaviour change based on current health status and personal needs and goals with respect to diet and physical activity **Name:** Weight Loss for Diabetes Prevention Program **Duration intervention:** accessible during 10 weeks	NR	808 registrations	**% female**: 75 **Age (SD)**: 42.3 ± 11.6 **% > high school:** NR
24. Micco (2007),[60] USA[b]	Weight loss through changing eating and exercise behaviour	**Design:** RCT **Recruitment:** newspaper advertisements **Conditions:** a. Internet intervention only; b. Internet intervention including in-person support	**a. Intervention:** weekly online lessons with homework assignment and goal setting, providing exercise schedule, facilitator provided weekly/bi-weekly feedback on behaviour and self-monitoring, weekly chat sessions with facilitator **Name:** VTrim (Internet only) **Duration intervention:** 12 months with multiple visits	NR	123 (a. 62; b. 61)	**% female**: 83 **Age (SD)**: 46.7 ± 10.8 **% > high school:** 93
			b. Intervention: weekly online lessons with homework assignment and goal setting, providing exercise schedule, facilitator provided weekly/bi-weekly feedback on behaviour and self-monitoring, monthly in-person group sessions **Name:** VTrim (Internet with in-person support) **Duration intervention:** 12 months with multiple visits	NR		

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
25. Petersen (2008),[61] USA	Weight management by creating life long habits	**Design:** pretest-posttest **Recruitment:** announcement on employee web portal with limited promotion **Condition:** Internet-based program	**Intervention:** comprehensive, interactive online program providing self-monitoring, and feedback on performance and progress, containing interactive tools and e-mail communications towards personalized goal achievement **Name:** Virtual Food Pro (VFP) program **Duration intervention:** 18 weeks (recommended duration) with multiple visits, however ongoing program	SCM	7743 participants	**% female**: 60 **Age (SD)**: NR **% > high school:** NR
26. Tate (2001),[62] USA	Weight loss through calorie restriction and increased physical activity	**Design:** RCT **Recruitment:** series of 2 e-mail messages and an advertisement posted to the work site's Intranet website **Conditions**: a. Internet education + Internet behaviour therapy; b. Internet education **Incentive:** $10 and $25 for attending the 3- and 6-month follow-up appointments	**a. Intervention:** website providing a brief review of basic information and organized directory of selected Internet resources (e.g., self-monitoring) and other resources, additionally weekly e-mail lessons and feedback and support from therapist and access to bulletin board **Name:** NR **Duration intervention:** accessible during 24 weeks	NR	91 (a: 46; b: 45)	**% female**: 89 **Age (SD)**: 40.9 ± 10.6 **% > high school:** 91
			b. Intervention: website providing a brief review of basic information and organized directory of selected Internet resources (e.g., self-monitoring) and other resources **Name:** NR **Duration intervention:** accessible during 24 weeks	NR		

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
27. Tate (2006),[63] USA	Weight loss through calorie restriction and increased physical activity	**Design:** RCT **Recruitment:** local newspaper advertisements **Conditions**: a. website with computer-automated e-mail feedback; b. website with human counselling; c. website with no counselling **Incentive:** $25 and $50 for attending the 3- and 6-month follow-up appointments	**a. Intervention:** website with additional study website containing self-monitoring diary and automated feedback on performance and progress, providing social support, and e-mail prompts to complete diary including behavioural lesson **Name:** Slim-Fast Web site combined with website with automated feedback **Duration intervention:** 6 months with multiple visits	CBT	192 (a. 61; b. 64; c. 67)	**% female**: 84 **Age (SD)**: 49.2 ± 9.8 **% > high school:** 55
			b. Intervention: website with additional study website containing self-monitoring diary and social support supplemented with human e-mail counselling providing feedback on performance and progress, e-mail prompts to complete diary including behavioural lesson **Name:** Slim-Fast Web site combined with website and human e-mail counselling **Duration intervention:** 6 months with multiple visits	NR		
			c. Intervention: website containing self-monitoring tool, providing feedback on progress, including social support and weekly e-mail prompts to report weight **Name:** Slim-Fast Web site **Duration intervention:** accessible during 6 months	NR		
28. Webber (2008),[64] USA	Weight loss through physical activity and dietary habits	**Design:** RCT **Recruitment:** newspaper advertisement **Conditions:** a. intervention website with weekly moderated online chat group sessions; b. intervention website **Incentive:** $40 for attending the follow-up appointment	**a. Intervention:** Internet behavioural program with weekly lessons, self-monitoring, information links and social support supplemented with weekly moderated online chat group sessions **Name:** NR, enhanced website **Duration intervention:** 16 weeks with multiple visits	MI	66 (a. 33; b. 33)	**% female**: 100 **Age (SD)**: 50.1 ± 9.9 **% > high school:** 70

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
			b. Intervention: Internet behavioural program with weekly lessons, self-monitoring, information links and social support **Name:** NR, minimal website **Duration intervention:** 16 weeks with multiple visits	NR		
29. Van Wier (2009),[65] Netherlands	Weight loss through sustainable lifestyle changes (reduction of calories through fat, sugar and alcohol and increasing physical activity)	**Design:** RCT **Recruitment:** health faire, company Intranet and/or personal letter **Conditions:** a. web-based intervention with e-mail counselling; b. intervention materials with phone counselling; c. usual care through lifestyle brochures	**Intervention:** interactive website with 10 homework modules and individualized webpages supplemented with e-mail counselling, also provided with self-help materials **Name:** ALIFE@Work **Duration intervention:** 6 months with multiple visits	SCT	1386 (a. 464; b. 462; c. 460)	**% female**: 33 **Age (SD)**: 43 ± 8.6 **% highly educated:** 60
30. Wing (2006),[66] USA	Weight gain prevention with emphasis on daily self-weighing and self-regulation	**Design:** RCT **Recruitment:** newspaper advertisements, brochures, and contacts with commercial and research weight-control programs **Conditions:** a. Internet-based intervention; b. face-to-face intervention; c. control group receiving quarterly newsletters **Incentive:** $25 for attending the 6- and 12-month assessments and $50 for attending the 18-month assessment	**Intervention:** intervention program with online chat sessions, web-based form for self-monitoring and social support; individual e-mail counselling was offered in case of weight gain until starting weight was reached **Name:** STOP Regain **Duration intervention:** 18 months with multiple visits	SRT	314 (a. 104; b. 105; c. 105)	**% female**: 81 **Age (SD)**: 51.3 ± 10.1 **% > high school:** NR

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
D. Smoking cessation						
					Mean: 3437 **Median:** 1160	
31. Balmford (2008),[67] Australia	Smoking cessation	**Design:** observational **Recruitment:** promotion through national quit smoking websites **Condition:** tailored automated advice Internet program	**Intervention:** website providing feedback on behavioural strategies, cognitive restructuring, motivation and relapse prevention with the aims to resemble in-persons counselling; website consisted of 5 modules that could be accessed during one visit **Name:** QuitCoach **Duration intervention:** NR, continuously accessible and designed for multiple visits	CBT RPM Perspectives on change (derived from SCM)	23,656 registrations	**% female**: 62 **Age (median)**: 24 **% > high school:** NR
32. Brendryen (2008),[68] Norway	Smoking cessation	**Design:** RCT **Recruitment:** online banner advertisements on websites or regional newspapers **Conditions:** a. Internet and cell phone based intervention; b. control group receiving 44-page self-help booklet	**Intervention:** multi-media (website, e-mail and SMS text messaging and interactive voice response system (IVR)) program, including a craving helpline and a relapse prevention system with just-in-time therapy; program provides information on a variety of determinants and processes for change, relevant in various phases of the process toward quitting smoking; information is provided through daily websites during the first phase of the intervention, supplemented with text messages and voice response messages **Name:** Happy Ending **Duration intervention:** 54 weeks with multiple visits	BSL CBT SCT SRT	290 (a. 144; b. 146)	**% female**: 50 **Age (SD)**: 39.6 ± 10.9 **% > high school:** 50
33. Brendryen (2008),[69] Norway	Smoking cessation	**Design:** RCT **Recruitment:** Online banner advertisements on Internet newspapers **Conditions:** a. Internet and cell phone –based intervention; b. control group receiving 44-page self-help booklet **Incentive:** free supply of NRT	**Intervention:** multi-media (website, e-mail and SMS text messaging and interactive voice response system (IVR)) program, including a craving helpline and a relapse prevention system with just-in-time therapy; program provides information on a variety of determinants and processes for change, relevant in various phases of the process toward quitting smoking; the information is provided through daily websites during the first phase of the intervention, supplemented with text messages and voice response messages **Name:** Happy Ending **Duration of intervention**: 54 weeks with multiple visits	BSL CBT SCT SRT	396 (a. 197; b. 199)	**% female**: 50 **Age (SD)**: 36.2 ± 10.2 **% > high school:** 41

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
34. Cobb (2005),[70] USA	Smoking cessation	**Design:** observational **Recruitment:** NR **Conditions:** Internet-based intervention	**Intervention:** website providing feedback on cognitive and behavioural processes, assistance with setting a quit date, action and coping planning, relapse prevention, information about medication support and options for peer and online counselling support. **Name:** QuitNet **Duration of intervention:** NR	SCM	1501	**% female**: 65 **Age (SD)**: 35.2 ± 10.8 **% > high school:** 80
35. Danaher (2006),[32] USA	Cessation of smokeless tobacco	**Design:** RCT **Recruitment:** print and broadcast media, Google ads, websites links, and mailings to target group, health care and tobacco control professionals **Conditions:** a. enhanced condition web-based program (interactive, tailored, and rich-media program); b. basic condition control website (static, text-based material)	**a. Intervention:** interactive and tailored web-based program offering eight modules, including text-based information (health and behavioural strategies focused on quitting and preventing relapse), video-based testimonials, printable resources, interactive activities, annotated links to other website resources, and two web forums one for support by peers and one for support by experts **Name:** ChewFree.com (enhanced) **Duration intervention:** NR	SCT	2375 (a. 1200; b. 1175)	**% female**: NR **Age (SD)**: NR **% > high school:** NR
			b. Intervention: website providing a printable self-help smokeless tobacco cessation booklet, printable cessation resources (e.g., describing the use of herbal snuff products, nicotine replacement products), and annotated links to other recommended websites for tobacco cessation **Name:** ChewFree.com (basic) **Duration of intervention:** NR	SCT		

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
36. Feil (2003),[71] USA	Smoking cessation	**Design:** RCT **Recruitment:** website search engines, banner advertisements, postings to discussion groups, newspaper advertisement and article, brochures at dental clinics and doctor's offices, radio interview **Condition:** Internet-delivered intervention **Incentive:** all subjects who completed the baseline survey were mailed checks for US$10 1. e-mail 10 dollar; 2. e-mail 20 dollar, 3 US mail 10 dollar, 4 US mail 20 dollar	**Intervention:** website providing guidance in improving motivation to quit, avoidance and dealing with cravings and setting a quit date, options for social support by peers and experts **Name:** Quit-Smoking-Network **Duration intervention:** NR	NR	606 enrolled	**% female**: 72 **% aged 25-54**: 85 **% > high school:** 80
37. Graham (2007),[72] USA	Smoking cessation	**Design:** pretest-posttest **Recruitment:** company's Intranet and e-mail **Condition**: Internet-based worksite intervention	**Intervention:** commercial program providing feedback on cognitive and behavioural processes, assistance with setting a quit date, action and coping planning, relapse prevention, information about medication support and unlimited use of options for peer support and online counselling support **Name:** QuitNet **Duration intervention:** NR	SCM	1776 program users	**% female**: 35 **Age (SD)**: 44.1 ± 9.6 **% > high school:** NR
38. Houston (2008),[73] USA	Smoking cessation	**Design:** quasi-experimental **Recruitment:** Google advertisements **Conditions:** a. website with extensive introduction; b. website with minimal introduction **Incentive:** a $20 gift certificate to a popular online store as reimbursement for completing the questionnaire for both Phase 1 and Phase 2 users	**a. Intervention:** website providing stage tailored self-management advice and advice on how to get assistance and support from others (family, doctors) to quit smoking; elaborate introduction to the program content **Name:** Free2Quit (extensive introduction) **Duration intervention**: NR	HBM SCT TTM	231 (a. 105; b. 126)	**% female**: 71 **% age**: <30: 19.0; 30-45: 47.6; 46-60: 32.0; >60: 1.3 **% > high school:** 63

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
			b. Intervention: website providing stage tailored self-management advice and advice on how to get assistance and support from others (family, doctors) to quit smoking; brief introduction to the program content. **Name:** Free2Quit (minimal introduction) **Duration intervention**: NR	HBM SCT TTM		
39. Lenert (2003),[22] USA	Smoking cessation	**Design:** pretest-posttest **Recruitment:** e-mail invitation **Condition:** web and e-mail based program	**Intervention:** web and e-mail based program primarily aimed at mood management; the program consisted of 8 modules that had to be accessed one at the time but could be completed in one visit, including self-monitoring tools, feedback on behaviour, and e-mail prompts for revisits; additional educational information and materials could be browsed **Name:** NR **Duration intervention**: 8 weeks which could be completed in one visit, but also through multiple visits	MM CBT	49 website users	**% female**: 78 **Age (SD)**: 46 ± NR **% > high school:** 75
40. McKay (2008),[74] USA	a. smoking cessation, b. smoking cessation through improving physical activity	**Design:** RCT **Recruitment:** advertisements on search engines and website links **Conditions**: a. web-based program with information and behavioural strategies; b. web-based personalized fitness program that would help to quit smoking	**a. Intervention:** website designed to encourage tobacco abstinence via the use of strategies that address each participant's behaviour, cognition, environment and self-management skills; provides options for peer and expert support **Name:** Quit smoking network (QSN) **Duration intervention:** NR	SCT	2318 (a: 1159; b: 1159)	**% female:** 71 **% age:** <30: 22.4; 30-39: 23.4; 40-49: 29.6; >50: 24.6 **% > high school:** 68
			b. Intervention: website encouraging participants to participate in a fitness program, to help them quit smoking; program provides tailored feedback on performance, providing goal setting, activity planning and monitoring of progress and includes access to additional online resources and a web-forum for peer support. **Name:** Active Lives **Duration intervention:** NR	SCT		

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
41. Saul (2007),[75] USA	Smoking cessation	**Design:** pretest-posttest **Recruitment:** additional screen during registration process **Condition:** Internet-based intervention **Incentive:** a US $10 check for completing follow-up survey	**Intervention:** Internet-based program providing feedback on cognitive and behavioural processes, assistance with setting a quit date, action and coping planning, relapse prevention, information about medication support and options for peer support and online counselling support **Name:** Quitplan.com **Duration intervention:** NR	SCM	607 registered visitors	**% female:** 64 **Age (SD):** 37.9 ± NR **% > high school:** 82
42. Severson (2008),[31] USA	Smoke free tobacco cessation	**Design:** RCT **Recruitment:** print and broadcast media, Google ads, websites links, and mailings to target group, health care and tobacco control professionals **Conditions:** a. interactive, tailored web-based program (enhanced condition); b. more linear, text-based website (basic condition) **Incentive:** $10 for each follow-up assessment and an additional $20 by completing all three follow-up assessments	**a. Intervention:** web-based intervention, providing tailored feedback on cognitive and behavioural processes for change, guidance in making a quit plan, support in staying quit, and options for support by peers and counsellor **Name:** ChewFree.com (enhanced condition) **Duration intervention:** NR, but multiple visits	SCT	2523 (a. 1260; b. 1263)	**% female:** 2 **Age (SD):** 36.8 ± 9.6 **% > high school:** 81
			b. Intervention: website providing linear text-based printable information on quitting and useful resources **Name:** ChewFree.com (basic condition) **Duration intervention:** NR	SCT		
43. Stoddard (2005),[76] USA	Smoking cessation	**Design:** pretest-posttest **Recruitment:** announcements on list serves, registration with popular search engines, and a direct e-mail **Conditions:** Internet self-help educational intervention	**Intervention:** website providing tailored feedback on nicotine dependency and depressive symptoms and subsequent access to an online quit smoking and nicotine replacement guide. **Name:** NR **Duration intervention:** one time visit	NR	538 participants	**% female:** 74 **% age:** 18-24: 5.2; 25-44: 48.5; 45-64: 42.7; 65+: 3.5 **% > high school:** 54

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
44. Stoddard (2008),[77] USA	Smoking cessation	**Design:** RCT **Recruitment:** e-mail invitations **Conditions:** a. website including a bulletin board; b. same website without bulletin board **Incentive:** either a 100 minute prepaid calling or US$7.40 postal stamp for those not completing follow-up after	**a. Intervention:** website providing online quit guide, targeted to stages of change, 5 unique (downloadable) self-help materials targeted to specific groups, evidence based information on positive health changes after quitting, option to contact counsellor for support and peer support through bulletin board **Name:** Smokefree.gov (including bulletin board) **Duration intervention:** NR	NR	1375 (a. 684; b. 691)	**% female:** 54 **Age (SD):** 43.6 ± 10.3 **% > high school:** 87
			b. Intervention: website providing online quit guide, targeted to stages of change, 5 unique (downloadable) self-help materials targeted to specific groups, evidence based information on positive health changes after quitting, option to contact counsellor for support **Name:** Smokefree.gov (without bulletin board) **Duration intervention:** NR	NR		
45. Strecher (2005),[78] England and Ireland	Smoking cessation among nicotine patch users	**Design:** RCT **Recruitment:** advertisements on nicotine patches **Conditions:** a. tailored intervention website; b. non-tailored web-based smoking cessation materials **Incentive:** £5 of oral care products by completing either 6- or 12-week, by completing £20 of oral care products	**a. Intervention:** provision of a web-based cessation guide and three sequential online tailored newsletters providing feedback on cognitive and behavioural concepts and behavioural support messages delivered via e-mail; opportunity to identify a supportive person who subsequently received an e-mail message with tailored advice **Name:** CQ plan **Duration of intervention:** 10 weeks with multiple visits	CBM of smoking cessation RPM	3971 (a. 1991; b. 1980)	**% female:** 57 **Age (SD):** 36.9 ± 10.2 **% > high school:** NR
			b. Intervention: website providing non-tailored information on cognitive-behavioural concepts **Name:** NR **Duration intervention:** accessible during 10 weeks	CBM of smoking cessation RPM		

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
46. Strecher (2008),[79,80] USA	Smoking cessation	**Design:** RCT **Recruitment:** invitation letter to smokers selected by 2 health care organizations **Conditions:** a. intervention website with multiple visits; b. intervention website with single visits **Incentive:** 10-week course of NRT	**a. Intervention:** website consisting of 5 modules that could only be accessed through multiple visits, providing tailored feedback on cognitive and behavioural processes, feedback on barrier identification, and possibility to set quit date, containing success stories and e-mail prompt to encourage revisits **Name:** Project Quit (multiple visits) **Duration intervention:** 5 weeks with multiple visits	CBM of smoking cessation RPM	944 (a. 487; b. 457)	**% female:** 60 **Age (SD):** 46.3 ± NR **% > high school:** 64
			b. Intervention: website consisting of 5 modules that could be accessed in a single visit, providing tailored feedback on cognitive and behavioural processes, feedback on barrier identification, and possibility to set quit date, containing success stories **Name:** Project Quit (single visit) **Duration intervention:** 1 time visit	CBM of smoking cessation RPM		
47. Swartz (2006),[81] USA	Smoking cessation	**Design:** RCT **Recruitment:** through large worksites (posters, brochures, link Intranet, e-mail employees, electronic newsletters) **Conditions:** a. Internet treatment condition; b. wait list control group	**Intervention:** website providing tailored feedback on cognitive and behavioural constructs and on planning to quit, containing video and audio fragments; separate content is provided for users from different race/ethnicity, sex and age **Name:** 1-2-3 Smokefree **Duration intervention:** one time visit, but multiple visits was encouraged	NR	351 (a. 171; b. 180)	**% female:** 52 **% age:** 18-25: 7.4: 26-39: 38.2; 40-55: 48.4; > 55: 6.0 **% > high school:** NR
48. Wang (2004),[82] Switzerland	Smoking cessation	**Design:** observational study **Recruitment:** via links and search engines **Condition:** web-based intervention	**Intervention:** online feedback program, providing tailored counselling letters with feedback on cognitive and behavioural constructs and feedback on progress, option to access forum and additional documents **Name:** Stop-Tabac **Duration intervention:** NR	RPM TPB TTM	18,361 unique users	**% female:** 49 **Age (SD):** 36 ± 11 **Average years of schooling:** 15

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
E. Alcohol reduction						
					Mean: 6128 **Median:** 288	
49. Cloud (2001),[83] USA	Abstaining or controlled drinking	**Design:** observational **Recruitment:** e-mail posting in newsgroup and search engines **Condition:** interactive web-based intervention	**Intervention:** website providing feedback on performance, risk for addiction, and cognitions, with access to online self-help manual **Name:** Carebetter.com **Duration intervention:** one time visit during 172 trial period	NR	2813 registrations	**% female**: 36 **Age (SD)**: 32 ± 10.3 **Education in years (SD):** 14.8 ± 3.6
50. Cunningham (2000),[84] Canada	Problem drinking, drinking habits	**Design:** observational study **Recruitment:** NR **Condition:** tailored Internet program	**Intervention:** website providing feedback on performance, normative feedback, and educational information **Name:** Try our free drinking evaluation **Duration intervention:** one time visit	NR	214 registrations	**% female**: 58 **Age (SD)**: 33.8 ± 12.6 **% > high school:** NR
51. Lieberman (2006),[85] USA	Alcohol abuse	**Design:** RCT **Recruitment:** no advertisement but spontaneously through search engines **Conditions:** a. intervention with feedback in multimedia context b. intervention with feedback in html text form	**a. Intervention:** multimedia website providing feedback on the negative effects of alcohol consumption on every day life, including an online guide who leads the visitor through the feedback process **Name:** Alcohol Checkup (multimedia context) **Duration intervention:** one time visit during 18 month	NR	288 (a. NR; b. NR)	**% female**: NR **Age (SD)**: NR **% > high school:** NR
			b. Intervention: website providing feedback on performance in a html text form **Name:** Alcohol Checkup (html text format) **Duration intervention:** one time visit during 18 months	NR		

