Heidi Enwald

TAILORING HEALTH COMMUNICATION

THE PERSPECTIVE OF INFORMATION USERS’ HEALTH INFORMATION BEHAVIOUR IN RELATION TO THEIR PHYSICAL HEALTH STATUS

UNIVERSITY OF OULU GRADUATE SCHOOL, UNIVERSITY OF OULU, FACULTY OF HUMANITIES, INFORMATION STUDIES, OULU DEACONESS INSTITUTE, DEPARTMENT OF SPORTS AND EXERCISE MEDICINE
HEIDI ENWALD

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Abstract

The aim of this thesis was twofold: firstly, to increase understanding about the user of health information; namely about differences of users’ characteristics of health information behaviour, and secondly, to contribute to the research on factors that could be used as bases to tailor health information. Health information behaviour was scrutinised as information needs and seeking and information use in particular. It was also studied in relation to individuals’ physical health status.

More studies on information use are needed, because understanding individual characteristics in issues related to information use has been considered critical for promoting healthy behaviours. Moreover, the thesis addressed the gap in research on the relationship between health information behaviour and tailoring health information.

The thesis consists of three empirical studies and a literature review. The empirical research environments were provided by an intervention study aiming to prevent type 2 diabetes among a high risk population and by a population-based study among military conscription aged men. The setting was the City of Oulu in Northern Finland with the University of Oulu and the Oulu Deaconess Institute as the main operators of the studies. The empirical data were collected through questionnaires as well as through physiological and biochemical measurements during years 2010 and 2011. The data were analysed with statistical methods. Moreover, a literature review of tailored interventions studies using a computer as the medium of delivery in the context of physical activity, nutrition and weight management, was conducted.

The findings indicate differences in health information users’ characteristics related to their information use as such and in relation to the indicators of their physical health status. It is suggested that, for example, health information presentation could be tailored on the basis of found differences and different message strategies and tactics could be used for different kinds of individuals. In addition, in the literature review the biases of tailored intervention studies stood out as influential on their outcomes.

The thesis contributes to the current field of research on both health information behaviour and tailoring health communication. Moreover, the findings can support the development of more effective health promotion programs and intervention studies.

Keywords: health communication, health information, health promotion, human information behaviour, information use, intervention studies, tailoring health information
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Oulun yliopisto, PL 8000, 90014 Oulun yliopisto

Tiivistelmä

Tutkimukseni vastaa tarpeeseen tutkia tiedon käyttäjiä, sillä tiedon käyttöön liittyvien yksilöllisten ominaisuuksien ymmärtäminen on keskeistä terveyden edistämisessä. Väitöskirja tuottaa uutta tietoa myös informaatiokäyttäytymisen ja terveystiedon räätälöinnin välisestä suhteesta.


Empiiristen tutkimusten tulokset viittaavat siihen, että niin terveystiedonkäyttäjien ominaisuuksissa informaatiokäyttäytymisessä kuin sen suhteessa heidän fyysisen terveydentilaansa on eroja. Terveystietoa tulisi keskittää eri tavoin erilaisille ihmisiille, muun muassa erilaisia viestitapojen ja -taktiikoita käyttäen. Kirjallisuuskatsauksen tulokset lisävät ymmärrystä siitä, miten tutkimusasetelman vinoumat voivat vaikuttaa interventiotutkimusten tuloksiin.

Asiasanat: informaatiokäyttäytyminen, interventiotutkimukset, terveyden edistäminen, terveystiedon räätälöinti, terveystieto, terveysviestintä, tiedon käyttö
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In Oulu, October 2013

Heidi Enwald
Abbreviations

χ²   chi-square
C   contingency coefficient
FET   Fisher’s exact test
OR   odds ratio
p   value of statistical probability
r   Spearman’s correlation coefficient
z   standardised z score in Mann-Whitney test

BMI   body mass index
CD-ROM   compact disc read-only memory
DXA   dual x-ray absorptiometry
EEG   electroencephalography
eHealth   transfer of health resources and health care by electronic means
ELM   Elaboration Likelihood Model
fMRI   functional magnetic resonance imaging
FPG   fasting plasma glucose test
ICT   information and communication technologies
IFG   impaired fasting glucose
IGT   impaired glucose tolerance
mHealth   mobile health
MRI   magnetic resonance imaging
OGTT   oral glucose tolerance test
PET   positron-emission tomography
SQUASH   short questionnaire to assess health-enhancing physical activity
TTM   Transtheoretical Model of behaviour change
VO₂max   maximal oxygen consumption
List of original publications


* Shared contribution
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1 Introduction

Already more than 2000 years ago, Hippocrates (c. 460–377 BCE), the father of Western medicine, taught that “If we could give every individual the right amount of nourishment and exercise, not too little and not too much, we would have found the safest way to health” (Curry & Fitzgibbon 2009: 6). But where have we found ourselves today? We are wired to crave and devour all the food available, because food has been scarce for most of the time during our evolution. To get all the energy we needed to survive, our bodies are planned to be active hunting and gathering all day. However, we now live in a very different environment than our ancestors. Decrease in physical activity due to the increasingly sedentary nature of many forms of work, changing modes of transportation and increasing urbanisation as well as increased dietary intake of energy-dense foods has led us to a global epidemic of obesity and type 2 diabetes (World Health Organization 2011a).

While evolutionary pressure to evolve genes to deal with the problem takes more time than we have in our lifespan, we have to make good healthy choices or fight against our bad habits by attempting to instil long-term lifestyle changes. Moreover, we are overwhelmed by the volume of health information partly due to the advent of the Internet. The level of the quality of this information varies; it can be contradictory or confusing and it is not always easy to comprehend. (Alpay et al. 2009). Furthermore, information users have diverse needs and preferences for health information to which general information does not necessarily respond (Brashers et al. 2002, Docherty et al. 2008, Fourie 2008). This calls attention to the need for studies focusing on the user of information, because understanding individual characteristics in the reception of the content of health information is critical for promoting healthy behaviour (Ginman 2000: 181, 187, Case 2012: 206).

1.1 Background

Health promotion and communication attempt to reduce and eliminate the risk factors of lifestyle-related health behaviours. Receiving information is an important initial step in health behaviour change (Freimuth et al. 1989: 39, Bar-Ilan et al. 2006). Nowadays individuals are encouraged to be well informed in health topics. They are expected to play an active role in seeking health information, managing their health and participating in health and medical decision-making. (McNutt 2004).
It is noteworthy that the need to understand the users of information and their health information behaviour is increasingly attracting researchers of information disciplines (Bath 2008, Case 2012: 37). Lewis (2006) has criticised that the medical sciences’ approach to health information mostly fails to consider information behaviour as a complex social act in the context of individuals’ lives. This makes the contribution of Information Studies even more essential. However, research on health information behaviour within the Information Studies field has mainly focused on health information seeking (e.g., Marton & Choo 2011, Johnson & Case 2012) in general and related to particular medical conditions, such as, cancer or AIDS or the potential for these diseases (Case 2012: 344). Instead, the study of information use, in the context of health, has not received an equal amount of attention (Vakkari 2008, Savolainen 2008, 2009, Wilson 2009).

Understanding target audiences and their information preferences as well as developing tailored health information and messages are priorities for all health promotion initiatives (Korda & Itani 2013). Tailoring of health communication is a means to increase effectiveness of health information by providing more user-centred information. It aims to increase the possibility that the information content is processed and accepted by the receiver. Tailored health information is customised to a specific individual and based on information unique to that individual. (Kreuter et al. 1999: 5, Hawkins et al. 2008). Computing technologies have enabled more sophisticated means of tailoring. Computers enhance the creation of tailored information by automating the collection of personal information and creation of messages. (Lustria et al. 2009). They also provide channels to be used for the delivery of tailored information as in “second generation” tailored health interventions (Oenema et al. 2001).