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
52. Linke (2004),[86] Linke (2005),[87] UK	Excessive alcohol consumption	**Design:** observational study **Recruitment:** press releases and news items in national media, 50,000 leaflets distributed to GPs, articles in professional publications in alcohol field, links in search engines and on appropriate health websites **Condition**: Internet-based interactive intervention	**Intervention:** website providing feedback on performance and cognitive constructs, self-monitoring and social support, providing educational materials; program consists of 6 consecutive intervention modules designed to be accessed at weekly intervals **Name:** Down Your Drink (DYD) **Duration intervention:** 6 weeks with multiple visits	CBT MET RPM SCM	1319 registrations	**% female**: 44 **Age (SD)**: NR **% > high school:** NR
53. Linke (2007),[88] UK	Promotion of sensible drinking	**Design:** observational study **Recruitment:** Off-line advertising campaign **Condition:** Internet-based interactive intervention	**Intervention:** website providing feedback on performance and cognitive constructs, self-monitoring and social support, providing educational materials; program consists of 6 consecutive intervention modules designed to be accessed at weekly intervals **Name:** Down Your Drink (DYD) **Duration intervention:** 6 weeks with multiple visits	CBT MET RPM SCM	10,000 registrations	**% female**: 51 **Age (SD)**: 37.4 ± 9.8 **% > high school:** NR
54. Matano (2007),[89] USA	Reduction of alcohol consumption	**Design:** RCT **Recruitment:** mailing of a descriptive recruitment flyer **Conditions**: a. intervention with full individualized feedback; b. intervention with limited individualized feedback **Incentive:** $20 + t-shirt	**a. Intervention:** website providing tailored feedback on performance, stress levels, cognitions and progress, self-monitoring and social support, provision of mini-workshops **Name:** Coping Matters (full individualized feedback) **Duration intervention:** accessible during 90 days	SLT	229 (a. NR; b. NR)	**% female**: 78 **Age (SD)**: 39.9 ± 11.3 **% > high school:** 83.9
			b. Intervention: website providing generic information on alcohol consumption and tailored feedback on stress levels and cognitions, however limited compared to above **Name:** Coping Matters (limited individualized feedback) **Duration intervention:** accessible during 90 days	SLT		

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
55. Riper (2008),[90] Netherlands	Reduction of alcohol consumption	**Design:** RCT **Recruitment:** advertisements in national newspapers and on health related websites **Conditions:** a. web-based interactive self-help intervention; b. online psycho-educational brochure	**a. Intervention:** web-based self-help program providing feedback on behaviour, cognitive constructs and progress, providing goal setting, self-monitoring, and social support **Name:** Minder Drinken (Drinking Less) **Duration intervention:** 6 weeks recommended treatment period with multiple visits	Cognitive behavioural and self-control principles	261 (a. 130; b. 131)	**% female**: 49 **Age (SD)**: 46 ± 9.0 **% vocational and academic education:** 69.7
			b. Intervention: website that provided a web-based psycho-educational brochure on the effects of alcohol use on physical and social functioning. **Name:** NR **Duration intervention:** 1 time visit	NR		
56. Saitz (2004) [91], USA	Alcohol use	**Design:** Observational study **Recruitment:** national banner-ad public service campaign on hundreds of commercial websites, features as a resource on large television program and linked to online stories, distribution of flyers, referrals from Internet search engines **Condition:** web-based intervention	**Intervention:** website providing feedback on performance, and access to additional information through online information library and searchable national database **Name:** Alcohol screening **Duration intervention:** one visit during 14-month period	HBM	39,842 registrations	**% female**: 33 **Age (SD)**: 32 ± 11 **% > high school:** NR
57. Westrup (2003),[92] USA	Reduction of alcohol consumption	**Design:** quasi-experimental **Recruitment:** brochure mailings **Conditions:** a. full individualized feedback; b. limited individualized feedback	**a. Intervention:** website providing tailored feedback on performance, stress levels, cognitions and progress, providing self-monitoring and social support, provision of mini-workshops **Name:** Coping Matters (full individualized feedback) **Duration intervention:** NR, with multiple visits	SLT	187 (a. NR; b. NR)	**% female**: 77 **Age (SD)**: 40.9 ± 11.5 **% > high school:** 81

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
			b. Intervention: website providing generic information on alcohol consumption and tailored feedback on stress levels and cognitions, however limited compared to above **Name:** Coping Matters (limited individualized feedback) **Duration intervention:** NR, with multiple visits	SLT		
F. Combination of behaviours						
					Mean: 1499 **Median:** 419	
58. Cook (2007),[93] USA	Nutrition/weight management, fitness/physical activity, and stress management	**Design:** RCT **Recruitment:** e-mail letter with online flyer from management, and posters **Conditions:** a: web-based condition; b: print materials **Incentive:** monetary incentives of $50/survey and raffle prize of $500	**Intervention:** multimedia (website, video) multi-component program, providing feedback on dietary and physical activity behaviours, cognitions and progress, including interactive calorie logbook, goal setting and action planning options, video testimonials, skills training and audio narration; intervention consists of three extensive programs for improving diet and physical activity and reduce stress, each taking 2-3 hours to complete. **Name:** Health Connection **Duration intervention:** NR, multiple visits were encouraged	SCT TTM	419 (a: 209; b: 210)	**% female**: 72 **Age (SD)**: 42 ± NR **% > high school:** 95
59. Cowdery (2007),[94] USA	Smoking cessation, weight management, nutrition, physical activity, alcohol, injury prevention, mental health, skin protection	**Design:** observational study **Recruitment:** print and electronic communication **Condition:** web-based tailored program	**Intervention:** commercial, health risk assessment program providing feedback on performance and stage of change relevant cognitions, information on associated risk factors and action planning tool **Name:** NR **Duration intervention:** 1 visit during 4-month implementation period	HBM SCT TTM	90 participants	**% female**: 82 **Age (SD)**: 45 ± NR **% > high school:** 94

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
60. Oenema (2008),[95] Netherlands	Saturated fat intake, physical activity, and smoking cessation	**Design:** RCT **Recruitment:** e-mail **Conditions:** a. tailored Internet intervention; b. no intervention waiting list control group **Incentive:** €10 for completing study	**Intervention:** website providing tailored feedback on behaviour, cognitions, and progress (for smoking cessation only), providing formation of implementation intentions **Name:** Gezondlevencheck (Healthy Life Check) **Duration intervention:** 1 visit	PAPM SCSM (modified version of SCM)	2159 (a: 1080; b. 1079)	**% female**: 54 **Age (SD)**: 43.6 ± 10.1 **% medium or high educational:** 73
61. Verheijden (2007),[23] Netherlands	Health promotion through several lifestyle behaviours aimed at physical activity as core behaviour, and dietary habits, alcohol intake, smoking, work, cardio-respiratory fitness, and muscle strength	**Design:** observational study **Recruitment:** press release and free publicity in newspapers and magazines **Condition:** web-based program	**Intervention:** online health promotion program providing feedback on performance and progress, containing self-tests; program consists of different modules that could be accessed by revisits **Name:** Dutch National Health Test **Duration intervention:** 2 weeks with multiple visits	NR	6272 visitors	**% female**: 66 **Age (SD)**: 36 ± 13 **% intermediate to (very) high educational level:** 90
62. Ware (2008),[96] UK	Weight loss, weight management, physical activity	**Design: o**bservational study **Recruitment:** leaflet distribution during working hours **Conditions**: web-based and monitoring device-based program	**Intervention:** multi-media (Internet, e-mail and mobile phone) program providing tailored feedback on performance and progress and goal setting, action planning, and social support; self-monitoring data is collected through accelerometers and weighing scales connected with the program through Bluetooth **Name:** MiLife **Duration intervention:** 12 weeks with multiple visits	SCPT DB	265 visitors	**% female**: 51 **Age (SD)**: 40.9 ± 8.1 **% > high school:** NR

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
63. Winett (2007),[97] USA	Fat, fibre, and fruit and vegetable intake, physical activity	**Design:** RCT **Recruitment:** pulpit announcements, flyers, posters, bulletins and kickoff luncheons **Conditions:** a. Internet program with series of church-based support; b. Internet program; c. waiting list control group **Incentive:** $20 for assessments at pretest, $30 at posttest, and $40 at follow-up	**a. Intervention:** website providing tailored feedback on performance and progress, goal setting and self-monitoring, audio narrated; use of the program was promoted by prompts from the pulpit and in in-church bulletins and newsletters; newsletters also provided feedback on church wide achievement of nutrition and physical activity goals **Name:** Guide to Health (with church-based support) **Duration intervention:** 12 weeks with multiple visits	SCT	1071 (a. 364; b. 364; c. 343)	**% female**: 67 **Age (SD)**: 51.4 ± 15.8 **% > high school:** NR
			Intervention: website providing tailored feedback on performance and progress, goal setting and self-monitoring, audio narrated; use of the program was promoted by prompts from the pulpit and in in-church bulletins and newsletters; without feedback on church wide achievement of nutrition and physical activity goals **Name:** Guide to Health (Internet only) **Duration intervention:** 12 weeks with multiple visits	SCT		

Study[a]	Target behaviour	Study characteristics	Brief description of Internet intervention, name and duration	Theory[c]	No. of study participants	Characteristics study population
64. Woolf (2006),[98] USA	Healthy diet, physical activity, smoking cessation, and reduced problem drinking	**Design:** quasi-experimental **Recruitment:** aggressive promotion by physicians and nurses of primary care practices, wall papers, and telephone hold-line messages **Conditions:** a. intervention website with tailored health advice; b. control group directed to static pages with limited information	**a. Intervention:** website providing tailored feedback on performance and cognitions, including access to tailored resource library with website links to local and national organizations and agencies **Name:** My Healthy Living (tailored advice) **Duration intervention:** 1 visit during 9 month period	TTM	273 (a. 177; b. 96)	**% female + age**: a. 79% female and <50; b. 71% female and <50 **% > high school:** NR
			b. Intervention: website providing static generic information pages on the 4 health behaviours, and general health promotion tips **Name:** My Healthy Living (static) **Duration intervention:** 1 visit during 9 month period	NR		

Notes: NR=not reported; RCT=randomized controlled trial; NRT=nicotine replacement therapy

[a] Information of publications that evaluated and reported on the same interventions but were separate studies were combined. This applies to the following studies: both studies of Hurling,[39,40], Gold[55] and Micco,[60] both studies of Brendryen,[68,69] Cobb[70] with Graham[72] and Saul,[75] Danahar[32] and Severson,[31] both studies of Linke,[86-88] and Matano[89] and Westrup[92]

[b] Both Internet interventions a. from Gold[55] and Micco[60] are identical as they come from the same study but are compared in two publications to a another intervention

[c] BSL=Behavioural Skills Learning; CBM=Cognitive–behavioural methods; CBT=Cognitive Behavioural Therapy; DB=Decisional Balance; DIT=Diffusion of Innovations Theory; ELM=Elaboration Likelihood Model; EM=Ecological Models; HBM=Health Belief Model; MET=Motivational Enhancement Therapy; MI=Motivational Interviewing; MM=Mood Management; PAPM=Precaution Adoption Process Model; RPM=Relapse Prevention Model; SCM=Stage of Change Model; SCSM=Social Cognitive Stages Model; SCPT=Social Comparison Theory; SCT=Social Cognitive Theory; SLT=Social Learning Theory; SMM=Self-Management Model; SRT=Self-Regulation Theory; TPB=Theory of Planned Behaviour; TTM=Transtheoretical Model

5

Characteristics of visitors and revisitors to an Internet-delivered computer-tailored lifestyle intervention implemented for use by the general public

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Abstract

The Internet has become important for the delivery of behaviour change interventions. This observational study examines how many people visited, registered and revisited a web-based computer-tailored intervention promoting heart-healthy behaviours when it is implemented for use by the general public. Among registered visitors, the association between visitors' characteristics and initiating, completing and revisiting the website and/or its behaviour-specific modules was analyzed. Server statistics showed that 285,146 visitors from unique IP addresses landed on the homepage in a 36-month period; of these, >50% left the intervention website within 30 s. In total, 81,574 (28.6%) visitors completed the registration procedure and gained access to the intervention; 99% of registered visitors initiated one module, 91% completed at least one module and 6% revisited the intervention. The majority of the registered visitors were women, medium to highly educated, with a body mass index (BMI) <25. Women, visitors aged 40–50 years, visitors with a medium educational level and visitors with a BMI<25 were more likely to initiate and finish the modules. It is concluded that a heart-healthy computer-tailored Internet program can reach substantial numbers of people, but additional research is needed to develop promotional strategies that reach the high-risk population, i.e., men, older and lower educated persons.

Introduction

The Internet has become a key medium to obtain health information.[1-3] It is, therefore, a very attractive mass medium for the delivery of behaviour change interventions since it allows to deliver individualized feedback and advice by means of computer tailoring.[4-6] An increasing number of health professionals have started to use the Internet to deliver behaviour change interventions on various health topics such as diet,[7,8] physical activity,[9,10] smoking cessation[11,12] or a combination of these topics.[6,13,14] Although the Internet has the potential to reach large numbers of people,[15,16] the actual reach of interventions seems to lag behind these high expectations.[17,18] Moreover, it may be difficult to keep visitors engaged long enough in the intervention program so that they become exposed to at least the most important parts of the program.[19-23] As stressed in the Diffusion of Innovations Theory[24] and also in the Reach, Efficacy, Adoption, Implementation and Maintenance (RE-AIM) framework,[25] it is important to know the characteristics of those who adopt an intervention.[24] It is also important to know who visits these intervention programs and how visitors use the program, e.g., which parts or modules do they visit, do they finish complete modules and do they revisit the Internet intervention. More insight into the characteristics of users who are currently reached, and those who actually use and revisit a program, may elucidate what needs to be changed in the promotion of Internet interventions to increase the reach and what changes are needed in intervention programs to keep visitors engaged and encourage them to revisit.

There are currently almost 1.5 billion Internet users worldwide;[26] this number will increase with the lowering of costs and the improved speed of Internet connections. With an Internet access penetration rate of 90.1%, the Netherlands has one of the highest rates worldwide, comparable with countries such as Canada (84.3%), Australia (79.4%), Japan (73.8%) and the United States (72.3%).[27] This means that approximately 14.5 million of all Dutch inhabitants, including children and adolescents, have Internet access. Despite these high penetration rates, relatively few people are reached with behaviour change Internet interventions,[16,28] whereas, theoretically, most of the Internet users are potential visitors.

It is important to reach those who could benefit the most from these Internet interventions, i.e., those who engage in risk behaviours such as smoking, lack of physical activity or unhealthy dietary patterns. These risk behaviours are prevalent among all population groups, but even more so among people with a lower socioeconomic status.[29-31] Therefore, people from all population groups should be reached with Internet-delivered interventions. However, not all population groups may sufficiently be reached since it has been reported that women, older people and people in lower socioeconomic positions have lower online access.[32-34] Even though the increase in Internet users is the largest among these under-served groups,[3,35,36]

it is still important to study to what extent these specific groups are currently reached with Internet-delivered behaviour change interventions.

To date, most studies have focused on the acceptability, feasibility and efficacy of behaviour change Internet interventions and very few on the actual reach of these interventions.[12,35,37] These studies (all focusing on interventions for single-risk behaviours) showed that, despite the fact that Internet access for women is generally somewhat lower,[32] the participation rate of women was higher than that of men and that different people were reached with different recruitment strategies. In the present study, we investigated which groups of people were reached with an Internet intervention that was implemented for use by the general public, aiming to promote heart-healthy behaviours, i.e., physical activity, low-saturated fat intake and non-smoking. Previous studies have focused on the characteristics of visitors of single-risk behaviour interventions only.[9,38-40] None of these studies reported on visitor characteristics of a multi-risk behaviour intervention or made a distinction between the three stages of exposure (i.e., first visit, staying and revisiting).

The present study examined how many people were reached with an implemented multi-risk behaviour intervention (www.gezondlevencheck.nl; *Gezondlevencheck* [GLC]/Healthy Life Check) by means of landing on the homepage and what proportion of these visitors actually used the program. The characteristics of these visitors were compared with those of the general adult population in the Netherlands. Within the group of people that registered for the GLC intervention, we investigated which visitors' characteristics correlated with initiating and finishing one of the three modules provided and which characteristics correlated with revisiting the intervention more than once.

Methods

Design and study population

An observational study was conducted from January 2005 through December 2007. During this period, server statistics revealed that 285,146 visitors from unique IP addresses accessed the homepage of the intervention program. A total of 81,574 visitors registered on the website and thereby gained access to the intervention program.

Intervention

For this study, data of the implemented Internet-delivered intervention GLC (www.gezondlevencheck.nl) of the Netherlands Heart Foundation (NHF) were used. This intervention is in the Dutch language and available free of charge via the Internet for the general public. The intervention consists of a website that provides individualized tailored feedback on saturated fat intake, physical activity and smoking cessation. The efficacy of these three modules, and

the full intervention program, has already been tested.[6,41,42] The efficacy of the GLC was evaluated in a two-group randomized controlled trial with 2000 adult participants.[6] Compared with the non-intervention control group, the GLC resulted in a significantly lower self-reported saturated fat intake (b=-0.76, $p<0.01$) and a greater likelihood of meeting physical activity guidelines of at least 30 min of moderate intensity physical activity on at least 5 days of the week among respondents who were insufficiently active at baseline (odds ratio=1.34, 95% confidence interval=1.001–1.80). No significant intervention effects were found for self-reported smoking status.

When people visited the intervention for the first time, they were asked to register before they could enter the intervention content. People could register by providing a login name, password and some personal characteristics (i.e., gender, age, educational level, height and weight); these characteristics were used to provide the visitors with their personally tailored advice. Although everyone could register, only visitors aged 18 years and older were included in this study because the intervention focused on this target group. After registration, a brief assessment of perceived fat intake, perceived physical activity level and smoking status was used to direct visitors to the modules that would best fit their needs. However, visitors were free to make their own choice regarding the module they wanted to visit first. Each of the three modules took 10–15 min to complete. The saturated fat intake and physical activity modules consisted of two parts. First, visitor's personal saturated fat intake or physical activity level was assessed by means of validated self-reported frequency questionnaires.[43,44] Based on this information and their personal characteristics, visitors received tailored feedback and advice regarding their personal saturated fat intake and/or physical activity. Second, after receiving tailored advice, visitors were able to continue with the program by answering a question about their intention to change their behaviour. Based on that answer, they were either directed to a module about their attitude regarding the topic or a module about self-efficacy. For the present study, we used only the first part (i.e., the assessment questionnaires) of the saturated fat intake and physical activity modules. Regarding smoking, for this study the whole module was taken into account; the content of this intervention and its efficacy have been described in detail elsewhere.[6] Multiple visits were possible and visitors were advised to visit the program again (revisits) to check their status and progress regarding changing a behaviour. However, these revisits were not manipulated in any way by, for example, sending reminders or other prompts. The personal feedback was saved on the server under a login name/password combination and could be accessed in a revisit.

Implementation

The GLC has been accessible for the general public from September 2004 onwards. The program is hosted and promoted by the NHF. The NHF continuously promotes the GLC through a variety of promotion methods, including (1) advertisements in NHF publications, e.g., in

their quarterly magazine, in regular newsletters for NHF sponsors and in newsletters distributed via pharmacies, (2) regular banners and URL links on the NHF website, (3) articles and advertisements in qualitative newspapers, (4) flyers and posters distributed in public places, e.g., libraries and municipal health services, (5) flyers distributed to health care professionals and articles in health care journals, (6) sponsored links on health portals and commercial websites and in e-mail newsletters of these portals and websites, and (7) free publicity, such as articles in freely distributed newspapers, women(-oriented) magazines and health magazines.

Measurements

Server statistics

Since the introduction of the intervention in September 2004, server statistics have registered the number of unique IP addresses and the length of time spent on the website (http://awstats.sourceforge.net/). Unique IP addresses were used as an indicator of the number of people that landed on the homepage; even though it may be possible that more than one person from a unique IP address accessed the website. For the present study, we used server statistics from January 2005 through December 2007. These server statistics were anonymously registered and were not linked to the data provided by the visitors. User characteristics were available only for those persons who stayed on the website and actually registered in the program.

Characteristics of registered visitors

Information on the personal characteristics of the registered visitors (e.g., gender, age, educational level, height and weight) were retrieved from the server database that stored the information needed for registration in the program, as well as the responses to the individual-tailoring questionnaires in the program. This information was stored in such a way that anonymity was guaranteed.

Smoking status was derived from the question "Do you currently smoke?" (yes/no). For this study, the education level was categorized as low (≤9 years: primary school, lower and intermediate secondary education or lower vocational training), medium (10-14 years: higher secondary education or intermediate vocational training) or high (≥15 years: higher vocational training or university). Age was categorized as 0 ≥40 to <50 years, 1 ≥18 to <30 years, 2 ≥30 to <40 years and 3 ≥50 years. Body mass index (BMI) was calculated as weight (kilograms) divided by height (meters) squared and categorized as 0 ≥18.5 to <25; 1 <18.5; 2 ≥25 to <30; 3 ≥30.