Tailoring health information and communication has mainly been scrutinised by researchers of Communication, Social Psychology and Public Health. Several studies have concluded that tailored information is more effective than general health information (see subchapter 3.3), but there is a need to identify evidence-based factors for providing tailored health information (Duncan 2006). More rigorous studies of the active ingredients in tailored communications, such as the use of different message strategies, are needed (Abrams et al. 1999, Noar et al. 2011).

Information users’ differences may focus on their information needs, desire for information as well as preferences for information sources and type of information. These differentiating factors could be used as a basis to tailor health information and communication. (Fourie 2008, Harland & Bath 2008). This view is supported, for example, by Ek and Heinström (2011), who argue that understanding the reasons
behind individual differences in health information behaviour is essential for the further development of tailored information services. However, there is a dearth of theoretically-driven empirical studies investigating individual characteristics of the information user in the context of health promotion.

1.2 Rationale for the topic of the thesis

This thesis answers the call for further study of health information users. The topic of this thesis is multidisciplinary as it combines the approaches of Information Studies, Public Health, Communication Studies, Psychology and Biochemistry. However, the main perspective is that of Information Studies.

This thesis aims to address the gap in previous research on the relationship between tailoring health information and health information behaviour. Health information behaviour is scrutinised as an interest in health information, the desire for information, searching for information, self-estimate of the impact of information and reception of different message strategies. In general, message strategies are related to information presentation and types. In this thesis perceptions of the fear appeal message strategy and preferences for feedback message tactics are investigated in particular. Furthermore, in the thesis the self-estimate of the impact of information and reception of message strategies are considered to relate to information use. This view is supported by Nahl and Bilal (2007: 4–8), who argue that information reception can be considered as the first stage of the information use process. Hence, this thesis contributes to a large extent to the body of research on health information use.

This thesis is among the first studies done in Information Studies focusing on tailoring health information (see subchapter 3.2). It contributes to the restricted amount of research that investigates factors relating to health information behaviour as a basis of tailoring health communication. At the same time, information behaviour is also examined in relation to individuals’ physical health status. Previous studies on this topic within the Information Studies field have covered health status through self-reported data (see subchapter 2.3.5), but this thesis provides different perspectives of this problem area through the examination of physiological and biochemical measurements of individuals’ health status and health outcomes.

In addition to contributing to theory, a practical viewpoint is offered when investigating the relationship between individuals’ health information behaviour and their objectively measured physical health status. Thus far in many tailored
intervention trials, objective measurements are conducted at the baseline for outcome measures, but these measurements are rarely used as a basis to tailor health information (see subchapters 3.4. and 3.9.2). Thus, in many cases these kind of data are already easily available and this thesis indicates ways how these data could be used in a more sophisticated manner. The basic idea of this thesis is that by figuring out possible connections between individuals’ health information behaviour and indicators of physical health status, these connections could be taken into account when tailoring health information. Generally speaking, the findings of this research may be utilised in designing tailored health information and in promoting health behaviours.

1.3 Research settings of the thesis

The thesis consists of four articles, of which three are empirical studies and one is a literature review. The empirical studies of this thesis focus on two target groups of the population: prediabetic individuals (Studies 1 and 2) and conscription aged young men (Study 3).

Studies 1 and 2 of this thesis were carried out in a setting provided by the physical activity promotion and type 2 diabetes prevention intervention trial (i.e. PreDiabEx). The setting was Oulu, Northern Finland. Oulu (65°N 25°E) is a growing university town of approximately 190 000 inhabitants. The trial was conducted by the University of Oulu (Medical Technology, Public Health Science and Physiology) and the Oulu Deaconess Institute in 2010. The participants were both men and women and the majority of them were over 60 years old. (See also subchapter 5.1.1).

Individuals at high risk for type 2 diabetes (i.e. prediabetic individuals) have less often been subjects of health information behaviour investigation than, for instance, patients of cancer or AIDS. However, providing information to those at high risk for diabetes is important in preventing type 2 diabetes (Van Esch et al. 2006). Diabetes prevention and education endeavour to motivate people to make healthy nutrition and physical activity choices and to provide social support to help individuals initiate and sustain lifestyle changes (Satterfield et al. 2008).

Study 3 was conducted in the setting of a large MOPO study (Ahola et al. 2013, MOPO study 2012) which aims to promote physical activity among young conscription aged men and prevent their social marginalisation in the region of Oulu. A substantially high proportion of inhabitants of Oulu are children and adolescents. The unemployment rate of young people (< 25 years) is relatively high in Oulu (19%) compared to other areas in Finland (e.g. national average is 14%) (National Institute
for Health and Welfare 2012a). Annually approximately 35% of the conscription aged
men in Oulu area are exempted from compulsory military or civil service, which is
the highest proportion in Finland. Adolescents and young men exempted from service
comprise a group with a wide range of psychosocial problems and should be targeted
with supportive interventions (Appelqvist-Schmidlechner et al. 2010).

The operators of the study are: the Oulu Deaconess Institute (Sports and Exercise
Medicine), University of Oulu (Medical Technology, Computer Science and
Engineering, Information Studies, Institute of Health Sciences and Cultural
Anthropology), City of Oulu, Virpiniemi Sports Institute, Finnish Defence Forces and
wellness and game technology companies from Northern Finland.

In the MOPO study an interactive, gamified activation method was developed
and examined, based on tailored health information, peer networks and participation.
In compulsory military call-ups conscription-aged men are reached and a great
deal of information about young men´s attitudes, preferences and behaviours has been
collected in military call-ups by the MOPO study during 2009–2012.

Men have been less frequently examined in the health information behaviour
literature than women (Case 2012: 344). Young men, the target group of Study 3 of
this thesis, were mostly 18 years old. For most of them this is the time when their
life changes dramatically. They may move away from home, begin new studies or
a new job as well as join military service. Consequently, their lifestyle also
changes. The positive health effects of a physically active lifestyle among youth
are observed into adulthood, such as a lesser amount of adult obesity (Tammelin
et al. 2003, Yang et al. 2007). However, traditional health promotion has shown
only moderate effectiveness and new methods for activation of young men are
needed (Ahola et al. 2013).

Study 4 was a “desk research”. The focus of this study was placed on tailored
intervention studies in the context of physical activity, nutrition and weight
management.

1.4 Aim of the thesis

The aim of this thesis is twofold: to increase understanding about the user of health
information and about tailoring health information.

Firstly, the thesis aims at indicating differences in the health information users´
characteristics that focus on their information behaviour. The differences are
investigated in health information behaviour as such, and in relation to indicators
of physical health status with an aim to explore the potential to tailor health
information on the basis of these differences.

Secondly, the thesis aims at examining intervention studies investigating the
effectiveness of tailoring in the context of physical activity, nutrition and weight
management.

More specifically, the thesis will seek to answer the following research questions:

1. What kind of differentiating factors can be identified in pre-diabetic
   individuals’ interest in and searching for health information as well as in the
   frequency prediabetic individuals wish to receive tailored health information
   in relation to their objectively measured physical health status? (Study 1)

2. What kind of differentiating factors related to health information use can be
   identified?
   
   2a) Does prediabetic individuals’ self-estimated impact of obtained health
       information differ in relation to their objectively measured physical health
       status? (Study 1)
   
   2b) Do the prediabetic individuals’ perceptions of the fear appeal message
       strategy vary according to their objectively measured physical health status?
       (Study 2)
   
   2c) Do the prediabetic individuals’ perceptions of the fear appeal message
       strategy vary according to possible improvements in their physical health
       status during a three-month health behaviour change intervention trial?
       (Study 2)
   
   2d) Do the preferences for the feedback message tactics vary according to
       objectively measured physical health status among prediabetic individuals or
       conscription aged young men? (Studies 2 and 3)
   
   2e) Do the preferences for the feedback message tactics vary according to
       possible improvements in prediabetic individuals’ physical health status
       during a three-month health behaviour change intervention trial? (Study 2)

3. How can the identified differentiating factors be taken into account in
   tailoring health information and information presentation? (Studies 1, 2 and
   3)

4. What kind of tailored intervention studies, which use a computer as the
   medium of delivery and aim at behaviour change in physical activity,
   nutrition or weight management, have been conducted? (Study 4) The
   analysis focuses on objectives set for the behaviour change, theories or
theoretical concepts used for building theoretical background, intervention
design, outcomes measured, statistically significant evidence related to
differences between intervention and control group and possible biases in the
selected intervention studies.