Characteristics of the general Dutch population

Data from Statistics Netherlands (www.statline.nl) were used, apart from assessing saturated fat intake, to compare the characteristics of the registered visitors with those of the general Dutch population aged 18 years and older. The instrument used to assess physical activity

among the Dutch population is the same as used for assessing physical activity in the intervention program.[44] The instrument for assessing saturated fat intake is different. Data for the Dutch population were assessed by means of dietary assessment of two independent 24-hour recalls and an additional questionnaire, including food frequency questions,[45] whereas in the intervention program, only a food frequency questionnaire was used.[43]

Outcome measures

For each module, two variables were created, one that indicated that a visitor had initiated the module and another that the visitor had finished a module and had received tailored feedback and advice. The variable for initiating a module (yes/no) was determined by the first question of the module on saturated fat intake, physical activity and smoking. The variable for finishing a module (yes/no) was determined by using either the last question of the assessment questionnaire for saturated fat intake and physical activity or the last question of the smoking module. The variable for revisiting the intervention (yes/no) was determined by comparing the first and last date of logging on to the intervention website.

Statistical analysis

Descriptive statistics were used to describe the registered visitors. Multiple logistic regression analyses were conducted with the outcome measures initiating and finishing a module (0=no; 1=yes) as dependent variables and gender, age, education level and BMI as independent variables. Age, education and BMI were used as categorical variables to determine which user characteristics increased the odds for visiting or finishing the Internet intervention. For revisiting the intervention, the risk behaviours physical activity, saturated fat intake and smoking were also incorporated in the model as independent variables. Statistical significance was set at a level of 0.05. All analyses were conducted in SPSS version 15 (SPSS, Inc., Chicago, IL, USA).

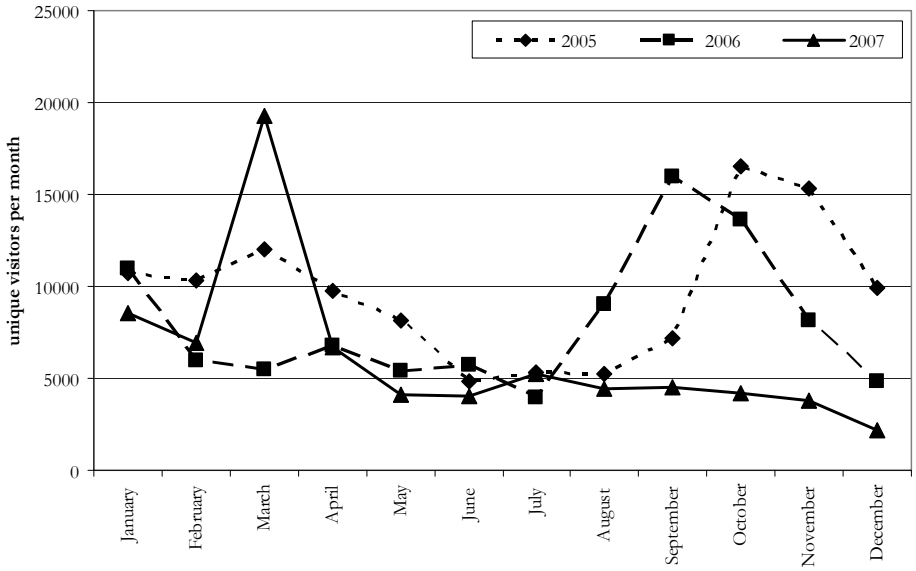
Results

Number of homepage visitors

Server statistics showed that during 2005-2007, 285,146 visitors from unique IP addresses (persons, as indicated by IP addresses) accessed the website of the GLC. Figure 5.1 shows the fluctuation of visitors during 2005-2007. During May until August, the number of visitors appears to be lower compared with the other months. The peaks in the number of visitors (October 2005, September 2006 and March 2007) resulted mainly from sponsored advertisements in a newsletter distributed by e-mail via a commercial Dutch lifestyle website.

Visitors stayed on the website for an average of 6 min and 43 s. However, the majority of the visitors (56.3%) left the website within 30 s. Of those that stayed >30 s, 23% stayed between 30 s and 2 min, 13% between 2 and 5 min, 28% between 5 and 15 min and 24% between 15 and

Figure 5.1 Number of visitors based on IP addresses accessing the intervention website from January 2005 through December 2007



30 min. The remainder (13%) stayed >30 min. The number of hits on the website was constant throughout the day, with a small dip around 6.00 p.m. and a sharp peak around 8.00 p.m.

Characteristics of registered visitors

By comparing the figures of the server statistics with the data provided by the people that registered, it appeared that 81,574 (28.6%) of the visitors logged on to the GLC and completed the registration procedure. Of all the registered visitors three-quarter were women, over half of the visitors were <40 years and most of them had a medium to high education level. Furthermore, over half of the registered visitors had a healthy BMI, whereas 40% was either overweight or obese. Compared with the general Dutch population (last column in Table 5.1), the registered visitors to the GLC were more often women, younger, higher educated and with a somewhat healthier BMI.

Regarding the three risk behaviours, fewer visitors smoked compared with the general Dutch population, i.e., 18.7 and 29.6%, respectively. Of all visitors who completed the physical activity module, 42.4% complied with the Dutch guidelines of at least 30 min of moderately intensive physical activity on at least 5 days of the week (compared with 55% in the general Dutch population). Regarding saturated fat intake, 63.2% complied with the Dutch guidelines of a maximum of 10 energy percent saturated fat intake, compared with only 10% of the general Dutch population.

Table 5.1 Personal and behavioural characteristics of visitors accessing the intervention website from January 2005 through December 2007 compared with the general Dutch population in 2006

	2005	2006	2007	total 2005-2007	Dutch population 2006[a]
N	39,688	24,772	17,114	81,574	12,752,453
Personal characteristics					
Sex (%)					
Men	25.5	24.0	24.8	24.9	49.0
Women	74.5	76.0	75.2	75.1	51.0
Age in years (%)					
≥18 – <30	34.9	38.5	37.0	36.5	18.4
≥30 – <40	20.5	20.6	20.1	20.4	19.1
≥40 – <50	20.9	18.8	19.3	19.9	19.9
≥50	23.7	22.1	23.6	23.2	42.6
Education level (%)					
Low	25.8	26.6	27.4	26.4	33.6
Medium	39.2	40.7	38.9	39.6	41.2
High	35.0	32.7	33.7	34.0	25.2
Body mass index (kg/m^2) (%)					
<18.5	3.6	4.4	4.9	4.1	1.6
≥18.5 – <25	55.0	55.3	56.2	55.3	51.9
≥25 – <30	30.3	28.7	27.9	29.3	35.2
≥ 30	11.2	11.6	11.0	11.2	11.3
Behaviours					
Smoking (%)					
Yes	17.7	20.1	19.2	18.7	29.6
No	82.3	79.9	80.8	81.3	70.4
30 minutes physical activity (PA) a day (%) (N=57,950)					
0 – 4 days a week	57.3	58.6	57.0	57.6	45.0
5 – 7 days a week	42.7	41.4	43.0	42.4	55.0
Saturated fat intake (%) (N=55,660)					
did not comply with the recommended level	38.0	36.5	34.2	36.8	90.0[46]
did comply with the recommended level	62.0	63.5	65.8	63.2	10.0

[a] Based on data from Statistics Netherlands (www.statline.nl)

Table 5.2 Results of multiple logistic regression analyses (odds ratio [OR]) and 95% confidence interval (CI) of starting/finishing the modules on physical activity (PA), saturated fat intake, smoking and revisiting the website as dependent variables and personal characteristics and behaviours as independent variables (2005–2007)

	Starting PA module[a]	**Finishing PA module[b]**	**Starting fat intake module[a]**	**Finishing fat intake module[b]**	**Starting smoking module[c]**	**Finishing smoking module[c]**	**Revisiting[d]**
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
N	65,059	57,756	56,286	53,244	10,327	6014	4857
Personal characteristics							
Sex							
men (reference)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
women	**1.23** (1.18 – 1.28)	**1.50** (1.41 – 1.58)	**1.51** (1.46 – 1.56)	**1.84** (1.69 – 2.00)	0.93 (0.85 – 1.01)	**1.44** (1.27 – 1.63)	**1.16** (1.06 – 1.26)
Age (years)							
≥40 – <50 (reference)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
≥18 – <30	**0.82** (0.78 – 0.87)	**0.90** (0.83 – 0.98)	**0.91** (0.86 – 0.95)	0.96 (0.85 – 1.09)	0.96 (0.85 – 1.09)	1.02 (0.84 – 1.25)	**0.79** (0.72 – 0.88)
≥30 – <40	**0.43** (0.41 – 0.45)	**0.44** (0.41 – 0.47)	**0.75** (0.72 – 0.79)	**0.56** (0.50 – 0.62)	**0.63** (0.56 – 0.70)	**0.44** (0.38 – 0.53)	**0.72** (0.65 – 0.79)
≥50	**0.63** (0.59 – 0.67)	**0.85** (0.78 – 0.93)	**0.90** (0.86 – 0.95)	**0.77** (0.68 – 0.87)	**0.83** (0.74 – 0.93)	**0.81** (0.67 – 0.97)	**0.74** (0.66 – 0.82)
Education level							
Medium (reference)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
low	**0.72** (0.68 – 0.75)	**0.82** (0.77 – 0.87)	0.98 (0.94 – 1.01)	1.01 (0.92 – 1.11)	0.99 (0.91 – 1.08)	**1.27** (1.10 – 1.45)	**1.12** (1.03 – 1.22)
high	**0.55** (0.52 – 0.57)	**0.62** (0.58 – 0.66)	**0.88** (0.84 – 0.91)	**0.73** (0.66 – 0.80)	0.97 (0.89 – 1.07)	**1.25** (1.08 – 1.45)	**1.25** (1.14 – 1.38)
Body mass index							
≥18.5 – <25 (ref)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
<18.5	**0.91** (0.86 – 0.97)	**0.69** (0.63 – 0.76)	**0.84** (0.80 – 0.89)	0.95 (0.83 – 1.08)	**1.22** (1.08 – 1.38)	0.83 (0.68 – 1.02)	0.97 (0.88 – 1.11)
≥25 – <30	**0.77** (0.70 – 0.85)	**0.54** (0.47 – 0.62)	**0.80** (0.73 – 0.87)	**0.66** (0.54 – 0.80)	1.11 (0.92 – 1.35)	0.86 (0.63 – 1.18)	1.03 (0.81 – 1.30)
≥ 30	0.97 (0.91 – 1.03)	**0.87** (0.79 – 0.97)	0.95 (0.90 – 1.01)	1.07 (0.93 – 1.22)	**1.14** (1.00 – 1.30)	0.88 (0.71 – 1.09)	1.03 (0.92 – 1.16)

Behaviours[e]	
30 min PA per day	**1.23** (1.11 – 1.37)
Saturated fat intake	**1.19** (1.10 – 1.28)
Smoking	0.93 (0.87 – 1.01)

ORs in **bold** indicate a significant association ($p < 0.05$)

[a] Coded as 0 (not started) or 1 (started);

[b] Coded as 0 (not finished) or 1 (finished);

[c] Coded as 0 (smokers who did not start) or 1 (smokers who started)

[d] Coded as 0 (one-off visit) or 1 (more than 1 visit);

[e] Reference: 0-4 days 30 minutes physical activity, comply with the recommended level of saturated fat intake, not smoking

Initiating and finishing behaviour modules

Of all visitors who completed the registration procedure, 99% initiated one of the three modules and 91% completed at least one module. Regarding physical activity, 80% initiated this module, of which 89% completed the assessment questionnaire and received tailored advice. The saturated fat module was initiated by 69% of the visitors, of which 95% completed the assessment questionnaire and received tailored advice. Of the 19% of the visitors who reported to be smokers, 68% initiated the smoking module and 58% finished this module. Of all the visitors that logged on, 57% visited both the physical activity and the saturated fat intake modules; of these, 52% completed both the assessment questionnaires and thus received personal advice on these topics. Of the 10,327 visitors who could access all three modules (i.e., the smokers), 31% visited all of them; of these visitors, 57% completed all three modules.

Results of multiple logistic regression analyses showed that women, visitors aged 40-50 years, visitors with a medium educational level and people with a normal BMI (18.5-25) were more likely ($p<0.05$) to both initiate and finish the physical activity module and the saturated fat intake module (Table 5.2). Regarding initiating the smoking module, no differences were found for gender and education level, but visitors aged 40-50 years and people with a BMI of either <18.5 or >30 were more likely to initiate the smoking module.

Revisiting the Internet intervention

In total, 6% (N=4857) of the registered visitors visited the GLC more than once in the period 2005-2007. Of these revisits, 33.6% took place within 1 week after the first visit, whereas 13.6 and 3.8% revisited the program within 2 and 3 weeks, respectively. After that, the length of time between the first visit and revisit increased relatively quickly. Regression analyses showed that women, visitors aged 40–50 years, visitors with a low or high educational level and people that did not comply with the advised physical activity level and saturated fat intake were more likely ($p<0.05$) to revisit the Internet intervention (Table 5.2).

Discussion

This study is one of few to report on the characteristics of visitors to a multi-risk behaviour Internet-intervention implemented for use by the general public. An important finding was that >50% of the visitors left the intervention within 30 s. However, once visitors had registered and gained access to the intervention program, almost every registered visitor initiated one of the modules, and most of them finished at least one module and received individually tailored feedback and advice for that specific risk behaviour. Compared with the general Dutch population, the majority of visitors that accessed the program were women, medium to highly educated and had a somewhat healthier BMI. However, women, visitors aged 40-50 years, visitors with a medium educational level and visitors with a healthy BMI (18.5-25) were more likely to finish the modules.

Since the introduction of Internet-delivered behaviour change interventions, high attrition rates have been a serious concern.[19,21,47,48] This problem is also reported in the field of E-learning[22,23] and was also experienced in the present intervention. An immediate reason for a person not to initiate the intervention may be sheer disinterest. A second reason could be the presence of a registration procedure to access the intervention program, as recently reported.[49] Kerr et al.[50] also stated that a registration procedure can be seen as a barrier, especially if there are concerns about the trustworthiness of a website. However, Griffiths et al.[51] indicated that sites that require registration before obtaining all the available information were perceived to be of higher quality. Providing visitors with a clear explanation for why a registration procedure is necessary may prevent them from leaving the website before they actually start the program. Furthermore, a professional appearance and a clear navigation structure are factors that visitors take into consideration when deciding whether or not to extend a visit on an intervention website.[47,49,52,53] Therefore, it is important to establish whether the presence of a registration procedure and an unprofessional appearance and/or an unclear structure are important factors for website visitors in deciding whether or not to continue with an Internet intervention.

Analysis of our visitors' characteristics revealed that women were more inclined to visit this Internet intervention, which is consistent with other studies.[11,35,54-56] Women were also more likely to complete a module and to revisit the site; this may be because women are generally more interested in health issues, also via the Internet.[16,33] The fact that men and older and lower educated persons were reached less often is disconcerting since these latter groups are at increased risk for cardiovascular disease. This lower reach is in contrast to the fact that the Internet is generally used more often by men and is increasingly used by older and lower educated people. However, the lower access of these latter groups[3,36] may be because the strategies used to promote the GLC were not specifically focused on these potential visitors. Therefore, it is advisable to explore whether promotion strategies aimed specifically at men, and at older and lower educated people, will attract them to this Internet intervention. Focus group discussions with potential visitors indicated that different groups are likely to be attracted by different kinds of (preferably) traditional promotion strategies (e.g., advertisements in newspapers and on TV and radio).[49] McClure et al.[12] demonstrated that different recruitment strategies for a smoking cessation website attracted different types of visitors. Furthermore, a potentially effective strategy to retain subgroups in the program may be to tailor the promotion activities and the intervention program itself to certain personal characteristics (e.g., gender or educational level) by employing a different 'tone of voice' or a different appearance (e.g., different layout, styles or colours).

A common criticism is that people who are more committed to a healthy lifestyle are more likely to visit a health promotion program on the Internet and will therefore be more inclined to stay and finish the intervention program. This study has shown that the registered visitors were more likely to be higher educated, smoke less and eat less-saturated fat compared with the

general adult Dutch population; this has also been reported by others.[9,14] However, the present results also indicate that the GLC attracted more people that were less active compared with the general Dutch population and that the proportion of people who were overweight was quit similar to that of the general Dutch population. Additional studies are needed to establish which kinds of promotion strategies can best be used to attract these subgroups.

Limitations

In the present study, we were dependent on the information registered in the design of the server statistics program attached to the website, which prevented us from answering some important and relevant questions. First, because the server statistics were not linked to the individual level, it was not possible to compare subgroups that differed regarding socio-demographic, psychosocial or behavioural measures, regarding exposure to the intervention (i.e., duration time and frequency of revisits). Second, the server registration system used IP addresses to identify the number of persons that visited the intervention website. This may have caused an inaccurate count of the total number of hits/visitors to the website since different people using one computer may have accessed the website. This might imply that the 28.6% of all visitors that actually registered on the website might be an overrepresentation. Third, the statistics program provided no information about active use, use of specific pages and other on-site behaviour. This type of information is important to gain deeper insight into use and usage patterns and number and patterns of revisits. This study shows that, when designing a server statistics program, it is important to determine at an early stage what information (at the individual and group level) is required to gain insight into use and usage patterns. Furthermore, the different promotion strategies used for the GLC were not included in the analysis. The different promotion strategies might have attracted, for example, more women and higher educated people to visit the intervention. For future interventions, it is recommended to keep accurate records of which promotion strategies were used so that these can be related to visitors' data to reveal which promotion strategies attracted which type of visitor. Finally, although we know how many registered visitors completed one or more modules and thus received personal feedback and advice, it is unclear to what extent these visitors actually read and acted on such feedback and advice. Future studies could focus more on how much of the information is read and how intensively it is read and processed, to gain more insight into using and processing of the Internet intervention content.

Conclusion

The present study shows that a heart-healthy computer-tailored Internet program can reach a substantial number of people. Although >50% of the visitors left the intervention before registering, attrition during the intervention program (as reported by others) was not a major problem in this multi-behaviour Internet intervention. Because our visitors could choose between three different behaviour modules, they may have felt 'freer' in their decisions and

perhaps more inclined to finish the selected modules. However, similar to other Internet interventions, more women and higher educated people visited the intervention. Therefore, in order to reach a population that is at increased risk (such as men, and older and lower educated people), future studies should aim at developing promotion strategies that will attract these specific subgroups.

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6

Results of distribution of a flyer to attract Dutch adults to an Internet-delivered physical activity promotion intervention: differences between three promotion channels

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Abstract

Internet-delivered behaviour change interventions are regarded as important to promote healthy lifestyle behaviours, including physical activity. The reach of evidence-based Internet-delivered health behaviour interventions is often disappointingly low. Efficient promotion strategies are needed to attract large numbers of people to such intervention websites. This explorative study examined how many people in the Netherlands with what characteristics visit an Internet-delivered physical activity promotion program, when a promotional flyer is distributed through general practitioners (GPs), door-to-door (DtD) distribution, and e-mail recommendation by family or friends. Eight GPs distributed 172 flyers to eligible patients; 3500 flyers were distributed DtD in the neighbourhood of the participating GPs; and visitors of the website were given the opportunity to send the flyer as an e-mail to family or friends. Server data were used to retrieve the number of visitors per promotion channel and to obtain information on visitor characteristics. χ^2- and t-tests were used to compare visitor characteristics between the promotion channels. The distribution by GPs resulted in a significantly higher response compared to the DtD-distribution (27.3% vs. 3.3%; $p<0.001$). The distribution by GPs resulted in significantly more male visitors, more visitors with a lower educational level, and more with a higher body mass index. Significantly more GP-invited visitors completed the whole intervention program. Only five visitors used the mail-a-friend option. This study showed that promotion through GPs attracted more visitors in general and from groups (male, lower educated) that are generally reached less through mass media promotion.

Introduction

Promotion of sufficient physical activity (PA) is an important public health target.[1,2] The Internet is increasingly being used as a channel for the delivery of PA promotion interventions, and positive effects of such interventions haven been reported.[3,4] However, as argued in for example the RE-AIM framework,[5] achieving an impact on health behaviour or public health does not only require efficacy of interventions, but also a high reach. The reach of Internet-delivered behaviour change interventions is often low,[6,7] and there is a need for effective strategies to improve the reach.

Theories such as the Diffusion of Innovations Theory[8] and Source, Message, Channel, and Receiver (SMCR) model,[9,10] suggest that characteristics of the intervention, the potential user, the promotion strategy and the source through which the message is delivered are all important in dissemination and adoption of Internet interventions. In an explorative Delphi study among health promotion and e-health experts[11] and a focus group study among potential users,[12] three potentially efficient promotion channels were identified: (1) through general practitioners (GPs) practices, (2) through door-to-door (DtD) distribution, and (3) through a mail-a-friend option provided within the intervention program.

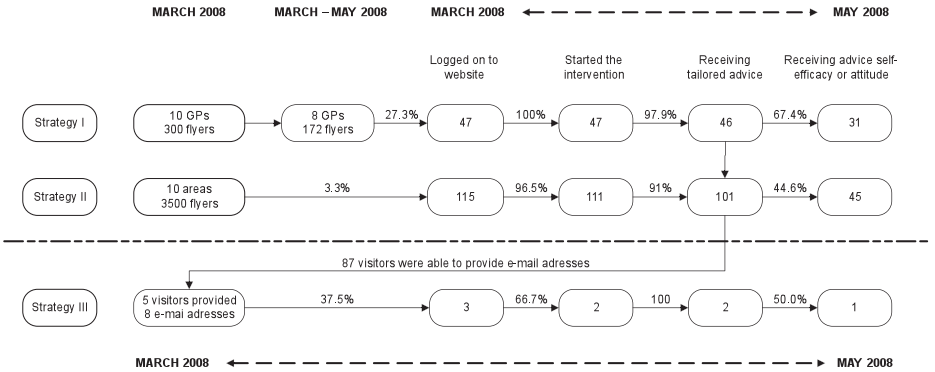
The aim of the present study was to examine how many adults would be attracted to a PA promotion website when it was promoted by a promotional flyer distributed through GPs, DtD, or e-mailed to family or friends. Furthermore, we examined the characteristics of the visitors attracted through each strategy, as well as how much of the intervention was completed.