Research question 2 is answered through subquestions 2a-2e. The findings related to
research questions 1 and 2 form the basis for answering research question 3.
Furthermore, research question 4 broadens the insight of tailoring health
communication and information.

1.5 Structure of the thesis

The structure of the thesis is as follows. Chapter 1 is an introduction to the topic with
a short description of the research environment followed by the aims, objectives and
research questions of the thesis. Chapters 2 and 3 present the theoretical foundation of
the thesis. Chapter 2 looks at the concepts of health, health behaviours, health
promotion and health communication. Furthermore, Chapter 2 addresses the various
aspects of health information behaviour and factors affecting it at the individual level.
Examples of studies focusing on health information behaviour and conducted in
Information Studies are provided. Tailoring health communication and information is
discussed in Chapter 3. The chapter begins with a discussion on different health
communication approaches and on studies scrutinising the tailoring of health
information in Information Studies. After that, the aims and bases of tailoring are
discussed. The message strategies for presenting tailored information are scrutinised
by focusing on feedback and fear appeal. The chapter ends by providing an overview
and a summary of systematic reviews of tailored health behaviour change programs
and interventions.

In Chapter 4 the rationale of the methodological choices of the thesis is outlined
to justify the decisions on data collection and analysis. Research paradigm,
metatheory, strategies and methods are discussed. Additionally, the data collection
and analysis of the included papers (Studies 1–4) are provided. In Chapter 5 the results of
Studies 1–4 are presented in detail. In Chapter 6 the results are synthesised and
discussed. The research questions are answered and the findings are linked with
relevant literature presented in the theoretical section. The reliability, validity and
limitations of Studies 1–4 are evaluated. In the end of Chapter 6 the contribution of
the results to both theory and practice are examined and suggestions for further
research are presented. Finally, in Chapter 7 conclusions are drawn and presented.
1.6 Original articles (Studies 1–4)

This thesis consists of four research articles; three empirical studies (Studies 1–3) and one literature review (Study 4). The relationships of Studies 1–4 and themes of this thesis are summarised in Figure 1.
Fig. 1. The themes of the thesis and relationships between Studies 1–4.
Here a summary of the original articles, that is Studies 1–4, is presented. The aim of Study 1 was to find potential differences between individuals in their human information behaviour as such and in relation to physical health status, identified by objective measurements of physical fitness, body composition and glucose homeostasis. Health information behaviour is scrutinised as interest in health information, the search for information and self-estimate of impact of information, as well as desire for information. The aim of Study 2 was to specify individual differences in the preference of message strategies, in particular, perceptions of a fear appeal message strategy and preferences for feedback message tactics as such, and also in relation to physical health status and changes in physical health status during the intervention period. Additionally, gender and age were factors in the analysis.

In Study 3 the focus was on preferences for feedback message tactics. Preferences for the ipsative, normative and theoretically-driven feedback message tactics were investigated as such, and in relation to objectively measured indicators of physical health status. Furthermore, preferences were examined in relation to self-reported education, self-estimate of physical activity, the stage of exercise behaviour change and exercise self-efficacy. The differentiating factors identified in Studies 1–3 could be taken into account in tailoring health information to different kinds of individuals. Study 4 aimed to present a review of the literature on tailored health communication to prevent obesity and related health problems at the individual level. Furthermore, an analysis of studies on “second generation” tailored interventions aimed at behaviour change in nutrition, physical activity or weight management was presented.

The contents of the papers are not entirely repeated in this thesis. However, the reader should be able to follow the discussion without prior reading of the papers.
2 Health, health promotion and health information behaviour

In the following chapter, health, health promotion and health information behaviour will be discussed. The chapter begins with a discussion of health and introduces health behaviours related to physical activity, nutrition and weight management. In addition prediabetes, the state in which some but not all of the diagnostic criteria for type 2 diabetes are met, is addressed. After that, health promotion, health communication and health interventions will be considered. The chapter ends by presenting an overview of health information and health information behaviour. Furthermore, examples of studies focusing on health information behaviour and conducted in Information Studies are provided.

2.1 Health and health behaviours

Health can be described as the physical, mental and social well-being and fitness that individuals enjoy. Health is not just freedom from disease or injury; it is multidimensional and to a large extent culturally defined. Many factors ultimately influence our health: genes, access to health care, food, physical activity, social interactions, living environment and many others (Fertman et al. 2010: 5). In this thesis health is primarily perceived as physical health. It is one dimension of health. At the individual level physical health can be defined as being free from pain, physical disability, disease and bodily discomforts that require the attention of health care professionals. Indicators of physical health status include an individual’s risk factors for several diseases and premature death. (Price et al. 2010: 93–94).

Chronic non-communicable (non-infectious) diseases, such as type 2 diabetes, myocardial infarction, stroke and osteoarthritis, are reaching epidemic proportions worldwide (Daar et al. 2007) and they have become a bigger cause of death globally than infectious diseases (World Health Organization 2008). Common risk factors, such as physical inactivity, increased dietary intake of energy, excess bodyweight (adiposity) and especially excess visceral fat, underlie most of these diseases. These risk factors cause serious health consequences for both the individual and society. (World Health Organization 2011a: 6). Reducing risk factors, for instance, by increasing physical activity, can improve one’s health status.
Health behaviour can be described as behaviour directed at promoting, protecting and maintaining health, as well as reducing disease risk and early death (Modeste & Tamayose 2004: 54–55). Many of the risk factors of non-communicable diseases are related to an individual’s lifestyle and they can even be called lifestyle-related health behaviours (Ray & Roos 2012). Health behaviours could be changed and risk factors reduced or eliminated by acts of prevention. In primary prevention the target group is the total population, selected groups or healthy individuals and its goal is to limit the incidence of disease and disability in the population by, for example, promoting reduction of the risk factors. In secondary prevention asymptomatic individuals with early disease or established high risk factors are targeted. Examples of this kind of prevention are pre-diabetes programs. The target groups of secondary prevention are usually found through medical records or screening tests. Tertiary prevention is directed at individuals who already have symptomatic disease. (National Public Health Partnership 2006: 3–4). The focus of this thesis is on primary and secondary prevention as in Studies 1 and 2 the target group is a sample of prediabetic Finnish individuals (that are individuals at high risk for type 2 diabetes) and in Study 3 the target group is a population-based sample of young Finnish men.

2.1.1 Health behaviour change and related theories and models

Behaviour change has been defined as “the adoption of a new behaviour or the modification or discontinuance of a prior behaviour” (Murray-Johnson & Witte 2003: 487). Lifestyle-related health behaviours develop early in life and thus eliciting changes in behaviours can be very complex. For example, an individual’s participation in physical activity is related to personal, social and environmental factors operating at multiple levels (Plotnikoff & Karunamuni 2011).

Several social cognition theories and models have been developed to explain individuals’ health behaviour and changes in health behaviour, and they are widely used in health promotion and subjects of debate in health psychology. Many of these theories or models can be defined as statements about causal relationships between individual level factors (such as knowledge, attitudes, motivation, sociodemographic factors, personality) and health behaviour change. For health providers they provide conceptual frameworks for developing effective health promotion programs, campaigns and interventions. (Campbell & Quintiliani 2006, Schwarzer 2008). Their theoretical constructs help in analysing
behavioural health problems and are also used as a basis to tailor health information and messages (Kreuter et al. 1999: 46, see subchapter 3.4). However, no single theory or model can account for all complexities of behaviour change and therefore theories and models should be seen as complementary rather than competing.

Social cognition theories and models have been divided into the motivational [e.g., the Social Cognitive Theory by Bandura (1977, 1986)], behavioural enaction [e.g., the Goal Setting Theory by Locke & Latham (1990)] and multi-stage models of behaviour change [e.g., the Transtheoretical Model (TTM) by Prochaska & DiClemente (1992) and Health Action Process Approach (HAPA) by Schwarzer (2008)]. Motivational models imply that motivation is sufficient for successful behavioural enaction. Behavioural enaction models focus on bridging the “gap” between motivation, intention and behaviour. Stage-based health behaviour change models propose that behaviour change is a non-continuous process occurring through stages that reflect different mind-sets of people. At each stage the individual barriers faced, when pursuing to change behaviour, differ. There has been a lot of debate on the validation of especially the stages of change used in these theories and models, but most researchers agree that the stage-based models make a useful contribution to understanding and promoting health behaviour change. (Armitage & Conner 2000).

The TTM claims that individuals move through a series of five stages of change in the adoption of healthy behaviours or cessation of unhealthy ones. According to this model, when adopting particular health behaviour, an individual can be at one of five stages: precontemplation, contemplation, preparation, action or maintenance. People in the action or maintenance stages may also relapse and then recycle between stages. It has been stated that different kinds of information, messages and support are needed for people in different stages of change (Rimer & Kreuter 2006). The TTM also includes other theoretical constructs. They can be used to explain what motivates an individual to progress through the stages of change toward a healthy change in behaviour. Self-efficacy is one of the major determinants of whether a person will progress through the stages. Self-efficacy originates from the Social Cognitive Theory and is defined as the confidence a person has in his or her ability to overcome barriers and adapt a particular behaviour (Toscos & Connelly 2010: 301). Self-efficacy can be seen as situation-specific, but it has also been conceptualised as a stable, trait-like disposition (Contrada & Goyal 2004: 157). According to Bandura (2006: 307) it is not a
global trait but a differentiated set of self-beliefs. (See also subchapter 3.8 and Study 3 of this thesis).

Increasing awareness and enhancing intentions are important predictors of health behaviour and included in many behavioural change theories and models. Individuals are often unaware of their risk-behaviour, making it unlikely that they would consider behavioural change. Awareness of the relationship between behaviour (e.g., diet) and outcome (e.g., health) may also be important, especially in earlier stages of behavioural change. (Brug et al. 1994). Behavioural intentions are defined as “plans individuals have about whether or not they intend to perform the recommended behaviour” (from adoption to discontinuance) (Murray-Johnson & Witte 2003: 487). However, a positive intention may not be enough for behavioural change (Sheeran 2005, Webb & Sheeran 2006), especially for complex, habitual behaviours, such as those related to nutrition. Such behaviours depend very much on personal abilities and environmental opportunities (Brug et al. 2005).

2.1.2 Health behaviours related to physical activity, nutrition and weight management

The focus of this thesis is on promotion of physical activity, nutrition and weight management. Physical activity can be defined as “any bodily movements produced by skeletal muscles that result in energy expenditure” (Caspersen et al. 1985: 126). A large percentage of North Americans and Europeans do not engage in the evidence-based recommended levels of physical activity (Haskell et al. 2007) while, paradoxically, the majority of individuals believe they do engage in sufficient physical activity (Hagger & Chatzisarantis 2005: 12). According to the World Health Organization (2010a: 24–26) recommended levels for adults are 30–60 minutes of moderate intensity on most days of the week; the American College of Sports Medicine and the American Heart Association recommend a minimum of 30 minutes of moderate-intensity aerobic (endurance) physical activity five days a week or a minimum of 20 minutes of vigorous-intensity aerobic physical activity three days a week (Haskell et al. 2007). Individuals, who do not fulfill these values, are seen as physically inactive or sedentary.

According to the World Health Organization (2011a: 75), 43% of Finnish males and 39% of females are physically inactive. In addition, according to recent research, prolonged sedentary behaviour, such as sitting, has been associated with raised mortality risk, regardless of the amount of total physical activity.
(Stamatakis et al. 2011). However, interruptions in sedentary time, like standing up, decrease the negative effects of sedentary behaviour (Healy et al. 2011, Rutten et al. 2013). Generally speaking, it has to be remembered that formal exercise is only one component of physical activity. Increasing physical activity can be also done through everyday activities such as performing yard work or housework or taking the stairs instead of the elevator. (Yap & Davis 2008).

A variety of behavioural factors influence the rate of obesity, such as, dietary behaviour and physical inactivity (Must & Tybor 2005). At a fundamental level, weight gain occurs when energy intake exceeds energy expenditure. Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health (World Health Organization 2011b, Prentice & Jebb 2001). Recent numbers indicate that the percentage of obese people (body mass index, i.e. BMI, over 30) has increased in European countries (Rokholm et al. 2010, Beghöfer et al. 2008). Over half of the Finnish population were overweight or obese in 2012. For men the percentages are higher than for women and there has been a slight downturn for women in recent years (National Institute for Health and Welfare 2012b). Beghöfer et al. (2008) conclude that in Europe, obesity has reached epidemic proportions. Furthermore, predictions have been made that if the trend continues, a majority of the world’s adult population will be either overweight or obese by the year 2030 (Kelly et al. 2008). According to, for example, Rokholm et al (2010), research on the causes, prevention and treatment of obesity should be a priority in the future.

### 2.1.3 Prediabetes and type 2 diabetes

In addition to focusing on promotion of physical activity, nutrition and weight management this thesis focuses on secondary prevention of type 2 diabetes (see Studies 1 and 2). Adiposity, unhealthy diet and a sedentary lifestyle are risk factors of prediabetes (formerly called borderline diabetes) and type 2 diabetes mellitus (formerly called adult-onset diabetes or noninsulin-dependent diabetes). Nowadays as more children and adolescents become overweight or obese and are physically inactive, type 2 diabetes is occurring more often also in young people (Kaufman 2011). The risk of type 2 diabetes increases with ageing and is also associated with the level of education; people in developed countries with a higher education have a lower risk. Type 2 diabetes is believed to be partly heritable, but only a few of its genetic risk variants have been identified. (Uusitupa et al. 2011). Type 2 diabetes is a complex metabolic disease, where the
ability of insulin to stimulate glucose disposal by muscle, adipose tissue and liver has decreased (Ali & Fonseca 2012: 31). In prediabetes an individual’s glucose tolerance is impaired, but still below diabetic levels. This is indicated by slightly increased fasting and/or postprandial glucose values. This slow initial phase is usually asymptomatic and may last for many years. To determine whether an individual has prediabetes or type 2 diabetes, results of biochemical measurements of blood are compared to reference ranges (Marshall 2008: 18–19, see subchapter 4.3.2).

In Finland, over 16% of men and 11% of women aged 45–74 years have type 2 diabetes and altogether around 42% of men and 33% of women have prediabetes or diabetes. It has also been estimated that over 50% of diabetic individuals do not know that they are diabetic as they have not yet been diagnosed. (Saaristo et al. 2010). Increased physical activity and weight loss have been shown to prevent or delay the onset of type 2 diabetes (Walker et al. 2010, Uusitupa et al. 2011, Sivaraman & Weickert 2012).

2.2 Health promotion and communication

According to the World Health Organization (2012b: 15–17) health promotion is the process of creating healthy public policies and services and also enabling individuals to increase control over, and to improve, their health. Alternatively, health promotion is seen as “a process by which the ecologically-driven socio-political-economic determinants of health are addressed as they impact on individuals and the communities within which they interact” (Whitehead 2004: 314). The relationship of the concepts of health promotion and health education is under debate. Generally speaking, health education is considered to occur at the individual level rather than at the level of society. (Whitehead 2004). However, in this thesis the concept of health promotion is generally used to refer also to health education.