Methods

Study design and promotion strategies

The three promotion channels were compared in an explorative non-randomized study (see Figure 6.1). In the GP-invited strategy (strategy I), 118 GPs in and around the city of The Hague were approached and asked to participate in this study by distributing a flyer on three consecutive days to 30 eligible patients in a 4-week period; 10 were willing to participate. Main reasons for not participating in the study were lack of time and no interest in participation. GPs were instructed in person and through a letter to hand out the 30 flyers on three consecutive days to the first 30 patients between 20-75 years of age, able to be physically active and with a good command of the Dutch language, who came to their office. The GPs did not have to assess their patients PA level, and were instructed not to give the flyer only to patients for whom they thought it would be important to improve their PA level for health or medical reasons. Furthermore, they registered sex and date of birth of patients they had given a flyer.

Figure 6.1 Study design and number of participants during different stages of the study



The second strategy (Strategy II) consisted of distributing 3500 flyers in letterboxes DtD. In the area around each of the participating GPs practices, a random selection of streets for DtD distribution of the flyer was made as follows: first, streets with less than 25% of non-native Dutch residents were selected, and subsequently streets with an average low <1500, average ≥1500 <2800 and high ≥2800 euro monthly taxable income were selected, to ensure that the flyers were evenly distributed among people from various socioeconomic positions.

In the mail-a-friend option (Strategy III), visitors of the website attracted through strategy I and II were invited to bring the intervention to the attention of family or friends by means of an easy to send e-mail that contained the promotional flyer in HTML-format. They could send an e-mail to up to three acquaintances (see Figure 6.2). Due to technical problems, the mail-a-friend option was operational only from the second week after the start of this study.

Flyer

A promotional flyer (see Figure 6.3) was specially developed for this study, in which information was provided about the intervention website, what the intervention comprised of and why this intervention was relevant and interesting for them to visit. It was particularly made clear that they would receive personal advice on their current level of physical activity, whether there would be a need for change, and suggestions for how to change. On all flyers a unique confidential user name and password was provided that the visitors had to use to access the PA promotion website.

The intervention

The PA intervention program was a component of a larger Internet-delivered lifestyle intervention of which the efficacy has been tested earlier.[13] After logging in, people had to provide their personal characteristics (i.e., gender, age, educational level, height and weight). After that, PA-

Figure 6.2 The mail-a-friend option

level was assessed by means of a validated self-reported questionnaire.[14] Hereafter, personally-tailored feedback on their PA-level was provided, as well as feedback and suggestions on how to improve PA when they did not comply to the physical activity guideline of engaging in at least 30 minutes of moderate intensity PA on at least five days of the week.[13] Subsequently, visitors had the opportunity to use the mail-a-friend flyer option. After a brief instruction, visitors could enter names and e-mail addresses of up to three people they wanted to notify of the intervention program (see Figure 6.2). Users who could improve their PA level could continue with the program to receive tailored feedback on strengthening attitude (for those not yet motivated to change) or self-efficacy for change (for those who intended to change).

Registration forms and server data

The registration forms from the GPs were used to determine the number of flyers distributed and for non-response analyses. Server data were used to retrieve the number of visitors per promotion channel and to obtain information on visitor characteristics. This information was stored in such a way that anonymity was guaranteed.

Statistical analyses

The number of visitors per promotion strategy was calculated based on the unique user name and password on each flyer. Descriptive statistics were used to describe visitor characteristics and website use. χ^2-tests and t-tests were used to detect differences in numbers of visitors attracted and visitor characteristics between the three promotion strategies.

Figure 6.3 The promotional flyer

Results

Website registration

From the ten participating GPs, eight returned the registration form. Five of the participating GPs were male (63%), mean age was 51 (range 41-61) and their practice consisted on average of 2,414 patients (range 2000-2640). This is comparable with characteristics of the average GP population and practice size in the Netherlands with 62% male, average age of 48 years, and average practice size of 2500 patients.[15] They distributed 172 flyers of which 47 persons logged in to the program (response 27.3%) and provided at least background characteristics (Figure 6.1). No significant differences were present regarding gender and age between the people who received the flyer and logged in on the website and those who did not. Of the 3500 DtD-distributed flyers, 115 persons logged in (response 3.3%) and 111 filled in at least the background questions; this response was significantly lower than the response to the distribution by GPs ($p<0.001$).

Of the website visitors, 87 could use the mail-a-friend option and five did so. The e-mail with flyer was sent to eight e-mail addresses which led to three visitors to the intervention website. Because of these small numbers, we did not include this strategy in further analyses.

Table 6.1 Characteristics of visitors who completed the tailoring questionnaire in the program

	Strategy I (N=47)	**Strategy II** (N=111)	**p-value difference Strategy I – Strategy II**
Demographic variables			
Gender (%)			**0.023** (chi)
Male	57.4	38.7	
Female	42.6	61.3	
Mean Age (SD)	55.3 (12.7)	53.3 (13.0)	0.394 (t)
Educational level (%)			**0.016** (chi)
Low	22.2	10.2	
Middle	44.4	32.4	
High	33.3	57.4	
Average body mass index (SD)	27.0 (5.7)	25.3 (4.4)	**0.038** (t)
Physical activity scores			
Average total PA (min/week) (SD)	1148 (996)	1143 (1133)	0.997 (t)
Average total PA of moderate to vigorous intensity (min/week) (SD)	420 (486)	497 (524)	0.384 (t)
Average total PA at vigorous intensity (min/week) (SD)	119 (215)	173 (240)	0.181 (t)
Compliant to guideline (%)	44.7	56.8	0.164 (chi)
Self-rated PA level (%)			**0.006** (chi)
< 5 days	89.4	68.5	
≥ 5 days	10.6	31.5	
Intention to change[a] (%)			0.229 (chi)
never thought about it	12.5	2.1	
do not know whether to exercise less or more	15.6	25.0	
do not want to exercise more than I do now	6.3	4.2	
do want to exercise more than that I do now	65.6	68.8	

Note: **bold** indicate significant difference between strategy I and II (p<0.05)
[a] Intention to change: N(GP-invited)=32; N(DtD-invited)=48

Visitor characteristics

Visitor characteristics are shown in Table 6.1. The distribution by GPs resulted in significantly more male visitors compared to the DtD-distribution, 57.4% and 38.7% respectively (p=0.023). GP-invited visitors were significantly lower educated (p=0.016) and had a higher body mass index (BMI) (p=0.038) than the visitors who received the flyer in their letterbox.

More of the GP-invited compared to the DtD-invited visitors thought that they did not meet the PA guideline of at least 30 minutes of moderate or vigorous intensity on at least five days per week (p=0.006). There were no differences in PA scores as assessed by the tailoring questionnaire or in the intention to become more physically active.

Completion of the intervention

Nearly everyone (92.4%) who started with the intervention completed the first part of the intervention in which they received tailored feedback on their level PA (Figure 6.1). However, significantly more GP-invited visitors than DtD-invited visitors proceeded to the second part of the intervention to receive feedback on attitude or self-efficacy (p=0.010).

Discussion

In this explorative, non-randomized study we found that promotion through GPs resulted in a higher percentage of visitors to a PA promotion website compared to DtD-promotion. Furthermore, when promoted through GPs significantly more men, more lower educated people, and more people with a higher BMI visited the intervention website. The GP-invited visitors were also more inclined to complete the whole intervention program. The DtD-distribution of the flyer resulted in a 3% response. The mail-a-friend option was not used often enough for further analyses.

The findings of our study seem to support that promotion through GPs is a potentially successful way for disseminating Internet-delivered behaviour change programs. What may make GPs especially an interesting channel for promotion is that specific groups of people (e.g., male, lower educated) seemed to be attracted. These groups have been found to be reached less in previous studies using mass media dissemination strategies.[16-18] Furthermore, visitors were more inclined to finish the whole intervention program, whereas other studies showed that it is difficult to keep visitors engaged long enough in the intervention program.[19,20] Giving the flyer when improving PA is important for medical reasons or even prescribing the intervention program by the GP might encourage even more people to visit the intervention program. However, it is important to note that GPs can only reach a limited number of patients, and that this number is much lower than what can be achieved with mass media distribution of flyers. Furthermore, it is important, that a cost-benefit analysis will be performed when testing these promotion strategies on a larger scale, to provide more insight in the most cost-effective approach.

Even though the response to the DtD-distribution was relatively much lower than the GP promotion, a 3% response is what can be expected from mass media promotion.[21,22] DtD-distribution of flyers is relatively cheap and easy to accomplish. Therefore, it can be used as a promotion strategy for nationwide or more local promotion of interventions, when budgets are low.

In our study, the mail-a-friend option did not seem to be a successful dissemination strategy. The low use seemed to be largely due to the fact that only a limited number of visitors used the

option to send an e-mail to family or friends, which is a first prerequisite for this strategy to work. More research is needed in how to efficiently use this option for adults.

Limitations

The most important limitation of this study is that it was a non-controlled explorative study. The fact that more male and lower educated people visited the program, might be due to selective distribution of flyers by (some of) the GPs. That is, although we instructed the GPs to give the flyer to all the eligible patients they saw on three consecutive days, some of the GPs may have given the flyer specifically to those patients that they thought could or should improve PA. Furthermore, the participating GPs might have been a selective sample and not representative for GPs in general. The characteristics of the participating GPs were comparable with the Dutch GP population,[15] but it may very well be that the GPs who participated in this study, were more interested in promoting PA among their patients than the average GP population. This may limit the generalizability of the findings to all GPs. Furthermore, only few GPs complied with the protocol, showing that participation and fidelity of potentially important intermediaries is as crucial as participation of the target population itself.

Conclusion

In this study we found that promoting an Internet-delivered PA promotion intervention by distributing flyers through GPs resulted in relatively more visitors to the PA Internet intervention than DtD-distribution. The GP seems to reach specific groups (e.g., men, lower educated people) that are generally reached less through mass media promotion.

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7

Demographic, behavioural, and psychosocial correlates of using the website component of a worksite physical activity and healthy nutrition promotion program: a longitudinal study

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Abstract

Background Internet-delivered behaviour change programs have the potential to reach a large population. However, low participation levels and high levels of attrition are often observed. The worksite could be a setting suitable for reaching and retaining large numbers of people, but little is known about reach and use of Internet-delivered health promotion programs in the worksite setting.

Objective This study aimed (1) to gain more insight in the use of the website component of a worksite behaviour change intervention and (2) to identify demographic, behavioural, and psychosocial factors associated with website use.

Methods The study was an observational study among participants from 5 workplaces in a cluster randomized controlled trial. At baseline, all participants visited a study website to fill out the baseline questionnaire. Then a physical health check was done followed by face-to-face advice. After this contact, all participants received an e-mail to promote visiting the website to view their health check results and the personal advice based on the baseline questionnaire. In the subsequent period, only participants in the intervention group received monthly e-mail messages to promote website visits and were offered additional web-based tools (self-monitors and a food frequency questionnaire (FFQ) assessing saturated fat intake) to support their behaviour change. Website use was monitored by website statistics registering website access. Complete data were available for 726 employees. Logistic regression analyses were conducted to identify characteristics of employees who visited and used the website.

Results In total, 43% of the participants visited the website after the e-mail to promote website visits. Participants who were insufficiently physically active were less likely to visit the website (odds ratio [OR]=0.63; 95% confidence interval [95%CI]=0.45-0.88), whereas individuals with an elevated total cholesterol level visited the website more often (OR=1.44; 95%CI=1.05-1.98). The monthly e-mails in the intervention group resulted in higher website use during a 3-month period (18% versus 5% in the reference group, OR=3.96; 95%CI=2.30-6.82). Participants with a positive attitude toward increasing physical activity were less likely to visit the website (OR=0.54; 95%CI=0.31-0.93) or to use the self-monitor and FFQ (OR=0.50; 95%CI=0.25-0.99). Female workers visited the website more often to monitor their behaviour and to receive advice on fat intake (OR=2.36; 95%CI=1.14-4.90).

Conclusions Almost half of the participants used the website component of a worksite behaviour change program. Monthly e-mails were a prompt to visit the website, but website use remained low. More women than men used the website to obtain personalized advice for behaviour change. No consistently higher participation was found among those with healthier behaviours. This health promotion program did not provide an indication that healthier subjects are more susceptible to health promotion.

Introduction

There are indications that Internet-delivered interventions may be effective in improving physical activity, healthy nutrition, and weight reduction.[1-5] Internet-delivered programs have the potential to reach a large population at relatively low costs. However, low participation levels and high levels of attrition are often observed in those programs.[5-8] These rates are of concern since studies with a higher utilization tend to have better behaviour change outcomes.[5] The Reach, Efficacy, Adoption, Implementation and Maintenance (RE-AIM)framework[9] stresses the importance of evaluating the reach and representativeness of program participants, and Eysenbach[6] and Danaher et al.[10] have emphasized the need to address process measures in addition to the effectiveness of Internet-delivered programs. The worksite has been identified as a promising setting to reach large numbers of people in a natural social network, which may increase participation.[11,12] However, the reach and use of Internet-delivered programs in the worksite setting are largely unknown.

In contrast with the high levels of attrition in the general population, Ware et al.[13] studied an intervention consisting of an Internet-delivered program at the worksite with an initial face-to-face contact and found a repeated participation over a 12-week period of 69%. Several studies on Internet-delivered behaviour change programs suggested that women, people who are more highly educated, and people with positive health behaviours participate more often in Internet-delivered health promotion programs compared with the general population.[8,14-16] However, there are also studies indicating that Internet-delivered programs have attracted individuals who would benefit most from them, that is, participants who are overweight.[8,13,16] It has also been suggested that the provision of regular new content and the possibility to monitor progress toward behaviour change could be important factors in encouraging website use.[17,18] Furthermore, a recent review reported several studies with enhanced effectiveness after frequent e-mail prompts.[19]

It has been indicated that participants may not be ready to rely solely on Internet-delivered programs.[5] The worksite setting, in which it is feasible to combine face-to-face contact and regular e-mails, may, therefore, be a good setting for the implementation of interventions. Therefore, we expect that providing an Internet-delivered lifestyle program in the workplace setting with an initial face-to-face contact, a behaviour change monitor functionality, and monthly e-mail messages will enhance program use.

More insight into these specific program characteristics could provide information on ways to attract visitors to an Internet-delivered health promotion intervention and to keep them using the program. The aim of the present study is to gain more insight into the use of a website component of a worksite intervention, in order to be able to identify factors related to

website use and intervention components that may enhance use. Therefore, the present study investigates the demographic, behavioural, psychosocial, and health-related factors in relation to program use in an Internet-delivered program with a face-to-face contact at the worksite.

Methods

Design, participants, and recruitment

An observational study was conducted from March 26, 2008, until February 9, 2009. Participants were employees from 5 different workplaces: 2 companies engaged in commercial services, 2 in health care, and 1 executive branch of government. The participants had enrolled in a 2-year cluster randomized controlled trial in which the departments (N=64) within these 5 workplaces were the units of randomization. An extensive description of this larger worksite lifestyle promotion program primarily aimed at physical activity and nutrition is described elsewhere.[20] The study was announced through e-mail, the company's intranet and/or a company magazine. In the 2 commercial services companies, all employees directly received an e-mail from a health management organization that had implemented the intervention in which employees were invited to visit the study website. For the other workplaces, interested employees could express their interest in participating in the study through e-mail. These 3 workplaces restricted the maximum number of participants in such a way that the first 200 (2 workplaces) or 300 (1 workplace) interested employees were allowed to participate. Participants enrolled in the study when they visited the website and completed the baseline questionnaire. Participation levels varied from 3% to 61% of all workers per workplace, with a median participation level of 10%. The number of participants per workplace ranged from 33 to 270 (median 175), and workplace sizes varied from 70 to more than 5000 employees (median 1706). Complete data on individual characteristics, behaviours, and health were available for 726 employees. The Medical Ethics Committee of Erasmus MC, University Medical Centre in Rotterdam, the Netherlands, approved the study and all participants gave written informed consent.

Procedure

All participants visited the study website by using an individualized username and password to fill out the baseline questionnaire and to make an appointment for a physical health check (Figure 7.1). The health check took place at the workplace and consisted of measurement of height, weight, waist circumference, total cholesterol level, blood pressure, and a bicycle test to estimate maximum oxygen uptake. Immediately after the health check, all participants received an overview of their test results in print. These results were discussed with the participants, and each participant received advice on how to improve or maintain their lifestyle in a face-to-face contact. Participants who were prehypertensive or who had an elevated cholesterol level were advised to visit their general practitioner or the occupational physician. The physical

Figure 7.1 Screenshot of the website

health check took one hour, and workers were allowed to participate during their regular work hours. The test reports were also provided on the study website together with personal advice based on participants' answers on the baseline questionnaire. After all participants in one workplace had completed the health checks, all participants were invited through an e-mail message to visit the website to view their health check results and the personal advice based on the baseline questionnaire (see Figure 7.2, period 1). The personal advice provided on the website corresponded with the advice in the face-to-face contact and was provided in a structured and reproducible way.

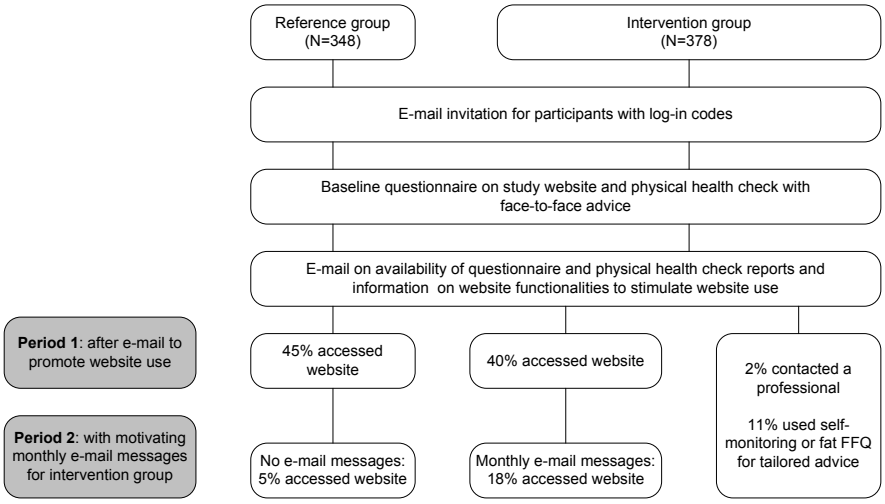
Reference group

Participants in the reference group had access to their physical health results and reports based on the online questionnaire. These reports consisted of their personal physical activity level and fruit and vegetable intake level and information on the recommended levels. The website provided general lifestyle and health information.

Intervention group

Participants in the intervention group had access to several additional website functionalities compared with participants in the reference group. Participants in the intervention group received more extensive computer-tailored advice on their self-reported physical activity and nutrition behaviour on the questionnaire. The electronically generated advice included per-

Figure 7.2 Study design with the two distinct periods for website use



sonal and action feedback taking into account perceived barriers for participants not meeting the guidelines.[20,21] Perceived barriers were assessed by asking for the most important barrier to engaging in the specific lifestyle behaviour.

In addition, participants had the opportunity to use the following intervention elements: (1) online self-monitoring of fruit and vegetable intake, physical activity, and weight to monitor progress toward behaviour change and obtain tracking charts, (2) a food frequency questionnaire (FFQ)[22] assessing saturated fat intake for tailored advice (after third e-mail message), and (3) the ability to ask questions of several professionals.

Finally, to stimulate sustained website use, participants in the intervention group received motivating monthly e-mail messages focusing on physical activity and nutrition. Participants received their first motivating e-mail message 1 month after they received an e-mail to visit the website to view their health check results and the advice based on the baseline questionnaire. With the motivating e-mail messages, the second important period of the website component started (see Figure 7.2, period 2). Period 2 covered 3 monthly e-mail messages focusing on physical activity and nutrition (duration of 12 weeks). The first monthly e-mail message was tailored to the individual, and if new information was available through the self-monitors, the subsequent e-mail was personalized again. If no new information from the participant was available, the e-mails contained more general information. The third message announced the opportunity to fill out the fat FFQ for tailored advice. In all monthly e-mail messages, partici-

pants were encouraged to fill out the self-monitors and to ask their questions. The monthly e-mail messages were written by a researcher (author SR).

Website use

Participants had to log in to the website using their personal login details to access their individual reports as well as to read general information on health and lifestyle. All website visits were registered, and for both period 1 and period 2, a variable for website visit (yes/no) was calculated for all the participants. Website use in period 1 was determined as at least 1 website visit within the month after the e-mail was sent to promote website use. Website use in period 2 was determined as at least 1 website visit within 3 months after the first motivating monthly e-mail message to the intervention group. For participants in the intervention group, self-monitor use and fat FFQ use were defined as using these features at least once in period 1 or period 2.

Demographic characteristics

In the baseline questionnaire, participants were asked about age, sex, education, marital status, and ethnicity. Educational level was assessed as the highest level of education completed and was categorized into low (primary school, lower and intermediate secondary schooling, or lower vocational training), intermediate (higher secondary schooling or intermediate vocational schooling) and high (higher vocational schooling or university). We applied the standard definition of ethnicity of Statistics Netherlands and considered a person to be non-Dutch if at least one parent was born abroad.[23]

Lifestyle behaviour and health indicators

Physical activity level was measured in the baseline questionnaire using the self-administered short version of the International Physical Activity Questionnaire (IPAQ),[24] which assessed vigorous and moderate intensity physical activity. The average time spent on physical activity per day was calculated. For all behaviours we calculated a dichotomous variable for compliance or noncompliance with recommendations. For physical activity level, we used a cut-off point of 30 minutes or more per day. We did not include walking in this calculation since walking at a casual pace is regarded a light-intensity activity.[25]

For fruit and vegetable intake, 400 grams of fruit and vegetable intake as measured with a self-administered 9-item validated Dutch Food Frequency Questionnaire was used as cut-off point.[26] Smoking was defined as current smoking status and excessive alcohol use as drinking at least 6 glasses on the same occasion at least once a week. The Short Form-12 (SF-12) questionnaire[27] was used to measure self-reported general, physical, and mental health. General health was dichotomized into "poor or moderate" and "good to excellent." Physical

and mental health were categorized as poor if the summed scores were in the lowest quartile (lower than 48.74 and 46.56, respectively).

Physical health check

In the physical health check, height and weight were measured to calculate body mass index (BMI) and to categorize individuals as normal weight (BMI<25 kg/m2) or overweight (BMI≥25 kg/m2). Total blood cholesterol was measured in nonfasting blood through a finger prick (Accutrend GC, Roche Company, Mannheim, Germany), and blood pressure with a fully automated sphygmomanometer (Omron M4-I, Omron HealthCare Europe BV, Hoofddorp, the Netherlands). A total cholesterol level above 5.0 mmol/l and a systolic or diastolic blood pressure above respectively 140 mmHg and 90 mmHg were considered elevated. A submaximal exercise test on a bicycle ergometer was conducted to predict maximal oxygen uptake according to the American College of Sports Medicine's (ACSM) protocol using their sex- and age-dependent cut-off points.[28]

Social cognitive variables

For physical activity and for fruit and vegetable intake, attitude, social support, self-efficacy, and intention to change were measured in the baseline questionnaire. Intention, self-efficacy, and attitude were measured on a 5-point Likert[23] scale ranging from "certainly not" to "certainly." All variables were dichotomized. Intention was measured by asking if the participant intended to change the behaviour in the next month.[29] A high intention was defined as probably or certainly intending to change the behaviour. Self-efficacy was assessed by asking if the participant was confident about engaging in the healthy behaviours in the next month.[29] High self-efficacy was defined as probably or certainly confident about changing the behaviour. To measure attitude, individuals were asked if they thought improving the behaviour would take a lot of effort.[30] Those participants who answered "probably not" or "certainly not" were considered as having a positive attitude. Finally, social support was measured by asking if family and friends support them in changing the specific behaviours. This was measured on a 4-point Likert scale ranging from "seldom or never" to "a lot."[29] High social support was defined as perceiving "pretty much" support or "a lot" of support.

Statistical Analyses

Descriptive statistics were used to present the baseline characteristics of the study population. The associations of demographic characteristics, behaviours, social cognitive variables, and health indicators with website use were investigated with logistic regression analysis. Separate analyses were conducted for website use in period 1 among the total study population and website use in period 2 among the intervention group. First, univariate logistic regression models were carried out to determine the single effects of the possible determinants. All variables with a p-value less than .20 in the univariate models were considered for inclusion in

Table 7.1 Baseline characteristics of the total study population and the intervention group in a longitudinal study among 726 employees

	Total Study Population (N=726)		**Intervention Group** (N=378)		**Reference Group** (N=348)	
	N	%	N	%	N	%
Demographics						
Female gender	403	56	209	55	194	56
Age (years)						
<30	100	14	56	15	44	13
30-39	203	28	94	25	109	31
40-49	228	31	112	30	116	33
50+	194	27	115	31	79	23
Education level						
Low	131	18	60	16	71	20
Intermediate	253	35	131	35	122	35
High	341	47	186	49	155	45
Dutch ethnicity	615	85	319	85	296	85
Married/cohabiting	547	75	285	76	262	75
Behaviour						
Insufficient moderate physical activity	223	31	115	31	108	31
Insufficient vigorous physical activity	502	69	258	68	244	70
Insufficient fruit or vegetable intake	323	45	159	42	164	47
Smoking	117	16	60	16	57	17
Excessive alcohol	27	4	13	3	14	4
Social cognitive variables						
Physical activity						
Positive attitude	355	49	197	52	158	45
High social support	112	15	55	15	57	16
High self-efficacy	562	77	288	76	274	79
Intention to increase physical activity	348	48	167	44	181	52
Fruit and vegetable intake						
Positive attitude	510	70	265	70	245	71
High social support	91	13	46	12	45	13
High self-efficacy	599	83	319	84	280	81
Intention to increase intake	124	17	68	18	56	16
Health indicators						
Overweight/obese	293	40	152	40	141	41
Poor/moderate general health	39	5	17	5	22	6
Lowest quartile mental health	181	25	97	26	84	24
Lowest quartile physical health	181	25	90	24	91	26
Elevated blood pressure	217	30	113	30	104	30
Elevated total cholesterol level	301	42	161	43	140	41
Poor predicted maximum oxygen uptake	90	13	43	12	47	15

the multivariate analysis. A backward regression method was used to determine the multivariate model. In the analyses, age and sex were included by default in each multivariate model. Variables with a p-value of .05 or less were retained in the multivariate model. The results are presented as the odds ratios (OR) and corresponding 95% confidence intervals (95%CI), with ORs below and above 1 representing, respectively, lower and higher website use. All analyses were carried out with SPSS version 15.0 (SPSS Inc, Chicago, IL, USA).

Results

Study population

In total, 726 employees participated in this study. The baseline characteristics of the study population are presented in Table 7.1. More than half of the participants (403, 56%) were female workers. The mean age of the study population was 42 years, ranging from 20 to 63 years, and 47% (341) had had higher education. Almost a third of the participants (223, 31%) were not physically active at a moderate intensity for at least 30 minutes per day, and 45% (323) had insufficient fruit and vegetable intake. Complying with the moderate intensity physical activity guideline was associated with sufficient fruit and vegetable intake (not in table). More than half of the participants who did not meet the physical activity guideline for moderate intensely physical activity had the intention to increase physical activity (122/223, 55%), compared with 45% (225/503) of the participants who did comply with the guideline. For fruit and vegetable intake, 22% (71/323) of the participants who did not meet the recommendation and 13% (52/403) of the participants who did, intended to increase fruit and vegetable intake. Participants complying with the guidelines were more likely to have a positive attitude. No association was found between self-efficacy and complying with the recommended levels for physical activity and fruit and vegetable intake (not in table).

Website visit

After the first e-mail message, 43% of all the participants visited the website component of the program; 45% (157/348) of the participants in the reference group and 40% (152/378) in the intervention group (OR=0.82; 95%CI=0.61-1.10). In the following three months in which the intervention group received a monthly e-mail message, 18% (67/378) of the participants in the intervention group visited the website again compared with 5% (18/348) in the reference group (OR=3.96; 95%CI=2.30-6.82).

Correlates of website visit

As shown in the univariate analysis in Table 7.2, older employees (OR=1.89; 95%CI=1.15-3.13), those with a positive attitude toward increasing physical activity level (OR=1.36; 95%CI=1.01-1.83), and those with an elevated cholesterol level (OR=1.51; 95%CI=1.12-2.04) were more likely to visit the website after the first e-mail message, and participants with insufficient

Table 7.2 Univariate and multivariate odds ratios (OR) and 95% confidence intervals (95%CI) of individual characteristics, behaviours, social cognitive variables, and health indicators for visiting the website in the first period after the health check (N=726)

	Univariate Analysis		Multivariate Analysis	
	OR	95%CI	OR	95%CI
Demographics				
Female gender	0.93	0.69-1.25	1.00	0.74-1.36
Age (years)				
<30	1.00		1.00	
30-39	1.35	0.82-2.23	1.35	0.81-2.24
40-49	1.35	0.83-2.21	1.18	0.72-1.96
50+	1.89[b]	1.15-3.13	1.65	0.97-2.79
Education level				
Low	0.92	0.62-1.39		
Intermediate	0.76[a]	0.55-1.06		
High	1.00			
Dutch ethnicity	0.96	0.64-1.45		
Married/cohabiting	1.34[a]	0.94-1.89		
Behaviour				
Insufficient moderate physical activity	0.66[b]	0.47-0.91	0.64[b]	0.46-0.90
Insufficient vigorous physical activity	1.01	0.73-1.39		
Insufficient fruit or vegetable intake	1.01	0.75-1.36		
Smoking	0.71[a]	0.47-1.07		
Excessive alcohol consumption	0.83	0.37-1.85		
Social cognitive variables				
Physical activity				
Positive attitude	1.36[b]	1.01-1.83		
High social support	0.84	0.55-1.27		
High self-efficacy	1.00	0.71-1.43		
Intention to increase physical activity	1.11	0.83-1.49		
Fruit and vegetable intake				
Positive attitude	1.22	0.88-1.69		
High social support	0.97	0.62-1.52		
High self-efficacy	0.89	0.60-1.31		
Intention to increase intake	0.70[a]	0.47-1.05		
Health indicators				
Overweight/obese	0.96	0.71-1.30		
Poor/moderate general health	1.29	0.68-2.46		
Lowest quartile mental health	1.18	0.84-1.66		
Lowest quartile physical health	0.97	0.69-0.37		
Elevated blood pressure	0.82	0.59-1.13		
Elevated total cholesterol level	1.51[b]	1.12-2.04	1.44[b]	1.05-1.98
Poor predicted maximum oxygen uptake	0.83	0.53-1.31		

[a] p<.20, considered for inclusion in the multivariate logistic regression analysis
[b] p<.05

Table 7.3 Characteristics of the intervention group and univariate and multivariate odds ratios (OR) and 95% confidence intervals (95%CI) of individual characteristics, behaviours, social cognitive variables, and health indicators for visiting the website in the second period in the intervention group (N=378)

	Univariate Analysis		Multivariate Analysis	
	OR	95%CI	OR	95%CI
Demographics				
Female gender	1.32	0.77-2.27	1.35	0.78-2.33
Age (years)				
<30	1.00		1.00	
30-39	0.97	0.39-2.39	1.02	0.41-2.54
40-49	1.26	0.54-2.97	1.47	0.62-3.52
50+	1.14	0.49-2.69	1.37	0.57-3.28
Education level				
Low	0.57	0.24-1.36		
Intermediate	1.04	0.59-1.84		
High	1.00			
Dutch ethnicity	1.05	0.50-2.20		
Married/cohabiting	1.01	0.54-1.87		
Behaviour				
Insufficient moderate physical activity	1.06	0.60-1.87		
Insufficient vigorous physical activity	0.86	0.49-1.51		
Insufficient fruit or vegetable intake	1.45[a]	0.85-2.46		
Smoking	0.46[a]	0.19-1.13		
Excessive alcohol consumption	0.41	0.05-3.24		
Social cognitive variables				
Physical activity				
Positive attitude	0.57[b]	0.33-0.97	0.54[b]	0.31-0.93
High social support	0.80	0.36-1.78		
High self-efficacy	0.83	0.45-1.51		
Intention to increase physical activity	1.11	0.65-1.89		
Fruit and vegetable intake				
Positive attitude	0.55[b]	0.32-0.96		
High social support	0.42[a]	0.14-1.20		
High self-efficacy	1.07	0.51-2.25		
Intention to increase intake	0.89	0.44-1.80		
Health indicators				
Overweight/obese	1.27	0.75-2.17		
Poor/moderate general health	0.99	0.28-3.54		
Lowest quartile mental health	0.65[a]	0.34-1.24		
Lowest quartile physical health	1.01	0.55-1.89		
Elevated blood pressure	0.75	0.41-1.38		
Elevated total cholesterol level	0.89	0.52-1.52		
Poor predicted maximum oxygen uptake	0.56	0.21-1.47		

[a] p<.20, considered for inclusion in the multivariate logistic regression analysis

[b] p<.05

moderate-intensity physical activity (OR=0.66; 95%CI=0.47-0.91) were less likely to do so. In the multivariate analysis, sufficient moderate physical activity (OR=0.64; 95%CI=0.46-0.90 for insufficient physical activity) and an elevated cholesterol level (OR=1.44; 95%CI=1.05-1.98) remained significantly associated with website visit in period 1. Attitude to increase physical activity did not remain statistically significant in the multivariate analysis (OR=1.34; 95%CI=0.98-1.82). Table 7.3 shows that among the participants in the intervention group, those with a positive attitude toward increasing their level of physical activity (OR=0.57; 95%CI=0.33-0.97) and fruit and vegetable intake (OR=0.55; 95%CI=0.32-0.96) were less likely to visit the website in the period with monthly e-mail messages. In the multivariate analysis, only attitude toward increasing physical activity level (OR=0.54; 95%CI=0.31-0.93) remained statistically significant.

Use of interactive website elements in the intervention condition

Of the website visitors in the intervention group, 11% (41/378) used the self-monitors or the FFQ, and 2% (8/378) contacted a professional via the website (Figure 7.2). Table 7.4 shows that female workers were more likely to use the self-monitor or fat FFQ compared with male workers (OR=2.36; 95%CI=1.14-4.90). As for website use in period 2, those workers with a positive attitude toward increasing their physical activity level were less likely to visit the website to use the specific website functionalities (OR=0.50; 95%CI=0.25-0.99).

Discussion

In this study, we examined the use of the website component of a worksite physical activity and nutrition promotion program. In total, 43% of the participants visited the website after an e-mail to promote website visits to view their personal health results and the personal advice based on the baseline questionnaire. Participants who did not meet the recommended level of physical activity were less likely to visit the website, whereas individuals with an elevated total cholesterol level were more likely to visit the website. Participants in the intervention group visited the website more often during a 3-month period than those in the reference group (18% versus 5%). Participants with a positive attitude toward increasing physical activity were less likely to use self-monitors for tracking their behaviour and to complete the fat FFQ to receive tailored advice. Compared with male workers, more female workers visited the website to monitor their behaviour and/or weight or to receive tailored advice on fat intake.

Website visits

Compared to previous studies, website visiting after the first e-mail reminder was relatively high.[6,8] The face-to-face contact may have had a positive influence and may be one of the reasons for the relatively high initial number of visitors. However, website use was not optimal, since it was intended that all participants would visit the website. By not using the website

Table 7.4 Univariate and multivariate odds ratios (OR) and 95% confidence intervals (95%CI) of individual characteristics, behaviours, social cognitive variables, and health indicators for self-monitor and fat FFQ use in the intervention group (N=378)

	Univariate Analysis		Multivariate Analysis	
	OR	95%CI	OR	95%CI
Demographics				
Female gender	2.41[b]	1.17-4.96	2.36[b]	1.14-4.90
Age (years)				
<30	1.00		1.00	
30-39	0.93	0.34-2.55	0.99	0.36-2.77
40-49	0.92	0.35-2.45	1.09	0.40-2.98
50+	0.67	0.24-1.86	0.85	0.30-2.43
Education level				
Low	0.87	0.34-2.28		
Intermediate	0.94	0.46-1.93		
High	1.00			
Dutch ethnicity	1.77	0.61-5.17		
Married/cohabiting	1.00	0.47-2.13		
Behaviour				
Insufficient moderate physical activity	1.21	0.61-2.40		
Insufficient vigorous physical activity	1.00	0.50-2.01		
Insufficient fruit or vegetable intake	1.69[a]	0.88-3.24		
Smoking	0.54	0.19-1.58		
Excessive alcohol consumption	0.68	0.09-5.35		
Social cognitive variables				
Physical activity				
Positive attitude	0.49[b]	0.25-0.96	0.50[b]	0.25-0.99
High social support	0.80	0.30-2.13		
High self-efficacy	0.73	0.36-1.49		
Intention to increase physical activity	1.37	0.72-2.63		
Fruit and vegetable intake				
Positive attitude	0.63[a]	0.32-1.24		
High social support	0.34[a]	0.08-1.46		
High self-efficacy	1.09	0.44-2.72		
Intention to increase intake	1.33	0.60-2.92		
Health indicators				
Overweight/obese	0.94	0.48-1.83		
Poor/moderate general health	1.82	0.50-6.63		
Lowest quartile mental health	0.93	0.44-1.97		
Lowest quartile physical health	1.37	0.67-2.82		
Elevated blood pressure	0.45[a]	0.19-1.05		
Elevated total cholesterol level	1.06	0.55-2.03		
Poor predicted maximum oxygen uptake	1.63	0.67-3.96		

[a] p<.20, considered for inclusion in the multivariate logistic regression analysis

[b] p<.05

component, a substantial part of the study group was not exposed to the content provided on the website. Leslie et al.[31] found in a study investigating a physical activity website in the workplace setting that a comparable 46% of the participating employees visited the website at least once. There are studies, however, that have found higher levels of website usage. Ware and colleagues,[13] for example, found in a study with a face-to-face contact and an Internet-delivered physical activity and weight management program that 78% of the participants were still using the website after 12 weeks. An important difference between our study and the study of Ware and colleagues is the role of the initial contact. In our study, the face-to-face contact consisted of feedback of test results and personal advice, while in the study of Ware it was a screening and an information session on how to use the Internet-delivered program. One of the explanations for the lower usage level in our study may be that people participated in the study primarily to get insight into their health status (cholesterol level and blood pressure) and that they were less interested in changing their behaviour. The fact that participants could visit the website component after a series of tests and advice based on these tests in a face-to-face contact may have made it less relevant for them to visit the website to review their results and to obtain additional advice and information about a healthy lifestyle. Another explanation might be a lack of new content on the website. It has been suggested by experts as well as potential users that the provision of regular new content could be an important factor in encouraging website use.[17,18]

Correlates of website visits

Participants with an elevated cholesterol level were more likely to visit the website, which may indicate that visiting the website component was relevant for participants with less favourable test outcomes. In contrast, in the month after the e-mail to promote website use was sent, individuals meeting the physical activity guideline were more likely to visit the website. Verheijden et al.[8] also reported contradictory findings, with more participation among people with healthier lifestyles and among overweight or obese participants. It could be hypothesized that those with poorer outcomes on health indicators had a higher risk perception as compared with those not complying with lifestyle recommendations. However, elevated cholesterol level was the only health indicator associated with website use, and this finding was not corroborated by other health indicators such as blood pressure and self-reported health and, thus, the finding that elevated cholesterol level was associated with website use may be spurious. The finding that participants not meeting the physical activity guideline were less likely to use the website might be related to the communication to encourage the individual to change their behaviour. However, this lower website use was only found in the first period and not in the period with monthly e-mail messages. Based on our results, no consistent higher participation was found among those with healthier behaviours, and, thus, a health-based selection in website use could not be demonstrated.

Use of interactive website elements in the intervention condition

In line with other studies, we found that Internet access in the following 3 months was low.[5-8] Even though the 3 e-mail reminders sent in this period resulted in a higher percentage of website visits compared with the reference group, only 18% visited the website. The difference between the reference group and the intervention group provides evidence that monthly e-mail messages function as a prompt to visit the website; however, it may be a weak prompt. Ware et al found a high repeated participation with an Internet-delivered program using an accelerometer and weighing scale as monitoring devices.[13] The availability of such devices might increase compliance with the use of self-monitors. Experts have suggested that the possibility to monitor progress could be a factor to encourage website use.[17] In a focus group, study participants mentioned that the possibility of asking questions on a website for behaviour change would increase use.[32] However, the findings of our study do not seem to support these notions. We do not know, however, why participants visited the website again in the 3-month period. Additional qualitative information of website use may shed more light on this in future studies.

Participants with a positive attitude (i.e., those who thought that it would not take a lot of effort to increase physical activity and fruit and vegetables intake) were less likely to track their behaviour or to obtain tailored advice on fat intake. This may indicate that they did not need the website component to visit it again. Whereas women and men did not differ with respect to website visits, more women used the website to track their behaviour or to obtain tailored advice on fat intake. In a systematic review on participation in worksite health promotion programs, a higher initial participation among female workers was found except for programs offering access to a fitness centre.[33] Other studies have also reported a higher participation among women in Internet-delivered programs.[2,8,34] This may be explained by a higher interest in health issues among women.[14]

Limitations

This study has some limitations. First, two measures of website use are reported: website access and the use of a self-monitor and a fat questionnaire to obtain tailored advice. These measures do not provide any information as to what extent the participants actually read the available information or how much time they spent on the website. Second, because of the combination of the website component with a face-to-face contact, we cannot generalize the results to website use of programs without face-to-face contact in the worksite settings. Third, departments within workplaces instead of individuals or workplaces were randomized. Since employees do not share their work space with employees from other departments, we do not think contamination was a major issue in our study. Furthermore, the programs for the intervention and reference groups were quite similar, with both groups having the opportunity to participate in a face-to-face contact and to use the website. Therefore, it would

be difficult for a participant to find out that different programs were offered. Fourth, the participation levels as well as the populations of the participating workplaces differed. Not all employees had equivalent access and use of computers and e-mail during their workday. Therefore, we estimated for all occupations in the study population if the work is primarily done using a computer. The group spending a major part of the day with computer work was not found to have an increased website use compared with workers with less or no computer work. Strengths of the study were that the user statistics are linked to the individual level and the availability of objective health indicators.

Conclusion

This study demonstrated that almost half of the participants used the website component of a worksite physical activity and healthy nutrition promotion program in the period after a face-to-face contact with personal advice. Monthly e-mail messages were a prompt to visit the website. However, over the longer term, low use was found in this target group. More women than men used the website to obtain personalized advice for behaviour change. No consistent higher participation was found among those with healthier behaviours. This health promotion program did not provide an indication that healthier subjects are more susceptible to health promotion.