Health communication is a means of health promotion. In this thesis its individual parties are, from now on, referred to as the information provider and information receiver. Health communication is about informing, influencing and motivating audiences about important health issues (Muturi 2005: 78). These audiences can also include health care professionals or health policy makers, but in this thesis the focus is on the general population.
2.2.1 Health promotion and interventions

The health professionals’ intention is that the health promotion and health education will culminate in behavioural change and lead to a positive health status outcome (Whitehead 2004). Benefits at the individual level may include changes in beliefs, attitudes, increased awareness and knowledge, habits and skills that relate to health maintenance, lowered risk for certain health problems, better health status, and improved quality of life (Green & Kreuter 1999: 19–22).

Health promotion programs provide planned, organised and structured activities that focus on helping individuals to make informed decisions about their health (Fertman et al. 2010: 6). It has been stated that lifestyle changes, including regular physical activity, reduced inactivity, healthy food choices, and portion control, are important elements of health promotion programs (Laddu et al. 2011). Stubbs and Lee (2004) point out that physical activity and nutrition must be addressed together in order to counteract obesity. Physical activity is particularly challenging to support as it usually takes more time and effort than most other preventive health behaviours (Haskell et al. 2007), such as increasing vegetable intake.

A major goal for public health is to provide evidence-based health behaviour change programs and campaigns to promote physical activity (Pratt et al. 2012) and weight management in populations. The concept of intervention can be defined as any act whose purpose is to improve health or alter the course of disease. Thus health promotion programs and campaigns include the idea of intervention.

Intervention studies investigate the effectiveness of intervention. A randomised controlled trial represents a typical experimental design of an intervention study and is considered the most rigorous method of determining whether a cause-effect relationship exists between an intervention and outcome. Participants are divided into two groups by random assignment and the experimental group is exposed to the manipulated variable, for example, to lifestyle promotion, while the control group is not. The groups are followed prospectively and comparison of the outcomes of the groups at the end of the study period is an evaluation of the intervention. (Lesaffre & Verbeke 2005, Bryman 2012: 50–52).

Information and communication technologies (ICT) such as the Internet and mobile phones provide new opportunities for delivery of innovative interventions (Pratt et al. 2012). Health behaviour change programs and campaigns delivered
via the Internet (i.e. web-based) have become increasingly popular for the promotion of lifestyle-related health behaviours (Kroeze et al. 2006). Availability, transferability, relatively low cost, and customisation are some of the benefits for selecting web-based programs and campaigns as well as a perception of anonymity, which may be appealing to reluctant or self-conscious participants. In addition, web-based health behaviour programs and campaigns appear to be cost-effective (Norman et al. 2007, Tate et al. 2009, Webb et al. 2010). The Internet is increasingly used by private and public healthcare organisations in their communications and information transfer (Eng 2002). The concept of eHealth involves the use of ICT to improve health in general and the healthcare system in particular (Eysenbach 2001, Chau & Hu 2004). Furthermore, mobile health (mHealth) is thought to be the next step of computerised health interventions (Riley et al. 2011). (See subchapter 3.5 and Study 4 for more about different channels of information delivery).

2.2.2 Health communication and persuasive communication

Health communication can contribute to all aspects of disease prevention and health promotion. It has been defined as “the crafting and delivery of messages and strategies, based on consumer research, to promote the health of individuals and communities” (Roper 1993: 179). On the other hand, persuasive communication has been defined as any conscious attempt to influence beliefs, attitudes, intentions, motivations and behaviours (Miller 1980). Influencing can take the form of shaping, reinforcing or changing. Political campaigns, advertising and our friends, relatives or loved ones can use persuasive communication and it is part of our daily lives. Persuasion takes time, consists of a number of steps, and actively involves the recipient of the message. (Perloff 2010: 10–20). McGuire (2001: 31–32) outlines 13 steps that need to occur in order for a health communication message to reach the receiver and cause the desired outcome, for example, health behaviour change. Examples of these steps are: attending to the message, becoming interested in it, comprehending its contents, generating related cognitions, learning how to respond to it, agreeing with it, deciding to act on the basis of it and acting on it. Thus, for persuasion to happen a long string of steps must be fulfilled and, of course, each of these steps only has a moderate probability of success. This also explains, in particular, the very low probability of success of general communication campaigns where everyone receives identical messages. (Johnson & Case 2012: 186–187).
In health communication individuals are often informed about the guidelines for healthy behaviour. In addition they are persuaded to change their health attitudes and behaviours. For this the information has to be translated into practical recommendations by supplementing health messages that convey why and how to achieve the recommended health behaviour. (Latimer et al. 2010). Provision of health messages through health promotion programs and campaigns can create awareness of an issue, change attitudes toward a health behaviour and encourage and motivate individuals to follow recommended behaviour (Ammary-Risch et al. 2010: 205). Petty and Cacioppo (1986) have shown that messages are more persuasive when they give more convincing evidence for an action or belief, when they raise an individual’s interest in processing the message and when the messages are easy to understand. In addition, vividness of the message and the persuasive appeals, such as fear appeal (see subchapter 3.7.2 and Study 3), as well as the source, receiver, channel, content and context, affect the persuasiveness of messages (Noar et al. 2009: 387).

The research on health behaviour change has also led to the development of technologies supporting behaviour changes (e.g., Consolvo et al. 2006, Nawyn et al. 2006). These so-called persuasive technologies (Fogg 2003) embed motivational strategies into everyday electronic devices to encourage and sustain long-term health behaviour changes. They attempt to shape, reinforce or change behaviours, attitudes, feelings or thoughts about an issue, object or action (Berkovsky et al. 2012). According to Oinas-Kukkonen (2013) behaviour change support systems are the primary focus of research in the area of persuasive technologies (see also Lehto 2013: 26–28). A key challenge in persuasion is that often the target audiences are large and heterogeneous and include users with wide-ranging goals, needs and preferences (Berkovsky et al. 2012). The solutions for this can be the targeting and tailoring of health communication. (Noar et al. 2009: 391). (See more about tailoring in Chapter 3).

Finally, it should not be forgotten that certain ethical concerns relate to health promotion and health behaviour change interventions. Health promotion generally takes for granted that individuals should adopt a lifestyle that society considers healthy, sensible and responsible. It is assumed that individuals value and prioritise their health as important and that they are in need of health-related advice in order to make sense of their actions and behaviours. (Whitehead 2004). Moreover, it is common that messages in health communication rely on appealing to personal responsibility. Messages may imply that illness or disability will result from failure to adopt a “responsible” lifestyle and that individuals may become a
burden to their family or society. Individuals may not perceive their behaviour as problematic and may react to these messages with feelings of guilt, shame or frustration, especially if they feel they cannot adopt the recommended behaviours. This may lead to a negative outcome of the health promotion. Consequently, it has been suggested that ethical analysis should be applied to each stage of development of health communication. (Guttman & Salmon 2004).

2.3 Health information and health information behaviour

According to the definition of the Internet Health Coalition (2000) “health information includes information for staying well, preventing and managing disease and making other decisions related to health and health care”. The Medical Library Association (2003) has stated that good health decisions depend on good health information. Additionally, it has been suggested that information together with increased knowledge and awareness are important initial steps in health behaviour change (Freimuth et al. 1989: 39, Bar-Ilan et al. 2006). However, information or knowledge alone does not guarantee change of behaviour (Rakowski et al. 1990, Barratt 2001). In fact, people may already know what approach they should take to improve their health, but for a variety of reasons they may not act on that knowledge (Sligo & Jameson 2000).

Researchers of human information interaction investigate the interaction between individuals and information with its multiple forms and purposes. Within this multidisciplinary research area Information Studies has been quite active (Fidel 2012: 17–21).

Bates (2009: 2381) states that "Information behaviour is the currently preferred term used to describe the many ways in which human beings interact with information, in particular, the ways in which people seek and utilize information". It is also the concept used in Information Studies to refer to a sub-discipline that engages in research conducted in order to understand the human relationship to information. The research focuses on information needs, seeking, searching, retrieving, organising and use (Wilson 1981, 2000, Spink & Cole 2005). Wilson (2000: 49) defines information behaviour as "the totality of human behaviour in relation to sources and channels of information, including both active and passive information seeking and information use. Thus it includes face-to-face communication with others, as well as the passive reception of information as in, for example, watching TV advertisements, without any
intention to act on the information given.” Pettigrew et al. (2001) point out that information behaviour phenomena are part of the human communicative process.