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8

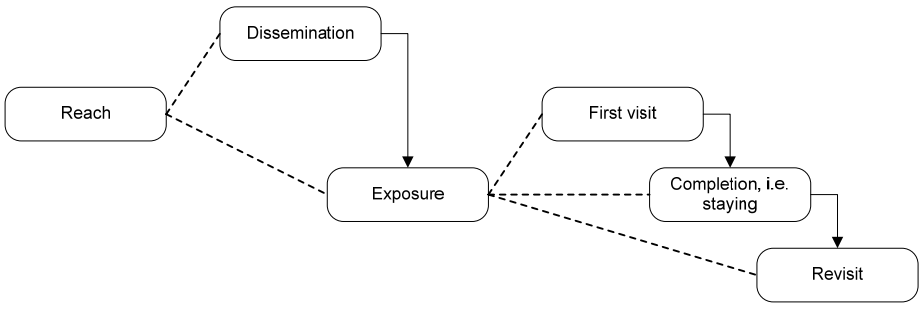
General discussion

The studies described in this thesis aimed to provide more insight into factors that can contribute to better dissemination of and exposure to Internet-delivered health behaviour change interventions ('Internet interventions') for adult target populations. Characteristics of users and of Internet interventions were studied as potential exposure enhancing factors. In addition, strategies that could enhance dissemination of Internet interventions were studied. The studies in this thesis addressed the following questions:

1. Which user and intervention characteristics are related to use of and therefore exposure to Internet interventions?
2. What are potential effective dissemination strategies that might enhance exposure to Internet interventions?

The conceptual model (Figure 8.1) used in the studies considers exposure and dissemination to be two elements of reach. Exposure is further divided into three phases: (1) a first visit to an intervention website, in which the potential user makes the decision whether or not to go to the intervention website and access the program, (2) an extension of the first visit, in which the user has to decide whether or not to stay on the website and be exposed to (part of) the intervention content, and (3) a revisit to an Internet intervention, in which the user has to decide to make a return visit to the intervention website, e.g., for sustained intervention exposure, by completing the intervention, monitoring of progress, revisiting the content, or seeking new content. This distinction was made because it was expected that different exposure enhancing or inhibiting factors may play a role in each of these phases. In this thesis, the term dissemination was used to refer to all the activities of developers or providers in bringing an Internet intervention to the attention of potential users.

Figure 8.1 Conceptual model of reach



This chapter summarises and integrates the main findings of the studies that were conducted to answer the research questions, then methodological issues will be discussed, and implications for further research and practice will be provided.

Main Findings

This section starts by discussing and integrating the main findings for factors associated with exposure to Internet interventions and the three phases of exposure that we have distinguished in the conceptual model (research question 1). It then moves on to discussing the findings with regard to potentially effective dissemination strategies (research question 2).

Exposure

First visit

The experts who participated in the Delphi study agreed that characteristics of the potential user, such as motivation to visit an intervention and perceiving the intervention as personally relevant, are important for a first visit to Internet interventions. The results of the focus group study (Chapter 3) were generally in accordance with the Delphi study. Additionally, potential users mentioned that motivation to change a health behaviour and curiosity about the intervention are factors that might encourage them to visit an Internet intervention.

In addition to personal characteristics, both the experts and the potential users suggested that intervention characteristics, such as an attractive interface and an easy to use program at first sight, may be important factors for a first visit. It is essential to take these aspects into account in the development of an Internet intervention, as people can form an opinion about the visual attractiveness of a website within 50 millisecond.[1] The findings of the secondary analyses of the *Gezondlevencheck* study (Chapter 5) may support the hypothesis that a decision whether or not to continue with an intervention program can be made quickly, as over half of the 285,146 visitors left the intervention website within 30 seconds of accessing the website.

Because it is to be expected that a first visit is directly related to the way an Internet intervention is disseminated, it is important that promotion strategies pay attention to essential individual characteristics of potential users and that people are persuaded in a way that attracts them to find out what an intervention entails. In addition, the channel through which an intervention is promoted and the authority or person who promotes it may be of importance in attracting people to a website for a first visit. The study about the distribution of a flyer to promote visiting a physical activity Internet intervention (Chapter 6) provides some indication that promotion of Internet interventions by general practitioners (GPs) may attract more people to actually visit an Internet intervention compared to people that received a flyer in their letterbox from Erasmus Medical Centre Rotterdam. Moreover, groups that have found to be less reached and exposed to Internet interventions (e.g., men, people with lower levels of

education, and people who engage in the risk behaviour(s)) may be more likely to be attracted to Internet interventions when the GP promotes them. The study on the worksite intervention (Chapter 7) showed that 43% of the participants visited the intervention website of a more comprehensive physical activity and nutrition promotion program after it was promoted by e-mail. In this study, participants who already met the minimum recommended level of physical activity, but also participants with an elevated total cholesterol level were more likely to visit the website, indicating that people with identified risk factors can be attracted to an intervention when promoted in this way. It must be noted, however, that the initial face-to-face contact in which they already received insight into their health status might also have motivated them to visit the website and that this worked in conjunction with the e-mail invitation. However, in spite of a personal e-mail invitation and personal motivation, more than half of the participants did not go online to view their health check results and their personal advice. This may be because they were more interested in gaining insight in their health status provided directly after their physical health check (i.e., cholesterol level, blood pressure) and less in health behaviour change.

It is often reported that women, higher educated people and people who are more committed to and interested in a healthy lifestyle are more likely to visit a health promotion Internet intervention.[2-6] Dutta-Bergman[7] showed that people who look for health information on the Internet are generally more health-oriented than people who do not. Women, who are generally more interested in health issues,[2] and people who are motivated to live a healthy lifestyle,[5] might therefore be more inclined to visit, use and revisit an Internet intervention. These considerations were partly confirmed in our studies of both the *Gezondlevencheck* (e.g., more women, higher educated people, fewer smokers, people eating less saturated fat) and the worksite intervention (e.g., more women, participants who met physical activity recommendations). Contrary to expectations, the *Gezondlevencheck* attracted more or the same proportion of people who were physically less active or overweight compared to the general Dutch population, and participants of the worksite intervention with an elevated cholesterol level were more likely to visit the intervention website in a worksite setting. These findings seem to concur with what has been reported in some previous studies. Verheijden et al.[6] found, for example, higher participation rates among people with healthier lifestyles (including non-smokers, people meeting guidelines for physical activity and vegetable consumption), but also among overweight or obese participants. Bundorf et al.[8] have reported that people with chronic diseases are more likely to search the Internet for health-related information than the general population, and our results and the results of Verheijden et al. indicate that the same may be true for overweight or obese people. It has further been found in earlier research that people who perceive their overweight as a health risk are more likely to initiate activities to loose weight[9] and the Internet may be a likely source for anonymous information on these matters. The distribution of flyers through different channels indicated that different

population groups can be reached with different promotion strategies. The perceived trust and authority of the GP[10,11] might have motivated people to visit the intervention website. Such differential effects of different health education website promotion sources should be further investigated in future research.

The results of this thesis indicate that it is important to motivate and interest people before they visit an Internet intervention and make the topic personally relevant to them. The use of effective promotion strategies is essential to persuade people in a way that attracts them to find out what the Internet intervention entails. However, the appearance of a website at first sight is important when encouraging people to proceed further after accessing the homepage of an Internet intervention. The channel through which the intervention is promoted or prompted may be important with respect to whom is attracted for a first visit.

Extending a visit

Low visitors exposure to the actual content of Internet interventions is a frequently reported problem.[12-14] Visitors (i.e., people that accessed the website) tend not to use the intervention content as intensively as intended[13] and it easy for visitors to leave the intervention website before having finished the program. The expert participants in the Delphi study (Chapter 2) agreed that after the first encounter with the intervention, the characteristics of an Internet intervention are particularly important to a decision to continue the website visit and therefore to get exposed to the content. The provision of personally tailored feedback, relevant and reliable information and a clear and easy navigation structure were mentioned as factors of relevance to continue a visit. In addition, the existence of a registration procedure to get access to the intervention site was indicated as a barrier to visit continuation by potential users (Chapter 3). However, if the reasons for registration were regarded as valid and were explained clearly, a registration procedure might be less of a barrier according to potential users. The fact that 71% of the visitors that accessed the *Gezondlevencheck* website left before getting access to the actual intervention content (Chapter 5), might to some extend be due to the registration procedure. However, the actual impact of registration procedures on extending a visit to an Internet intervention needs to be further researched.

The potential users further indicated that the first few minutes on an intervention website are crucial. In these minutes, exposure to the content should be sufficiently appealing and interesting – with respect to the visual appearance[12] and the content of the intervention site – to make it worth staying at the intervention site. Next, many Internet interventions start with a questionnaire to enable a personal assessment or 'diagnosis' of the user to enable computer-tailored feedback and advice.[4,15,16] The length of such a questionnaire was also regarded by potential users as an important (de)motivator; long questionnaires were reported to discourage continuation of a visit to an Internet intervention site. However, in an unpublished pilot study among 412 people of 50 years or older, in which the length of the screening questionnaire to

assess physical activity was varied (175 randomized to the short (max 22 items) and 237 to the long (max. 45 items) questionnaire), we found that the longer questionnaire was more often completed (73%) compared to a shorter questionnaire (62%). Yet, significantly more participants who had completed the shorter version extended their visit to get exposed to other parts of the intervention program (56% vs. 37%). This may indicate that longer questionnaires for providing an older population with personally tailored physical activity feedback do not lead to lower response rates. However, completing such a longer questionnaire may reduce the chance of exposure to additional parts of the intervention website. It may be that there is simply a maximum average time that participants were willing to spend on this intervention website, and the longer it took to complete the questionnaire, the less time remained for other activities. These results provide a first indication that the length of the assessment questionnaire may be of influence to the exposure to the intervention content, but the effects of different lengths of questionnaires on the effects of tailored feedback needs to be further investigated.

Further, the potential users mentioned several interactive elements that can make it more interesting to stay on an Internet intervention. Next to practical information, such as the availability of recipes for healthy meals and success stories of previous users, peer support elements (e.g., chat room, forum) to exchange experiences and to motivate and support each other were mentioned as intervention elements that may increase the time spent on an intervention website. The literature review presented in this thesis (Chapter 5) also indicated that the inclusion of facilitation of peer support (e.g., chat room, forum) may be related to a prolonged stay on an intervention website. However, although peer support might have a positive influence on the time people spend on an intervention website, it does not necessarily mean that visitors are exposed to and actively engaged in the intervention content. Moreover, even though both experts and potential users indicated that peer support is possibly associated with improved exposure to Internet interventions, the actual use of this option was reported to be moderate to extremely low in some of the included studies in the review.[17,18] Although visitors with access to a bulletin board spent significantly more minutes on a smoking cessation intervention website compared to visitors without access to a bulletin board, Stoddart et al.[19] found in the same study that only one in ten visitors viewed or used the bulletin board. Social networking features (e.g., Hyves, Facebook, MySpace) as peer support may also increase time spent on the website and can be very attractive for attracting and engaging visitors,[20] but such features are hardly utilized in currently existing Internet interventions.[21] Future studies can provide more insight into the added value of such features in terms of exposure rates. It has also been suggested in other studies that visitors prefer audio, graphics and interactivity as parts of Internet interventions,[22,23] but these types of features did not come out as important in the review study.

The actual utilization of an intervention can be assessed by its website use.[24] The use of computer log data may provide more insight into actual use of the intervention and its contents,

for example such as the interventions mentioned in Chapters 5 and 6. The results presented in Chapter 5 showed that of the visitors who registered and therefore gained access to the intervention content of the *Gezondlevencheck*, 91% completed at least one complete intervention module, and thus received individually tailored feedback. Women, visitors aged 40 to 50, medium to highly educated people and people with a healthy body mass index (BMI) were more likely to initiate and to complete an intervention module. The provision of three different behaviour modules (physical activity, saturated fat intake, and smoking cessation) might have enhanced the exposure of visitors to part of the intervention content, as people could make their own choice about which topic they were most interested in, which may make them more inclined to finish a module. However, this does not necessarily mean that they visited the modules which were most relevant to them. Similar results were found among the people who accessed the intervention website in the study described in Chapter 6. Nearly everyone who logged on to the intervention website started the intervention and received tailored feedback on physical activity. Visitors invited to access the website through their GPs were significantly more inclined to continue with the program to get exposed to the whole intervention compared to people who were attracted to the website through the door-to-door distribution of flyers. This suggests that the more personal promotion by GPs might have a positive effect on the motivation of visitors to complete an Internet intervention. In contrast to many other studies,[12-14] the results of both studies indicate that it is possible to keep people engaged in the intervention program for a longer time once they have accessed the program. This may be because of the provision of feedback opportunities regarding multiple behaviours and person-to-person promotion, but more research is necessary building on the present first explorations.

The results of this thesis indicate that intervention-related characteristics and the way the Internet intervention is promoted are likely to play a role in the decision and motivation of people to continue their visit and get exposed to the intervention content. Obviously, some elements need to be integrated in each Internet intervention (e.g., reliable information and easy to follow navigation structure), but different health promotion methods and strategies (e.g., goal setting, self-monitoring, peer support) may be more important for different health behaviours and population groups. However, it is important to consider carefully which methods and strategies to include in an Internet intervention, as providing more elements can work counter productive. Lenert[25] reported, for example, that adding a mood management component to an Internet smoking cessation intervention was potentially harmful regarding 7 day smoke free abstinence.[25] Glasgow et al.[14] showed that adding additional components (i.e., goal setting and nutrition program) to a basic Internet intervention aiming to loose weight and therefore increasing visitors' effort, resulted in decreased engagement with the intervention content. It is therefore important to investigate which element or combination of elements are the most effective to enhance exposure to Internet interventions.

Revisit

Many Internet interventions require multiple visits to the intervention website in order to fully complete the program.[6,26,27] Repeated exposure to health behaviour change messages may be necessary to initiate and sustain behaviour change.[28-30] Furthermore, some earlier studies provided evidence that repeated exposure to computer-tailored Internet interventions increases the likelihood of sustained behaviour change.[6,30-32] The experts (Chapter 2) indicated that a positive first/previous visit, the provision of new information during a follow-up visit, and the possibility to monitor progress in behaviour change (i.e., assisted self-monitoring) were factors that might enhance a revisit, whereas sending reminders might be an effective way to encourage these revisits. These results were supported by the potential users (Chapter 3). Additionally, the potential users made it clear that they should be convinced that there is a good reason to revisit an intervention website, i.e., the revisit should have clear added value to them. Furthermore, providing reminders for revisits may be useful, but the potential users pointed out that such reminders should only be sent out if the users indicated that they would like to receive them. Our review presented in Chapter 4 showed that the inclusion of e-mail or phone contact to provide additional intervention content and/or prompts, as well as regular intervention website updates were associated with more logins on the intervention websites. In addition, Fry et al.[26] reported in a review that the use of regular prompts can be effective in improving the effectiveness of behaviour change interventions and that effectiveness is enhanced if prompts are frequent and personal contact with a counsellor is included. Although this may sound very promising, several studies have indicated disappointing results regarding revisiting an Internet intervention regardless of the use of e-mail reminders, and showed that there was a sharp decline in website visits after the initial weeks.[23,33,34] Counselling support through the Internet in addition to the Internet interventions itself may enhance website utilization. However our review found no evidence for increased revisits when Internet interventions were combined with Internet-based person-to-person counselling. Furthermore, adding counselling support to Internet interventions will very likely increase the intervention costs and decrease the Intervention reach substantially.[20]

In two studies revisits to an intervention website were examined. In the study of the *Gezondlevencheck* (Chapter 6), multiple visits were possible as visitors were advised to revisit the program to check their status and progress regarding the risk behaviours addressed. However, there were no e-mail reminders or other prompts to promote revisits. In total, 6% of the registered visitors visited the *Gezondlevencheck* website more than once. Women, visitors aged 40 to 50, visitors with a low or high educational level, and people who did not comply with the advised physical activity level and saturated fat intake were more likely to revisit the *Gezondlevencheck* than their counterparts. It appeared that people, who would benefit the most from the intervention program, were most likely to return to the website more or less spontaneously. Being obese (BMI>30) was not found to predict revisits to the intervention

website, which accords with the study by Wanner et al.,[35] but contrast with results reported by Verheijden et al.[6] Verheijden also found that people meeting guidelines for physical activity of moderate intensity and for vegetable consumption were more likely to revisit the intervention website. In addition, the analyses conducted on the data of the worksite intervention for the present thesis showed that sending three monthly e-mails resulted in significantly more revisits compared to a reference group that did not receive any e-mails. However, even with e-mail reminders, only 18% of the participants visited the web-based intervention, compared to 5% of the reference group without monthly e-mails. Participants with a positive attitude towards physical activity were less likely to revisit the website and to track their behaviour or to obtain a tailored advice on fat intake. Although women did not differ from men regarding website visits in general, more women compared to men visited the website to monitor their behaviour and/or weight or to receive tailored advice on fat intake. This higher participation among women in Internet interventions in both these studies is consistent with results from earlier studies.[3,4,6] This may be because women are generally more interested in health issues.[2]

The results of this thesis support the rather obvious: that it is important for people to have a reason to revisit an intervention website. These revisits can potentially be enhanced by providing regular new content on the website and providing visitors with the opportunity to monitor behaviour change. Currently, the use of e-mail reminders appears to be the most evidence-based way to attract revisits, even though this does not mean that the number of revisits is optimal; there is still considerable room for improvement of the number of revisits.

Dissemination

The second aim of this thesis was to investigate potential effective dissemination strategies that might enhance exposure to Internet interventions. In accordance with the Precaution Adoption Process Model,[36] it makes sense that potential users first need to be aware of the existence of an Internet intervention and realise that it is personally relevant for them, before they take action and actually visit such an intervention. Just making an intervention available on the Internet without further promoting it in anyway is not likely to attract many visitors. A number of potential promotion strategies were proposed by experts and potential users (Chapter 2 and 3). In contrast to what might be expected, conventional communication channels and means (e.g., publicity campaign with simultaneous use of various mass media, word-of-mouth by family or friends, recommendation by health care providers) and strategies (e.g., publicity campaigns, TV and radio commercials, articles in newspapers) were indicated as more effective than more novel channels and strategies (e.g., e-mail, SMS, instant massaging, webpage banners) for our adult study population. It may, of course be that adults are less receptive to electronic promotion channels, than adolescents and young adults.[37] In addition, potential users suggested that a combination of different strategies would be the most useful way to attract as many people as possible to visit an intervention. Even though online promotion

strategies were not regarded as effective by experts and potential users, promising results have been found for links on related websites and use of Google AdWords.[5,38-40] The results from the studies in this thesis therefore do not rule out any promotion strategy and more research is definitely needed on this issue.

This thesis includes an exploratory study on promotion strategies (Chapter 6). This study explored the effects on website visits of a flyer promoting visiting a physical activity Internet intervention. The flyer was distributed through three different channels, and the study focussed on differences between these three channels. The distribution through GPs resulted in a higher percentage of visitors, as well as proportionally more male visitors, visitors with lower education and a higher BMI compared to door-to-door distribution. It has been indicated by Rogers[41] that people with less formal education are more likely to discontinue the adoption of innovations. People with low education level may, therefore, be expected to be less likely to use an Internet intervention which has been demonstrated in previous studies.[5,42] However, this study shows that the way an intervention is promoted might stimulate specific groups of people to actually use and visit such an intervention website. However, this study was a first exploration only and more research is necessary to experimentally test the impact of GPs and other health professionals in motivating people to visit and use an Internet intervention. As the Internet can provide visitors with the opportunity to automatically inform family and friends (i.e., electronic word-of-mouth), a third channel was tested, the tell-a-friend option.[43] Unfortunately, this option was hardly utilized, indicating that this distribution was not very effective in the way it was implemented. However, word-of-mouth communication has been acknowledged as an effective marketing tool that can influence human behaviour.[44] It has also been indicated that word-of-mouth is considered more credible than promotion through, for example, mass media,[45] as it is regarded as both tailored and independent.[46] It is therefore important to further explore the possibilities and barriers for electronic word-of-mouth as a tool to effectively disseminate Internet interventions.

Research on effective dissemination of an implemented Internet intervention is thus still in its infancy.[47] However, the dissemination potential is a key factor of the success of Internet interventions. In this thesis a number of potentially effective promotion strategies have been put forward to be investigated for efficacy and efficiency in future research.

Methodological issues

The studies presented in this thesis used a variety of different methodologies from qualitative exploratory research, through a systematic review, analysis of existing data and original quantitative (quasi-)experimental research. These studies have several limitations and the results and conclusions should be interpreted in light of these limitation. In this section, con-

siderations regarding study designs, sampling and participants, measures, and the theoretical framework are discussed.

Qualitative studies

Two qualitative studies were conducted, a Delphi study and a focus group study. These qualitative studies were exploratory and were important to generate ideas about factors associated with use and exposure to inform the systematic review, the secondary analysis, and the more experimental research.

The strength of the Delphi technique (Chapter 2) is that it is particularly suited for generating ideas about topics on which scientific knowledge is scarce. In addition, it allows for including the viewpoints of stakeholders or experts. As a Delphi study can be conducted 'electronically' there are little geographical restrictions for inclusion of respondents – experts from around the world can be included – and the technique guarantees anonymity of responses. The technique focuses on exploring levels of agreement between respondents on the important topics included in the study aims.[48,49] The results are, of course, much dependent on which respondents are invited and which invitees are willing to participate. In our study, we aimed at including a mix of experts from health promotion research and practice, e-marketing/e-commerce, web design, and technical website development. However, experts from technical and marketing/commerce backgrounds were underrepresented. Thus, the information gathered relies more on the opinions of health educators and health promoters with knowledge of Internet interventions, but may not reflect opinions of relevant experts in other fields of Internet interventions focussing on other behaviours. However, since the opinions did not seem to differ between the experts from different fields, we do not expect that the results are biased to a large extent. Furthermore, we did not include Internet communication experts outside of the field of health education and health promotion. Including experts from a broader field could have added valuable information.

A limitation of the focus group study might be the relatively small and selective sample. Issues of representativeness were, however, considered less important than our objective of obtaining opinions from people with different educational levels. It proved difficult to recruit people for the focus group interviews despite using various recruitment methods. The recruitment methods resulted in an underrepresentation of men and young adults, which may have biased the results, despite the fact that the opinions of the few male and younger adults included appeared to be not that different from the opinions expressed by others. Another serious limitation was that few people had actually visited an Internet intervention to promote healthy behaviour. Thus, our results do not include responses of people who had actual experience with the interventions that were the specific target of our study.

Systematic review

The study reported in Chapter 4 is a systematic review to examine whether the factors that came out as potentially important exposure enhancing factors in the qualitative studies, were associated with more exposure in existing empirical studies. The strength of this review is that it is one of the first to systematically study which characteristics of Internet interventions can be associated with more exposure to an intervention and its contents. However, there some barriers were encountered when conducting this review. First, we had to rely, as in every other systematic review, on the information provided in the included publications. Second, existing evidence at the moment is not optimal, as many evaluations of Internet interventions did not provide any information on objective exposure outcome measures. This substantially reduced the number of publications that could be included in the review. Third, among the studies that did include exposure information, the objective exposure outcome measures were very diverse and inconsistently presented. As the pooling of data was not possible, the review is then of a qualitative not quantitative nature, which limits the strengths of its conclusions. More consistent descriptions of intervention contents and greater consistency in presentation of objective outcome measures in the scientific papers is very important to improve the quality of data that can be analyzed in systematic reviews. If these recommendations are met, the review could be repeated to enable drawing more definite conclusions on which characteristics of Internet interventions might be effective to enhance exposure to their contents.

Empirical studies

The chapters 5 to 7 describe three empirical studies. Although controlled designs are important to investigate the efficacy of Internet interventions, observational studies were the best possible option to study exposure to Internet interventions that are already 'live' and implemented for use by the general public.

The aim of the observational study reported in Chapter 5 was to examine the use of the Internet intervention the *Gezondlevencheck* that was implemented by the Netherlands Hearth Foundation (NHF) in September 2004. The strength of this study was that we were able to investigate who uses an Internet intervention and how extensively people use an Internet intervention when it is implemented in real-life and not in a controlled study setting. As posited in the Reach, Efficacy, Adoption, Implementation and Maintenance (RE-AIM) framework,[50,51] it is important to evaluate the reach of an intervention by examining how many people of the target group are exposed to the intervention and to what extent. Unfortunately the NHF had not kept an accurate record of the used promotion strategies, which made it difficult to relate these strategies to the first visit to intervention website. This study on use of the *Gezondlevencheck* was based on secondary analyses of existing data. We used information that was available in the dataset and server registration data that provided objective assessments of exposure to the intervention website, although the latter one was only available at the aggregate level. Because of this, server statistics could not be linked to variables at the individual

level. This made it impossible to compare exposure to the intervention (e.g., duration time and frequency of revisits) between subgroups that differed regarding socio-demographic, psychosocial or behaviour characteristics. In future research it is therefore important to register objective exposure measures at the individual level.

An explorative quasi-experimental design was used to investigate the efficiency of distributing a promotion flyer to promote exposure to a physical activity promotion intervention website (Chapter 6). Because of the limitations related to this study design, the results should be regarded as explorative and preliminary, and in need of further investigation in better controlled studies and including behaviour change outcomes.

In Chapter 7 reports an observational study in a worksite setting within a cluster RCT to investigate who was exposed to the website component of this intervention in a more or less real-life setting. Face-to-face contact was an important part of this intervention, which might have had an effect on the decision of participants to visit or revisit the intervention website. This made it difficult to isolate the effect of invitation and reminder e-mails only.

Measures

To examine use of and exposure to Internet interventions, we had to rely on the available exposure measures. We decided to focus on objective exposure measures, to avoid bias because of participants' memory, interpretation, and social desirability that can occur when using self-reported exposure measures. Furthermore, it is relatively easy and feasible to have a variety of exposure statistics registered of website visits as there are few technical boundaries to do so. Chapters 5 to 7 revealed relevant information regarding website use by reporting on initiating and completing a module/intervention, and revisiting the intervention website. However, the depth of the information depended on the availability of data which was possibly limited. Chapter 5 showed, for example, that the exposure measure 'duration visit' provided interesting information about the use of the *Gezondlevencheck* website, even though it was only registered at an aggregated level. The review in Chapter 4 showed that there are few studies that report these exposure measures and there is no consensus on what objective exposure measures to use and how to report them. Logins on intervention websites was the most frequently reported exposure measure; other reported exposure measures were completion of the initial visit, time spent on the intervention website, and completion of the intervention program if revisits were required. The summary statistics used to report the exposure measures vary between publications; some measures were reported as mean, other as median or percentage of a predefined categorization. Therefore, information is preferably obtained at the individual level, and more consistency in obtaining and reporting such exposure measures is necessary to gain better insight into actual exposure. This will enable to better link intervention elements to exposure, for individuals with specific characteristics. Apart from exposure measures available in datasets (e.g., starting intervention, completing modules/intervention), there are other important outcome measures that should be recorded at a minimum: duration of a visit to

examine how long the visitor is exposed to the intervention content, the number of pages visited to examine whether the visitor has seen enough of the content, and the frequency of visits to examine multiple exposure to the intervention program. Better insight in these issues can enable more evidence-based exposure promotion to Internet interventions.

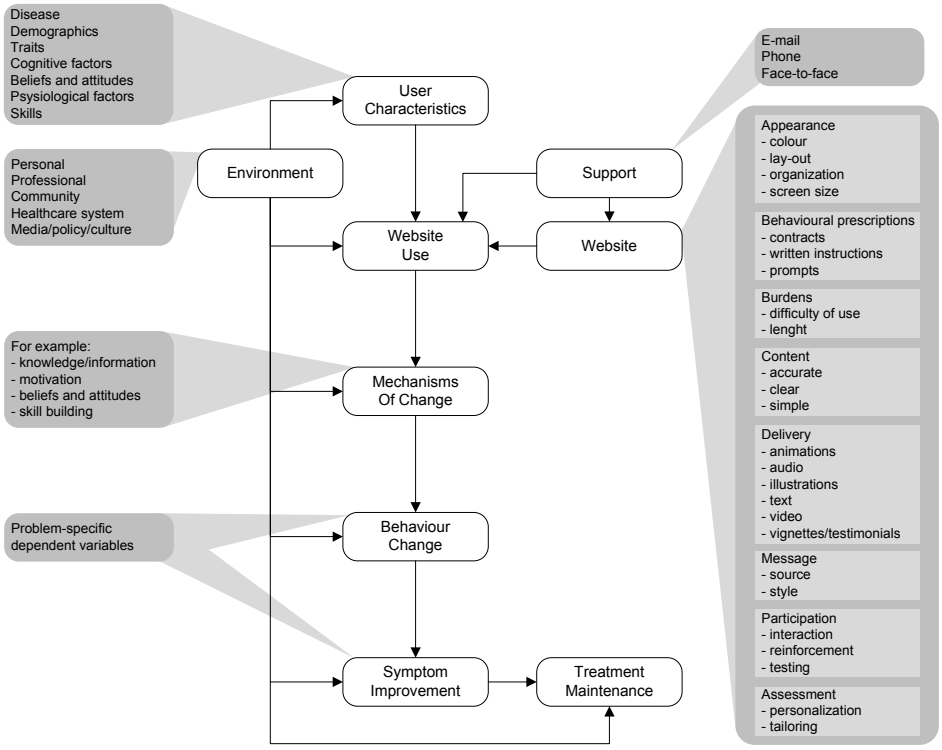
Theory

This thesis uses the RE-AIM framework[50,51] as a theoretical basis, in particular, to emphasize the importance of investigating reach of an Internet intervention, next to the efficacy. In accordance with the Diffusion of Innovations Theory[41] we assumed that successful dissemination and exposure would depend on the characteristics of the target population and characteristics of the Internet intervention. Possible individual cognitions of (potential) users, derived from the Theory of Planned Behaviour[52] such as attitudes, subjective norms and perceived behavioural control, were also assumed to be related to the use of Internet interventions as use of interventions can be considered as a behaviour stemming from a more or less planned or deliberate decision making process. Informed by these theories, reach was divided into dissemination and exposure, in which the latter one was further divided into first visit, extended visit, and revisit. The studies conducted suggest that this distinction may have been useful, although the results also indicate that dissemination and accessing the intervention for the first time are closely related as successful dissemination increases the likelihood of a first visit. The theories used are not specifically developed and tested for application to Internet interventions. Such Internet interventions have a number of characteristics that distinguish them from other health behaviour change interventions, such as interactivity and the effort one needs to put into gaining access to the intervention program. It might therefore be useful to investigate if specific elements can be added to existing theories to better predict and explain dissemination of and exposure to Internet interventions. The Technology Acceptance Model (TAM) explicitly describes the acceptance of an intervention when a technology is involved.[53] TAM is derived from the Diffusion of Innovations Theory of Rogers[41] and posits that people are more likely to adopt and use new technology tools, such as Internet-based interventions,[54] when they perceive the program and its content as being both useful and easy to use. The Diffusion of Innovations Theory was originally developed with respect to consumer products. However, people cannot buy an Internet intervention, they can use them by going online which has been acknowledged by TAM.[54] Elements of this model were incorporated in our Delphi and focus group study.

Interestingly, Ritterband et al.[24] recently proposed a Behaviour Change Model for Internet interventions (see Figure 8.2) that is built on the integration of multiple theories. This model consists of nine components or nonlinear steps that explain how Internet interventions work and which factors might be associated with success. Although this model is a first step in the recognition that the research of Internet interventions is complex and depends on many

different aspects, this model is likely to evolve over time. Even though this Behaviour Change Model seems to be more elaborate than the one we used, most of the factors found in our studies are or can be incorporated within this more elaborate model, which indicates that our results are in accordance with other studies. For example, it is indicated that characteristics of potential users do influence the use and therefore exposure to the intervention website, and whether people get exposed to the intervention content depends on e.g., visual appearance, length of the assessment questionnaire to receive tailored advice, and the provision of interactive elements. These elements accompanied with the use of prompts and professional and peer support might influence revisits to an intervention program. Thus, our conceptual model was suitable for gaining insight into dissemination of and exposure to Internet interventions, and does fit in the broader Behaviour Change Model of Internet interventions. This model can be used in future research.

Figure 8.2 Behaviour Change Model of Internet interventions[24]



Implications of the study findings

The studies presented in this thesis were among the first to explore which factors may contribute to a better dissemination of and exposure to health behaviour change Internet interventions targeting adults. A number of implications for future research arise from our results.

Implications for future research

The studies in this thesis primarily generated qualitative evidence on potentially important determinants of exposure to Internet interventions and the importance of some of these factors were examined in more in-depth studies. The next step in the study of identifying important and modifiable determinants of exposure is to test and corroborate the importance of the identified determinants in quantitative studies with strong study designs.

First, the qualitative studies indicated that individual characteristics, such as individual motivation to change health behaviour and to visit an intervention delivered through the Internet, and perceiving the intervention topic as personally relevant, are important in the decision of people to visit an Internet intervention. Important next steps are to verify the importance of these factors in quantitative observational and experimental research, following which strategies can be developed and tested to examine how these determinants can best be addressed in the promotion of an Internet intervention to achieve the highest visitor rates.

Second, many different intervention-related characteristics, such as design and navigation structure of the website, provision of interactive features, peer support facilitating elements, self-monitoring features, regular website update, and use of e-mail prompts, were indicated to have a potential impact on continuation of visits and revisits. In the systematic review we did not find many strong indications for specific intervention elements that are related to exposure. It is therefore important to test, for example, in small scale, controlled experiments the effect on exposure for each of these methods and strategies as well as the effectiveness to change the targeted health behaviour. Dismantling or deconstructing studies can, for example, be used to examine the contribution of individual components. Such further examination of potential important intervention-related characteristics is also needed to provide public health practitioners with recommendations for Internet intervention development.

Third, an important limitation in the existing literature was that monitoring of exposure to intervention websites is insufficient, or at least insufficiently reported. To further the research on determinants and improvement of exposure to Internet interventions, it is of utmost importance that exposure measures are reported objectively and that there is consistency in the way these exposure measures (i.e., website usage metrics) are reported. Important objective outcome measures that need to be registered include for example, starting the intervention,

completing modules/intervention, frequency of visiting, webpage viewing (i.e., whether the visitor has seen enough of the content), duration of each visit (i.e., time exposed to the content), and use of provided methods and strategies (e.g., goal setting, activity planning, self-monitoring, forum/chat, e-mail prompts).[22,55] The recording of these objective measures at the individual level is justified by two reasons: first, this will provide essential information on who is reached with what kind of intervention, method and/or strategy and to what extent; second, this would allow for studying possible mediating effects of exposure to these objective exposure measures, such as the possible effect of visit duration or frequency of website visits on short or long term behaviour change.

Finally, to gain greater insight into the reach of Internet interventions, more studies with population designs should be conducted. To disseminate an Internet intervention, there is also more and solid research needed to investigate the effectiveness of the different promotion strategies that emerged from the qualitative studies. Conventional promotion strategies, as mostly preferred by experts and potential users, more novel electronic strategies (e.g., e-mail, mail-a-friend, banners), and combinations of different strategies should be examined. Although we were only able to test a few promotion strategies, our study showed that GPs might be a useful channel to reach people who may otherwise be less likely to visit Internet interventions, while door-to-door flyer distribution might be an easy way to reach many people at relatively low costs. Experimental tests of the effectiveness of promoting an Internet intervention through GPs and other healthcare providers is needed to gain a better understanding of the value of GPs promoting Internet interventions. Worksites may be a good setting for the distribution of Internet interventions, but more research is needed on how to attract more and a greater diversity of people to actually use the intervention components, for example by using a combination of promotion strategies in addition to e-mail prompts only. Furthermore, it is advisable to take cost-effectiveness into account in studying the different promotion strategies. This will give insight into which promotion strategies are the most cost-effective to reach the target group in general and vulnerable groups in particular.

Implications for practice

This thesis provides many factors that might be important to account for the development of a health behaviour change Internet intervention and in improving dissemination of and exposure to currently implemented and newly developed Internet interventions.

First, our studies again confirm that it is advisable to form a linkage group even before the development stage of an Internet intervention as this is an essential element of intervention planning.[56] This linkage group should consist of health promoters, researchers, website designers, web text writers, and, importantly, potential users of the interventions. It is important to actively involve such groups, as this would make it possible to tackle problems in an early

stage instead of adjusting an already implemented intervention.[57] Including potential users in the linkage group should increase the likelihood that the intervention is both attractive to the target population and meets their needs.

Second, motivating and interesting people for the intervention topic before visiting the website by making the topic personally relevant for potential users are important factors in motivating and attracting visitors to pay a first visit to the intervention website. Next, many interactive methods and strategies have emerged from our studies that could be applied in an intervention in order to motivate people to stay longer on the website and use more of the content. However, not every method or strategy might be equally important or effective for all health behaviours that can be addressed in Internet interventions, or may equally appeal to all target groups. Previous studies might provide relevant information and, in addition, potential users of the target population can be consulted to investigate which interactive methods and strategies are, in their opinion, important to include in the intervention to make it appealing and worthwhile to visit. Furthermore, when revisits are required it is advisable to ensure that these revisits are worthwhile by providing users with new information on a regular basis and by providing them the opportunity to monitor behaviour change (i.e., self-monitoring). Although the effect of reminders is not optimal, they are to date the most effective way of attracting revisits to an intervention website.

Third, as there are no technical barriers to tracking objective exposure measures of Internet interventions, it is strongly recommended that the use of the interventions is monitored in the highest detail as possible and connected to login data for individual tracking of visitors whenever possible. This will provide important information on whether the intervention is used as intended, which intervention components are used most or least and where improvements to the intervention may be required.

Finally, in order to determine the actual reach of an Internet intervention, it is important to report the size of the target group of the intervention, how many people have been exposed to the promotion strategy, how many of them are eligible to use an intervention, and how many actually visit the website, and how representative these visitors are for the intended target group.[58] Furthermore, it is recommended that promotion strategies are specifically targeted at groups that are still less reached, such as men, people with low educational level, and people with risk behaviour(s). Even though it is still unknown which promotion strategies are the most effective in attracting people in general and specific population groups in particular, it is advisable to use a mix of mass media and more individually targeted promotion strategies (e.g., through health care providers) to make potential users aware of an Internet intervention and to attract them to visit the website. It is thus very useful to keep accurate records of used promotion strategies to disseminate an Internet intervention. By relating the promotion strat-

egies used to visitor data, more insight will be gained into which promotion strategies attract which type of visitors most (cost-) effectively, and therefore provide essential information for adaptation of the promotion strategies.

General conclusion

This thesis has added insight into an unknown area of determinants of exposure to Internet interventions aimed at adults. Explorative research suggests that individual level characteristics, such as motivation and perceived personal relevance, are important in attracting visitors to an Internet intervention, whereas intervention characteristics are likely to be important for the actual exposure to the intervention content. Peer and counsellor support are likely to result in longer website visits, whereas e-mail prompts and regular updates of the intervention website are probable efficient strategies to improve revisiting an intervention. Future systematic research with stronger research designs is needed to test and corroborate the potential determinants that have been identified in this thesis, in order to improve use of and exposure to Internet interventions. With respect to effective dissemination strategies, a mix of mass media and more individually targeted promotion strategies might be an effective way to disseminate an Internet intervention. More research is needed to identify the best combination of strategies for disseminating Internet interventions for different health behaviours and different target groups, with specific emphasis on difficult to reach underserved groups.

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Summary & Samenvatting

Summary

Many health behaviour change interventions have become available on the Internet over the past decade. As Internet interventions can potentially reach many people at relatively low costs, the Internet is an attractive and increasingly used medium for the delivery of health behaviour change programs. However, the actual reach of Internet interventions to date appears to be very low, limiting their potential public health impact. The studies presented in this thesis aimed to identify which determinants and strategies can contribute to a better dissemination of and exposure to health behaviour change Internet interventions ('Internet interventions') among adults. The following research questions are addressed in this thesis: (1) Which user and intervention characteristics are related to use of and therefore exposure to Internet interventions? (2) What are potential effective dissemination strategies that might enhance the exposure to Internet interventions?

These questions were addressed by this thesis using a conceptual model in which dissemination and exposure are considered to be two elements of reach. Dissemination refers to all the activities of developers or providers in bringing an Internet intervention to the attention of potential users. Exposure is essential to initiate behaviour change and is divided into three phases: (1) a first visit to an intervention website, in which the potential user makes the decision whether or not to go to the intervention website and access the program, (2) an extension of the first visit, in which the user has to decide whether or not to stay on the website and be exposed to (part of) the intervention content, and (3) a revisit to an Internet intervention, in which the user has to decide to make a return visit to the intervention website, e.g., for sustained intervention exposure, by completing the intervention, monitoring of progress, revisiting the content, or seeking new content. This distinction was made because different exposure-enhancing or -inhibiting factors were anticipated to play a role in attracting and engaging people with Internet interventions in each phase.

The general introduction (**Chapter 1**) presents the background, aims and theoretical framework used in this thesis.

Chapter 2 describes a three-round Delphi study conducted among experts to survey their opinions on which determinants are potentially important for the dissemination of and exposure to Internet interventions. Regarding a first visit to an Internet intervention, the experts indicated that characteristics of the potential user are important, such as motivation to visit an intervention and a perception of the intervention as personally relevant. The experts generally agreed that the characteristics of Internet interventions are more important than users' personal characteristics to a decision to continue the intervention visit and to gain exposure to the content. Tailored feedback, relevant and reliable information and an easy to

follow navigation structure were seen as relevant factors in determining the continuation of visits. Factors that might encourage revisits were identified as positive experiences of the first or previous visit, the provision of new information during a follow-up visit, the possibility to monitor progress in behaviour change, and sending reminders. The experts indicated that conventional promotion strategies were likely to be effective in disseminating an Internet intervention, such as word-of-mouth, mass media publicity campaigns, and recommendation by health professionals.

Chapter 3 presents results of the qualitative focus group study. We investigated how potential users perceive Internet interventions and what would attract them to visit, engage in and revisit an Internet intervention. The results of this focus group study generally supported the findings of the Delphi study. Additionally, potential users indicated that being motivated to change a health behaviour and curiosity about the intervention content were important factors in the decision to visit an Internet intervention. The factors considered relevant to extending a visit were mainly those of the intervention, such as the number of questions to be answered to receive tailored advice, the existence of a registration procedure, and a professional, well ordered design. Regularly updated content and the option to monitor behaviour were regarded as important in encouraging revisits. Conventional promotion strategies were mostly favoured by the potential users, but no particular strategy seemed to be favoured above another. A combination of different strategies was suggested to be the most useful.

A systematic review summarizing empirical evidence on intervention characteristics associated with use of and exposure to Internet-delivered health behaviour change interventions is described in **Chapter 4**. The review showed that many different methods and strategies that may enhance exposure to the intervention interventions have been applied, including tailored feedback, peer support, the use of interactive elements, and e-mail reminders. Also, a large variety of objective exposure outcome measures were used in the reviewed studies, which made the studies and results difficult to compare. The review indicated that peer support options (e.g., chat room, forum) and counsellor support are related to a longer stay on the intervention websites, while e-mail or phone contact, as well as regular intervention website updates are associated with a higher frequency of visits to the intervention websites.

To gain insight into who is reached by current Internet interventions, analyses were conducted on existing data of an already implemented Internet intervention, the *Gezondlevencheck*. The *Gezondlevencheck* is an Internet program that provides individualized feedback on saturated fat intake, physical activity, and smoking cessation. **Chapter 5** reports on how many people visited, registered and revisited the Internet intervention. The results showed that over half of the visitors left the intervention website within half a minute of accessing the website. However, in contrast to previous findings, the results showed that of the visitors who registered

and gained access to the intervention content, 99% actually started the intervention program and 91% finished at least one module, receiving individually tailored feedback and advice for one of the target behaviours. Compared with the general Dutch population, visitors that accessed the program were more likely to be women, medium to highly educated, and in the normal weight BMI range. In addition, women, visitors aged 40 to 50 years, visitors with a medium education level and visitors with a BMI of 20-25 were more likely to finish the provided modules. This indicates that substantial numbers of people can be reached with an Internet intervention, but additional research is needed to develop promotion strategies that reach the high-risk population, i.e., men, older and lower educated persons.