Savolainen (2008: 2–3) has introduced information practice as a co-ordinate concept for the information behaviour. He considers that both concepts basically refer to the same thing, how individuals deal with information, but from somewhat different perspectives. Savolainen (2007) concludes that the discourse of information behaviour connects primarily to the cognitive viewpoint while information practice draws more heavily on social constructionism. In this thesis the difference between these umbrella concepts, used in Information Studies, are not debated, but the concepts of information needs, seeking, searching and use and their relation to health, primarily in light of the research done in Information Studies, is indicated. In general there is no consensus among researchers on how to define these concepts, for example, information use (Savolainen 2009, Kari 2010).

In this thesis all human information behaviour that takes place in the context of health is defined as health information behaviour. Major activities underlying health information behaviour are establishing health information needs, information seeking or searching and information use. Health information behaviours can be examined in different contexts. For example, doctors, health care workers, caretakers and patients may have different needs and experiences. In this thesis the everyday (non-work related) health information behaviour of individuals is focused on. For instance, everyday life information seeking refers to the acquisition of information used by individuals to gain knowledge or solve their daily life problems, not connected to their occupational tasks or educational setting (Savolainen 1995).

2.3.1 Information needs, desire for information and information seeking in relation to health

Information may be needed to alleviate an anxiety, to make a decision, to develop a greater understanding or to find out about a subject or solve a problem (Case 2012: 5). For example, a health problem or concern may lead to experiencing information needs (Wilson 1997). Information needs are thought to arise from basic human needs that have cognitive, physiological and psychological or emotional qualities (Wilson 1981). They “do not arise in a vacuum but rather owe their existence to some history, purpose and influence” (Case 2002: 226). The concepts that relate to information needs are, for example, “a vague
dissatisfaction” (Taylor 1968), “an anomalous state of knowledge” (Belkin 1980), “a gap” (Dervin 1983), or “an uncertainty” (Krikelas 1983, Kuhlthau 1991). Generally speaking, information needs can be conceptualised differently, depending on the context in which they appear (Savolainen 2012).

Derr (1983) states that information may be needed without being desired and Chatman and Pendleton (1995: 136) separate information need and information want. The concept of “desire for information” is also used to describe the amount (and frequency) an individual would like to have information (Fourie 2008). In other words, information could be important in an individual’s life, but yet that person may have no interest in gaining it. According to Fidel (2012: 87) information needs can be unconscious, but information wants (or desire for information) can usually be put into words by the individual.

Information seeking is assumed to be an important element in decision making and health outcomes (Johnson et al. 2001, Rimer et al. 2004). Human information behaviour research has recognised information seeking as the central form of interaction that individuals employ to get information (Fidel 2012: 22). Information seeking can be active or passive. Active information seeking has been defined as “the purposive seeking for information as a consequence of a need to satisfy some goal” (Wilson 2000: 49). Information searching is seen as a narrower and more focused concept (e.g., Wilson 2000). In Study 1 of this thesis it is used as a synonym for information seeking.

Individuals can seek health information for several reasons. For instance, individuals who want to maintain a good health status seek information to understand risk factors and to learn about prevention. On the other hand, individuals with illnesses often seek information to understand their diagnosis, to decide on treatments and to predict their prognosis. (Brashers et al. 2002).

Sociodemographic variables, such as one’s age, gender, education, occupation and wealth are the mainstay of Social Research, which tries to find patterns among the behaviours, beliefs and attitudes of populations based on connections and correlations with such variables (Case 2012: 152) (see also Studies 1, 2 and 3 of this thesis). Research on health information seeking and information sources has revealed, for example, that higher educated individuals seek information, read more, use professional sources to a larger extent and have less trouble in evaluating information (Ek 2004). Traditionally, health and medical information is mostly obtained from health care professionals, friends or family members (Johnson 1997). Today, health-oriented consumers typically seek out a variety of health and medical information and use various sources of information,
including interpersonal sources, mass media and, increasingly, the Internet (Dutta-Bergman 2004a, Fox 2005, Askola et al. 2010, Marton & Choo 2011, Pálsdóttir 2011; cf. Savolainen & Kari 2004). People may seek health information for their own information needs, but also for the caretaking of family and friends (Abrahamson & Fisher 2007). Women are more likely to seek health information than men (Pifalo et al. 1997, Pálsdóttir 2003, Pew Internet 2013) and they are more likely to seek information for others (Abrahamson & Fisher 2007). According to Pálsdóttir (2003) women also are more likely than men to consider that the health information on the Internet is useful for them. Pálsdóttir (2008) and Huntington et al. (2002) have studied individuals’ interest in health information. The findings of Pálsdóttir’s analysis indicate that those in the “passive” cluster are both significantly less interested in health and lifestyle and they seek information less often than individuals in other clusters of her analysis. In addition, information seeking that is accompanied by a critical approach in the selection of information sources and low information behaviour barriers, together with high health self-efficacy beliefs, relates to the healthiest behaviour. Moreover, it has been stated that individual characteristics, such as, locus of control and world views, influence health information interest and health information seeking (Ek & Heinström 2011).

2.3.2 Information use in relation to health

It has been stated that information use is a poorly defined concept linked to information need (Wilson 1999). According to Cole and Leide (2006) information use is a process in which an environmental stimulus, which includes stimuli obtained from reading, viewing and listening activities, modifies the user’s knowledge structure. Wilson (2000: 50) states that information use behaviour “consists of the physical and mental acts involved in incorporating the information found into the person's existing knowledge base”. Information is interpreted and internalised by the individual in order to construct knowledge, and this knowledge may result in further action (Savolainen 2008: 50, 65). In Information Studies knowledge is commonly defined as the intellectual content of our minds (Vickery 1997) and knowledge structures are the sets of concept relationships that comprise each individual’s model of the world (Pettigrew et al. 2001).

The concept of “information reception” has been used to define the first stages of the information use process, which could be seen to include noticing,
filtering, evaluating and comparing the content of the obtained information (Nahl & Bilal 2007: 4–8). In this thesis, information reception relates also to perceptions of and preferences for different kinds of message presentations, in other words, message strategies (see Studies 2 and 3).

In addition to the cognitive viewpoint in Information Studies, information use has been studied from the constructivist and socio-constructivist viewpoints (e.g., Talja et al. 2005). These viewpoints have a lot in common as they all thematise information use as processes occurring within the human mind. They share the assumptions that a human being is an information processor, that comparing and interpreting qualities of things is fundamental to the information use process and that the reception of information is mediated by an individual’s existing state of knowledge. (Savolainen 2009, Talja et al. 2005).

Generally speaking, there has been a shortage of studies on information use in Information Studies (Vakkari 1997, 2008). Information use is a highly complex process and studying it is a particularly challenging endeavour (Fidel 2012: 35). Fisher et al. (2004) discuss the ways to detect information use. Information use has been investigated, for example, through the following research questions: “how many times has an information source been used?” or “how helpful has the information been in different situations?” Many studies focus on the response to the information (Fidel 2012: 35). It is common to give information users a chance to estimate their own information behaviour by answering a questionnaire and this approach is also used in this thesis (see Studies 1, 2 and 3).

Some studies have focused on health information sources (e.g., the Internet) and individuals’ use of health information (e.g., Eriksson-Backa 2003, 2012, Pálslóttir 2008, 2010, Yates et al. 2009, Ek et al. 2013). Researchers at the Pew Internet and American Life project regularly follow the trends in the USA (Pew Internet 2013). Furthermore, Pálslóttir (2008, 2010) has studied everyday health information and lifestyle matters among Icelanders and also information use in this context. In a study by Eriksson-Backa (2003) certain health situations led to a preference for certain information sources. For instance, most diabetic individuals were found to prefer health professionals and pregnant women mainly used health magazines. Additionally, Yates et al. (2009) focused on categorising the experiences of ageing Australians in using information to learn about their health. The foci of information use of the elderly were categorised to purposeful identification of how to be healthier or to maintain wellness, reminding or validating the importance of wellness, understanding of the body, protecting and
preserving health, filtering information and accumulating information on wellness.

From the viewpoints of persuasive and health communication we can infer that the steps that need to occur for persuasion to take place, portrayed by McGuire (2001: 31–32), relate to the process of information use (see subchapter 2.2.2). It could be concluded, that for persuasion to take place, information use has to occur.

2.3.3 Presentation of information and individuals’ preferences

When information is communicated it always has some form of presentation. In this thesis presentation of information refers to constructing a message. In health communication messages can be framed and constructed in several ways by using message strategies (see subchapter 3.7). The study of how message content and structure influence communication effectiveness is one of the most widely researched topics in persuasive communication. In typical studies, participants are exposed to one of several versions of an experimentally varied message. Effects of exposure to the different variations are then assessed, including reactions to the communication, as well as changes in specific attitudes, beliefs, and behaviours that were addressed in the communication. (Kreuter & McClure 2004).

According to Lustria (2007: 767) “information processing theories posit that persuasion occurs more successfully as a result of the internalisation of messages rather than from simple information retention”. One of the most popular of these theories and models is the Elaboration Likelihood Model (ELM) of persuasion by Petty and Cacioppo (1986). It was formulated to explain contradictory research findings, specifically the effects of messages on attitude change. In Information Studies, for example, Dutta-Bergman (2004b) and Tomic (2010) have stated that the ELM may be used to explain and evaluate information seeking and information use. The ELM proposes that individuals process information in two distinct ways: central (i.e. systematic) and peripheral (i.e. heuristic). In central processing individuals carefully scrutinise message content, leading to enduring attitude and behaviour change. In peripheral processing, in turn, minimal effort is invested to interpret the information and only limited, temporary effects on cognitions and behaviours are likely to occur. (Petty & Cacioppo 1986).

Decisions are typically characterised as choices made among alternatives; at least two options are available, and the decision maker may select only one of them (Case 2012: 97). One of the research topics related to decision-making and
information use are the individuals’ preferences (Savolainen 2009). The information user’s way of interpreting and choosing between alternatives is affected by, for example, the way in which the alternatives are presented or displayed by the information provider (Bettman et al. 1998). In addition, individuals make decisions based on patterns and past experience (Snowden 2005), and preferences for information change in response to changing health-related situations and experiences (Ormandy 2010). Additionally, Ginman and Eriksson-Backa (2001) state that our personal preferences for information may affect our health behaviours in several ways.

In information behaviour research individuals’ preferences have been studied, for instance by examining their preferred channel of information (Dunne 2002, Pálsdóttir 2008). The concept of “preference for information” has often been used interchangeably with an individual’s tendency towards engaging in health information seeking behaviour (Lambert & Loiselle 2007, Anker et al. 2011). On the other hand, preferences for types of information have been studied, for example, by Williamson (2005) in the context of a breast cancer portal. In this thesis, it is assumed that a health message, presented in a manner the individual prefers could be better accepted by him/her, resulting in the use of the information and thus proving more effective in promoting healthier behaviours. Thus, receiving information in a preferred manner could be seen as a facilitator of information use. Additionally, in tailoring health communication the information content and the presentation can be matched with the individual’s preferences (Rimer & Kreuter 2006). (See subchapter 3.4 and Studies 2 and 3). The relationship between concepts of health information behaviour, reception of fear appeal message strategy and preferences for feedback message tactics is presented in Figure 2.
Fig. 2. The relationship between concepts of health information behaviour, perception of fear appeal message strategy and preference for feedback message tactics.

In this thesis the relationship between these concepts is seen as hierarchical. Information reception is part of the information use process and preferences for feedback message tactics and perception of fear appeal message strategy are seen to be related to information reception.

2.3.4 Barriers to information use and decision making

From the viewpoint of this thesis the most important barriers to information use and information reception are psychological and cognitive. Ginman (2000) points out that many times there is a gap between the wealth of information and behaviour, in other words, there is an information-behaviour gap (see also Sligo & Jameson 2000). An example of this, presented by Ginman (2000), is women’s knowledge about breast cancer and their actual behaviour. Most women know that early diagnosis is an efficient method for reducing mortality caused by breast cancer. In spite of this, women often neglect the invitations to recommended, free examinations. In general, sometimes individuals would rather not know that they could be at high risk for a disease and they avoid the situations where they are at risk of hearing negative news. This situation is called information avoidance (Sairanen & Savolainen 2010, Case 2012: 109–112).
People may directly or selectively avoid information that is considered distressing (Miller 1987, Sairanen & Savolainen 2010, Lu 2010) or when it conflicts with the beliefs with which they are comfortable (Babrow 2001). “The tendency to avoid, ignore, or deny information has always been somewhat of an anomaly in human behaviour” (Case et al. 2005: 354). The questions of health information avoidance have also been approached from the viewpoint of fear appeals, coping and uncertainty management, especially in the fields of Psychology and Communication, but also in Information Studies (Case et al. 2005, Sairanen & Savolainen 2010). In a study by Sairanen and Savolainen (2010) it was found that health information was primarily avoided because of the risk of experiencing negative emotions such as fear, anxiety and depression. For instance, information avoidance related to dietary choices can include justifications related to practicability, issues related to price, hedonism (e.g., “it’s bad for me, but I eat it anyway”), denial (e.g., “it’s not as bad as they say”), fatalism (e.g., “we’re doomed anyway”), cognitive repression, which is refusal to think about the issue at all, or magic thought that is overestimation of bodily powers (e.g., “my body can handle it”) (Brunel & Pichon 2004, Narayan et al. 2012). (See subchapter 3.8 for a discussion on information avoidance in relation to self-image maintenance and perception of the fear appeal message strategy).

Moreover, an individual may feel that the environment bombards them with too much information and become distressed. This kind of situation is called information overload and it may lead to information avoidance. (Case 2012: 117). Information overload is directly related to information use, because the experiences of information overload affect the way in which information sources are selected or rejected. (Savolainen 2008: 165). According to Savolainen (2008: 165) there is no consensus among researchers about the definition on information overload and whether the phenomenon really exists. Eysenbach (2003) states that individuals who are exposed to too much information may be more likely to become confused and make poor health decisions that can potentially have harmful effects on outcomes. In a study by Kim et al. (2007) lower socio-economical status, poor health and high affective components of information seeking (indicated by strong frustration and low confidence in finding information) were associated with information overload.

Additionally, the terminology used in health information may be difficult and presented in a way that the information receiver does not understand (Docherty et al. 2008, Fourie 2008). Coping with differences between “lay language” and professional terminology can be a barrier to information use and decision making.
and it is related to an individual’s health literacy and health information literacy (McKenzie 2002, Brennan & Safran 2005: 13–14, Eriksson-Backa 2008). Thus, one way to avoid the experience of information overload or avoidance is to become information literate. The Medical Library Association (2003) defines health information literacy as a “set of abilities needed to: recognize a health information need; identify likely information sources and use them to retrieve relevant information; assess the quality of the information and its applicability to a specific situation; and analyze, understand, and use the information to make good health decisions”. For example education has been found to be a sociodemographic factor that relates to individual differences in the level of health information literacy (e.g., Eriksson-Backa et al. 2011, 2012, Niemelä et al. 2012).

2.3.5 Health information behaviour in relation to health status and health behaviours

In this thesis individuals’ health information behaviour is investigated in relation to their physical health status (see Studies 1, 2 and 3). The individuals’ health status has also been previously linked to their health information behaviour, but the research done has relied on self-reported data. This thesis is an exception among research on this topic as the indicators of physical health status are measured with objective measurements. In addition, the self-reported stage of exercise behaviour change, which reflects the exercise behaviour and readiness to change it, is utilised (see Study 3). Generally speaking, objective measurements can provide more reliable results than subjective measurements (Michie & Abraham 2004, see subchapter 3.9.2).