The study in **Chapter 6** assessed the number and characteristics of visitors attracted to a physical promotion Internet intervention by distributing a promotional flyer through three channels (handed out by the general practitioner (GP) to patients, door-to-door distribution in GP neighbourhoods, and e-mail to family or friends). The distribution through GPs resulted in a higher percentage (27%) of visitors per flyer to the website compared to door-to-door distribution (3%). The promotion through GPs resulted in more men, lower educated and higher BMI visitors. Visitors invited through GPs were also more likely to complete the whole intervention program. The mail-a-friend option was hardly used.

Chapter 7 reports on a study investigating the influence of e-mails to encourage visits and revisits to a website component of a worksite intervention to promote physical activity and healthy nutrition. The results showed that 43% of the participants visited the website after an e-mail promotion to all participants. More revisits to the Internet intervention were registered after sending three monthly e-mails compared to a reference group that did not receive any e-mails. However, even with the e-mail reminders, only 18% of the participants used the internet intervention. In accordance with previous studies, the results indicated that more women than men visited the website, but in contrast to previous studies the results provided no evidence that the website was used more frequently by participants with relatively better health or who were already engaging in more healthy behaviour.

In the general discussion (**Chapter 8**) the findings of all studies are integrated and conclusions and recommendations for practice and future research are given. It can be concluded that based on explorative research individual level characteristics, such as motivation and perceived personal relevance, are important in attracting visitors to an Internet intervention, whereas intervention characteristics are likely to be important for the actual exposure to the intervention content. Peer and counsellor support are likely to result in longer website visits, whereas e-mail prompts and regular updates of the intervention website are probable effective strategies to improve revisiting an intervention. Future systematic research with stronger research designs is needed to test and corroborate the potential determinants that have been

identified in this thesis, in order to improve use of and exposure to Internet interventions. With respect to effective dissemination strategies, a mix of mass media and more individually targeted promotion strategies might be an effective way to disseminate an Internet intervention. More research is needed to identify the best combination of strategies for disseminating Internet interventions, with specific emphasis on difficult to reach underserved groups.

Samenvatting

In het afgelopen decennium zijn veel gezondheidsbevorderende interventies via het internet beschikbaar gekomen. Met internetinterventies kunnen potentieel veel mensen worden bereikt voor relatief lage kosten. Daarom is het internet een aantrekkelijk medium dat steeds vaker gebruikt wordt voor het aanbieden van programma's die gezond gedrag bevorderen. Internetinterventies blijken echter tot op heden een zeer laag bereik te hebben, wat de potentiële impact van deze programma's voor de volksgezondheid beperkt. De studies die in dit proefschrift gepresenteerd worden, hebben als doel determinanten en strategieën te identificeren die bij kunnen dragen aan een betere verspreiding van en blootstelling aan gezondheidsbevorderende internetinterventies voor volwassenen. In dit proefschrift worden de volgende vragen behandeld: (1) Welke kenmerken van de gebruiker en van de internetinterventie hangen samen met het gebruik van en daarmee blootstelling aan internetinterventies? (2) Wat zijn potentieel effectieve verspreidingsstrategieën die blootstelling aan internetinterventies kunnen verbeteren?

Als uitgangspunt voor de studies is een conceptueel model opgesteld waarin verspreiding en blootstelling worden beschouwd als twee elementen van bereik. Verspreiding verwijst naar alle activiteiten die ontwikkelaars en aanbieders van een internetinterventie kunnen gebruiken om deze onder de aandacht van potentiële gebruikers te brengen. Blootstelling is essentieel om gedragsverandering op gang te brengen en is onderverdeeld in drie fasen: (1) een eerste bezoek aan een interventiewebsite, waarbij de potentiële gebruiker de beslissing neemt om de website en het programma al dan niet te bezoeken, (2) blijven op de website bij een eerste bezoek, hierbij moet de gebruiker beslissen om wel of niet op de website te blijven en te worden blootgesteld aan (een deel van) de inhoud van de interventie, en (3) een herbezoek aan de internetinterventie, waarin de gebruiker moet beslissen om terug te gaan naar de interventiewebsite, bijvoorbeeld om andere of nieuwe delen van de interventie te bezoeken, om het programma af te maken, of om na te gaan of er vooruitgang is in gedragsverandering. Dit onderscheid is gemaakt omdat naar verwachting in elk van deze fasen verschillende bevorderende en belemmerende factoren bepalend zijn voor blootstelling aan en betrokkenheid bij een internetinterventie.

In de algemene introductie (**hoofdstuk 1**) worden de achtergrond, de doelen en het gebruikte theoretische kader voor dit proefschrift beschreven.

Hoofdstuk 2 beschrijft een Delphistudie, bestaande uit drie ronden die werd uitgevoerd onder experts, om inzicht te krijgen in hun opvattingen over determinanten die mogelijk belangrijk zijn voor de verspreiding van en blootstelling aan internetinterventies. Met betrekking tot een eerste bezoek gaven de experts aan dat kenmerken van de potentiële gebruiker, zoals

motivatie om een interventie te bezoeken en de interventie als persoonlijk relevant ervaren, belangrijk zijn. In het algemeen waren de experts het er over eens dat kenmerken van de internetinterventie belangrijker zijn dan deze persoonlijke kenmerken voor de beslissing om verder te gaan met een interventiebezoek. Relevante interventiekenmerken voor het blijven op de website zijn volgens de experts advies-op-maat, relevante en betrouwbare informatie, en een gemakkelijk te volgen navigatiestructuur. Een positieve ervaring tijdens een eerder websitebezoek, het aanbieden van nieuwe informatie tijdens een follow-up bezoek, de mogelijkheid om verandering in gedrag te monitoren en het versturen van herinneringen werden gezien als belangrijke factoren gerelateerd aan een herbezoek. De experts gaven aan dat de meer traditionele promotiestrategieën, zoals mond-tot-mondreclame, een massamediale publiciteitscampagne en aanbevelingen door professionele zorgverleners, effectief zouden zijn om een internetinterventie te verspreiden.

In **Hoofdstuk 3** worden de resultaten van de kwalitatieve focusgroepstudie gepresenteerd. Hierin is onderzocht hoe potentiële gebruikers internetinterventies ervaren en wat hen zou doen besluiten om een internetinterventie te bezoeken, te blijven en terug te komen. De resultaten van de focusgroepstudie ondersteunden grotendeels de resultaten van de Delphistudie. Potentiële gebruikers gaven daarnaast aan dat gemotiveerd zijn om een gezondheidsgedrag te veranderen en nieuwsgierig zijn over de inhoud van de interventie belangrijke factoren zijn bij de beslissing om een internetinterventie te bezoeken. Vooral interventieaspecten, zoals het aantal vragen dat beantwoord moet worden om advies-op-maat te krijgen, de aanwezigheid van een registratieprocedure en een overzichtelijk en professioneel design, werden genoemd als relevante factoren om langer op de website te blijven. Om herbezoeken te bevorderen, werden het regelmatig updaten van de inhoud en de mogelijkheid om gedrag te monitoren als belangrijk beschouwd. Traditionele promotiestrategieën hadden de voorkeur van de potentiële gebruikers om een internetinterventie onder de aandacht te brengen, maar er was geen specifieke strategie die de voorkeur kreeg. Een combinatie van verschillende strategieën werd voorgesteld als de meest bruikbare strategie.

In **hoofdstuk 4** wordt door middel van een systematische review samengevat welke interventiekenmerken samenhangen met gebruik van en blootstelling aan internetinterventies. Uit deze review blijkt dat er een grote variëteit aan methoden en strategieën wordt gebruikt in internetinterventies die mogelijk de bloostelling aan een internetinterventie verhogen. Voorbeelden van methoden/strategieën zijn advies-op-maat, steun door anderen, het gebruik van interactieve elementen en herinneringen via e-mail. Verder werd in de geïncludeerde studies gebruikgemaakt van een grote verscheidenheid aan objectieve blootstellingsmaten, wat het moeilijk maakte om de resultaten van de verschillende studies te vergelijken. Uit de review blijkt dat het aanbieden van steun van anderen (bijv. chat room, forum) en steun van een counselor samenhangen met een langdurigere blootstelling aan de interventiewebsites,

terwijl contact via e-mail of telefoon en het regelmatig vernieuwen van de interventiewebsite samenhangen met een hogere frequentie van bezoeken aan de interventiewebsites.

Om inzicht te krijgen in wie momenteel bereikt worden met internetinterventies, zijn analyses uitgevoerd op bestaande data van een reeds geïmplementeerde internetinterventie, de *Gezondlevencheck*. De *Gezondlevencheck* is een online programma dat advies-op-maat geeft over verzadigd vetinname, lichamelijke activiteit en stoppen met roken. **Hoofdstuk 5** beschrijft hoeveel mensen de internetinterventie bezochten, zich registreerden en het programma opnieuw bezochten. De resultaten laten zien dat meer dan de helft van de bezoekers binnen een halve minuut de website verliet. In tegenstelling tot eerdere bevindingen bleek dat van de bezoekers die zich registreerden en toegang kregen tot de inhoud van de interventie, 99% daadwerkelijk startte met het interventieprogramma en dat 91% van deze bezoekers in ieder geval één interventiemodule afmaakte en dus advies-op-maat over een van de gedragingen ontving. Vergeleken met de algemene Nederlandse bevolking, waren de bezoekers die toegang hadden tot het programma vaker vrouwen, vaker gemiddeld tot hoog opgeleiden en vaker mensen met een gezonde BMI. Daarnaast maakten vrouwen, bezoekers van 40 tot 50 jaar, bezoekers met een gemiddeld opleidingsniveau en bezoekers met een BMI van 20-25 vaker de aangeboden modules af. Dit geeft aan dat veel mensen bereikt kunnen worden met een internetinterventie, maar dat aanvullend onderzoek nodig is om promotiestrategieën te ontwikkelen die de hoog risicopopulatie kan bereiken, zoals mannen, ouderen en laagopgeleide mensen.

In **Hoofdstuk 6** wordt beschreven hoeveel bezoekers een internetinterventie ter bevordering van lichamelijke activiteit bezochten en welke kenmerken de bezoekers hadden. Om mensen uit te nodigen voor deze internetinterventie werd een flyer verspreid via drie kanalen (uitgedeeld door de huisarts aan patiënten, huis-aan-huisverspreiding in de omgeving van de huisartspraktijk, en e-mail aan familie en vrienden). De verspreiding via huisartsen resulteerde in een hoger percentage (27%) bezoekers per flyer in vergelijking met de huis-aan-huisverspreiding (3%). De promotie via huisartsen resulteerden in meer bezoekers van het mannelijke geslacht, lager opgeleiden en mensen met een hogere BMI. Bezoekers die de flyer van de huisarts kregen, doorliepen vaker het volledige interventieprogramma. De mogelijkheid om familie en vrienden via een flyer per e-mail op de hoogte te brengen van het programma werd nauwelijks gebruikt.

Hoofdstuk 7 beschrijft een onderzoek naar het effect van het verzenden van e-mails op het bezoek en herbezoek van een websitecomponent van een interventie op de werkplek. De interventie richtte zich op het bevorderen van lichamelijke activiteit en gezonde voeding. De resultaten lieten zien dat 43% van de medewerkers die meededen aan het onderzoek de website bezochten, nadat deze via e-mail was gepromoot. Er werden meer herbezoeken geregistreerd

na het verzenden van drie maandelijkse e-mails in vergelijking met de referentiegroep die geen e-mails ontving. Echter, zelfs met herinneringen via e-mail bezocht slechts 18% de internetinterventie. In overeenstemming met eerdere studies, bleek dat meer vrouwen dan mannen de website bezochten. In tegenstelling tot eerdere studies toonden de resultaten niet aan dat de website meer werd gebruikt door werknemers met een relatief betere gezondheid of mensen die al actief bezig waren met het aannemen van een gezondere leefstijl.

In de algemene discussie (**hoofdstuk 8**) worden de resultaten uit de onderzoeken geïntegreerd en conclusies en aanbevelingen gegeven voor de praktijk en verder onderzoek. Geconcludeerd kan worden dat op basis van exploratief onderzoek kenmerken van het individu, zoals motivatie en ervaren persoonlijke relevantie, belangrijk zijn om bezoekers naar een internetinterventie te krijgen, terwijl interventiekenmerken van belang lijken te zijn voor de daadwerkelijke blootstelling aan de inhoud van de interventie. Ondersteuning door anderen en door een counselor leiden tot mogelijk langere websitebezoeken, terwijl herinneringen via e-mail en regelmatige updates van de interventiewebsite mogelijk effectieve strategieën zijn om het aantal herbezoeken te verbeteren. Om het gebruik van en blootstelling aan internetinterventies te verbeteren is systematisch onderzoek met sterkere onderzoeksdesigns nodig om de potentiële determinanten, die geïdentificeerd zijn in dit proefschrift, te testen en te bevestigen. Een mix van massamedia samen met individueel gerichte promotiestrategieën kan een effectieve verspreidingsstrategie zijn voor internetinterventies. Meer onderzoek is nodig om de beste combinatie van strategieën te identificeren voor de verspreiding van internetinterventies, met speciale aandacht voor groepen die nu nog moeilijk worden bereikt.

Persoonlijk

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Een proefschrift schrijf je niet alleen, ook al staat enkel mijn naam op de voorkant. Graag wil ik dan ook deze ruimte benutten om een aantal mensen te bedanken die een belangrijke rol hebben gespeeld in de totstandkoming van dit proefschrift.

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Mijn eerste stappen in de wetenschappelijke wereld heb ik gezet bij het gezellige Kenniscentrum van het NIVEL. Roland, jij durfde het met mij aan en zag in dat het vergelijken van autodealers niet zoveel verschilde van het vergelijken van ziekenhuizen. Diana, jij gaf me de vrijheid om mezelf als onderzoeker te ontwikkelen. (Oud-)NIVEL-ers, het is leuk om nog regelmatig contact met jullie te hebben.

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Jorik, promoveren met een minder goede gezondheid was niet altijd de meest ideale combinatie. Naast werk en (gezellige) verplichtingen bleef er weinig tijd en energie over voor ons samen. Hoewel ik me hierover soms schuldig voel, klaag jij hier nooit over. Bedankt voor al je liefde, steun, geduld, en natuurlijk je kookkunsten! Ook al is er in de afgelopen jaren veel gebeurd, op onze eigen manier weten we er altijd weer wat van te maken. Ik kijk dan ook uit naar ons nieuwe avontuur op Curacao.

Wendy

Curriculum Vitae

Wendy Brouwer is geboren op 28 november 1973 in het Betuwse dorpje Tricht, Buurmalsen. In 1993 behaalde zij haar VWO-diploma aan het Koningin Wilhelmina College in Culemborg. Na de middelbare school heeft zij een jaar in Engeland gewoond, vlakbij Cambridge in Saffron Walden en Haslingfield. Zij heeft hier gewerkt als au pair en cursussen Engels gevolgd aan de Anglia Polytechnic University Cambridge. Daarna is Wendy in 1994 Economie gaan studeren aan de Rijksuniversiteit Groningen. In 1999 studeerde zij af als Bedrijfseconoom met als specialisaties Marktonderzoek en Marketing Management. Na haar afstuderen werkte zij als marktonderzoeker bij ISEO Marketing Research in Leiden. In januari 2001 is ze begonnen als junior onderzoeker bij het NIVEL (Nederlands instituut voor onderzoek van de gezondheidszorg) in Utrecht. Hier heeft ze diverse onderzoeken uitgevoerd waaronder onderzoek naar de kwaliteit van zorg vanuit patiënten/consumentenperspectief en de Evaluatie van de Wet op de Orgaandonatie. Vanaf juli 2006 was zij als onderzoeker verbonden aan de afdeling Maatschappelijke Gezondheidszorg van het Erasmus MC in Rotterdam en voerde haar promotieonderzoek uit dat resulteerde in dit proefschrift. Gelijktijdig voltooide zij de Masteropleiding Epidemiologie aan het EMGO-instituut van het VU Medisch Centrum Amsterdam (2009).
Vanaf juni 2011 gaat Wendy samen met Jorik wonen en werken op Curacao.

Wendy Brouwer was born on November 28, 1973 in Buurmalsen, the Netherlands. She obtained her secondary school education at the Koningin Wilhelmina College in Culemborg in 1993. After completing secondary school she lived for one year in England, near Cambridge in Saffron Walden and Haslingfield. She worked here as an au pair and followed courses English at the Anglia Polytechnic University Cambridge. As of 1994 Wendy studied Economics at the University of Groningen. In 1999 she graduated as Business Economist, specializations Market Research and Marketing Management. After graduation, she worked as a market researcher at ISEO Marketing Research in Leiden. In January 2001, she started working as junior researcher at NIVEL (Netherlands Institute for Health Services Research) in Utrecht. At NIVEL she conducted various studies, including studies regarding quality of care from the perspective of patients/consumers and the evaluation of the Dutch Organ Donation Act. In July 2006 she was employed as researcher at the Department of Public Health at the Erasmus Medical Centre in Rotterdam, where she carried out the research presented in this thesis. During this time, she followed the Master of Science program Epidemiology at the VU Medical Centre Amsterdam, from which she graduated in 2009.
From June 2011, Wendy will go living and working on Curacao together with Jorik.

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PhD Portfolio

Summary of PhD training and teaching activities

Name PhD student: Wendy Brouwer
PhD period: 2006 – 2010
Erasmus MC Department: Public Health
Promotor: Prof.dr.ir. J. Brug
Supervisor: Dr. A. Oenema

	Year	Workload (hours/ECTS)
1. PhD training		
General courses		
Biomedical English Writing and Communication, Erasmus MC Rotterdam	2007	4 ECTS
Master of Science in Epidemiology, EMGO Institute, VU University Medical Centre Amsterdam	2009	24 ECTS
General Medicine, Wageningen University	2009	6 ECTS
Specific courses		
Public Health Research: from epidemiology to health promotion; Intervention development and evaluations, NIHES, Erasmus MC Rotterdam	2006	1 ECTS
Planning Health Promotion Programs: an Intervention Mapping Approach, Research Institute for Psychology & Health, Maastricht University	2007	0.5 ECTS
Symposium 'Mixed Methods. A State of the Art', Netwerk Kwalitatief Onderzoek AMC Amsterdam	2008	5 hours
Presentations		
Nederlands Congres Volksgezondheid, Rotterdam (April 11-12); poster presentation "Bevordering van gezond gedrag via internet: een Delphi studie over verspreiding van en blootstelling aan internetinterventies"	2007	1 ECTS
Werkgroep Voedingsgewoonten (WeVo), Utrecht (April 3); oral presentation "Verspreiding van en blootstelling aan leefstijlinterventies via internet"	2008	1 ECTS
13th World Congress on the Internet in Medicine (MedNet), St. Petersburg, Russia (October 15-18); oral presentation "An exploration of factors related to dissemination of and exposure to Internet-delivered behaviour change interventions"	2008	1 ECTS
Symposium CEPHIR (Centre for effective public health in the larger Rotterdam area), Rotterdam (October 29); oral presentation "Wie bereiken we met leefstijl internetinterventies? Aanknopingspunten voor verbetering van bezoek en blootstelling aan internetinterventies"	2008	1 ECTS
Symposium on Supporting Health by Technology II, Enschede, (May 28); poster presentation "Who uses an Internet-delivered tailored lifestyle intervention when it is implemented for use in real life?"	2009	1 ECTS
8th conference of the International Society of Behavioural Nutrition and Physical Activity, Lisbon, Portugal (June 17-20); oral presentation "Who visits a web-based tailored lifestyle intervention when it is implemented for use by the general public?"	2009	1 ECTS

8th conference of the International Society of Behavioural Nutrition and Physical Activity, Lisbon, Portugal (June 17-20); poster presentation "Do different dissemination strategies result in different numbers and characteristics of visitors to an Internet-based intervention?"	2009	1 ECTS
Nederlands Congres Volksgezondheid, Rotterdam (April 8-9); oral presentation "Bevordering van gebruik van een beweegadvies-op-maat interventie via internet: test van twee verschillende promotiestrategieën"	2010	1 ECTS

International conferences

Symposium Supporting health by technology, Enschede (May 20)	2008	0.2 ECTS
13th world congress on the internet in medicine (MedNet), St. Petersburg, Russia (October 15-18)	2008	1 ECTS
2nd Symposium Supporting health by technology, Enschede (May 28)	2009	0.2 ECTS
8th conference of the International Society of Behavioural Nutrition and Physical Activity, Lisbon, Portugal (June 17-20)	2009	1 ECTS

2. Teaching activities

Curriculum Medical students, 1st year, Erasmus MC Rotterdam; lectures as part of Theme 1.C: 'Disorders in nutrition, metabolism and hormonal regulation'	2009	5 hours
Curriculum Medical students, 2nd year, Erasmus MC Rotterdam; lectures as part of Theme 2.2: 'Disorders in nutrition, metabolism and hormonal regulation'	2009	5 hours

The Internet has become the key medium to obtain health information for many people. This makes the Internet an attractive and increasingly used medium for the delivery of health behaviour change programs aiming to contribute to the primary prevention of chronic diseases. Although in theory Internet applications hold great promise for the delivery of health promotion and behaviour change interventions, evidence suggests that the use of such Internet interventions is disappointingly low, especially when these interventions are implemented for use by the general public. In order to improve overall impact of these interventions, more insight is needed in how to improve dissemination, reach and use of Internet-delivered health promotion interventions. This thesis reports on a number of studies on the identification of determinants and strategies that can contribute to a better dissemination of and exposure to health behaviour change Internet interventions among adults.