Self-reported health status has been studied in relation to information seeking and use of information sources. In a study by Ek and Heinström (2011) individuals with perceived health problems were more likely to end up avoiding health information than those without perceived health problems. Additionally they had weak cognitive mastering of the context, incapacity to influence their own situation and lower motivation to act on health issues. Moreover, it has been stated that elderly individuals with poor self-estimated health are more vulnerable regarding obtaining and using health information and therefore health-related information should be understandable and easily accessible for them (Eriksson-Backa et al. 2012). Houston and Allison (2002) found out that compared to individuals with better self-reported health status, individuals with fair or poor
health status were more likely to use health-related online chats, less likely to search for health information for others and more likely to talk about the new health information with their medical doctors. However, in a study by Goldner (2006) people with a disability or chronic disease were more likely to search for information on multiple health topics from the Internet than those with a better health status. Later on in a study by Liu et al. (2009) no significant difference was found between active and less active online health information searchers in terms of their self-reported health status. This may be due the fact that people often search health information on behalf of others and in these situations their own health status might not be relevant. Furthermore, an association between health status and information overload has also been observed, as individuals with poor self-reported health status suffered from overload in a study by Kim et al. (2007).

Additionally, health information behaviour has been studied in relation to self-reported health behaviours, such as exercise activity and diet (e.g., Eriksson-Backa 2003, Pálsdóttir 2008, Hirvonen et al. 2012). It has been stated that information seeking correlates strongly with preventive health behaviours (Ramanadhan & Viswanath 2006, Ramirez et al. 2013). Moreover, the findings of a study by Pálsdóttir (2008) indicate that information seeking that happens less often but in a more focused way, accompanied with a critical choice of information sources and low information behaviour barriers, goes hand in hand with the healthiest behaviour. Hirvonen et al. (2012) studied the connection of young men’s information behaviour and their stage of exercise behaviour change according to the TTM. In pre-action stages, where individuals do not exercise regularly, information is most often encountered through passive practice or nondirected monitoring. In the action stage, where individuals have recently changed their exercise behaviours, information is obtained most frequently by active seeking. In the maintenance stage, where individuals maintain earlier adopted behaviours, information is habitually obtained through active scanning.
3 Tailoring health communication and information

The following chapter will discuss about tailoring of health communication and information. The chapter starts by discussing health communication approaches and how tailoring health information has been brought out in Information Studies. After that, the aims of tailoring and bases for tailoring health information are covered. This is continued by a discussion of the tailoring process, channels for delivery and effectiveness of tailored health information. The message strategies for tailoring health information are scrutinised with particular attention given to the feedback and fear appeal message strategies. Moreover, sociodemographic and psychosocial characteristics affecting the reception of message strategies are addressed. The chapter ends by providing an overview of tailored health behaviour change programs and interventions as well as a summary of systematic reviews on these interventions.

In health communication, health information or messages can be delivered to a general audience or to segmented, targeted audiences (Evans 2006). Traditionally, health promotion materials have been generic (Kreuter et al. 1999: xii, Johnson & Case 2012: 184). In generic mass media communication materials are intended to appeal to a large group of people (Brug et al. 2003) and a relatively large undifferentiated audience receives identical information content (Kreuter & Wray 2003). In many cases as much information as possible is provided and individuals need to find the relevant information on their own. However, it is likely that only individuals, who are already motivated, are willing to search through e.g. lengthy brochures for information that applies to their situation. (Brug et al. 2003).

Although health information is widely available, appropriate information suited to particular individual needs cannot often be found (Williamson 2005). In addition, people do not always access or obtain information that could be beneficial to them (Chatman & Pendleton 1995). One reason for this could be that an individual’s information needs can be unconscious and thus they are not aware of them (Fourie 2008, Case 2012: 82). In addition, individuals do not always know how to express their information needs, for example due to anxiety caused by fear of diseases (Fourie 2008). Besides other psychological and cognitive barriers to information use and decision making (discussed in subchapter 2.3.4) also lack of self-efficacy can inhibit the recognition of an information need
(Johnson et al. 2001). It has been concluded that general health communication is not sufficient to meet the information needs of individuals (Docherty et al. 2008).

Furthermore, when trying to obtain information, individuals usually seek out information that is most accessible (Johnson & Case 2012: 160) and they tend to want “fast knowledge” that is already framed for them (Nicholas et al. 2006: 227). Due to all of these reasons, it is important that health providers make information easily available to the individuals they aim to reach (Johnson & Case 2012: 206) and that the health information provided is relevant to the individual and presented in a suitable form (Tuominen 2004, Dervin 2005). Moreover, health providers are aware of some of the unexpressed information needs of individuals as well as their possible difficulties in understanding information (Fourie 2008).

In conclusion, it has become clear that generic health campaigns are not very effective (Neuhauser & Kreps 2003) and the possibilities of a “one size fits all” approach of health communication are limited (Colineau & Paris 2011).

Tailoring of health information is a means to overcome the problems related to the provision of general health information. It attempts to provide carefully selected information suitable for an individual and consequently may lower or remove psychological or cognitive barriers to information use and decision making. Tailoring also makes it easier for the receiver to interpret, understand and trust information (Te’eni 2001).

3.1 Audience segmentation and tailoring

The goal of audience segmentation is to identify population subgroups that share the same characteristics. It is commonly used in advertising and marketing, including social marketing (Lefebvre & Flora 1988, Rimer & Kreuter 2006). Kotler and Roberto (1989: 24) define social marketing as “a process that promotes the voluntary behaviour of target audiences by offering benefits they want, reducing barriers they are concerned about, and using persuasion to motivate their participation”. Social marketers have brought the principle of audience segmentation also to the promotion of changes in health behaviours (Evans 2006). Audience segmentation at its broadest is targeted communication. In targeted communication, the aim is to reach particular population subgroups (or a population segment) that is more homogenous in their information needs and wants than the population at large (Brug et al. 2003).

Tailored communication is a more sophisticated, individualised form of segmentation. Kreuter et al. (1999: 5) define tailored health communication and
tailored health promotion materials as “any combination of information and behaviour change strategies intended to reach one specific person based on information unique to that person, related to the outcome of interest, and derived from an individual assessment.” Assessments are usually conducted by asking questions, for instance, about the individual’s goals in health behaviour change or self-estimated health behaviours. In addition to assessment, data for tailoring may be obtained from existing sources, such as medical records (Kreuter et al. 1999: 101–102). The aim of tailoring is to increase the perceived personal relevance of health information, which consequently helps engage individuals and create ideal conditions for persuasion and attitude or behaviour change to occur (Lustria et al. 2009). Or in other words, the aim is to “produce an individualised communication so that the participant can say ’This applies to me’” (Yap & Davis 2008: 55).

Targeting and tailoring are not discrete categories of communication, but overlapping segments of the continua (Hawkins et al. 2008). They combine the benefits of interpersonal communication and mass media (Evans 2006). Tailoring imitates and automates the process of person-to-person counselling by providing more customised information than the mass media, but still has some of the benefits of mass media approach, such as possibilities for larger reach than interpersonal communication (Noar et al. 2009).

Interpersonal communication can combine the highest level of assessment with content individualising (Kreuter et al. 1999: 6–7). Because interpersonal communication can utilise most of the senses and it allows immediate back and forth discussion and spontaneity, it has become the standard against which other communication strategies are evaluated (Kiousis 2002). However, although interpersonal communication holds the potential to be the most highly individualised, a lot of general information is delivered via interpersonal communication. (Spitzberg & Cupach 1984: 53–67). The limitation of interpersonal communication is that it reaches only a small segment of the population and this segment may consist of individuals who are self-selected and somewhat motivated to change their behaviour (Marcus et al. 2009: 240). Moreover, a greater level of individualising may increase cost and effort for health promotion campaigns and programs (Hawkins et al. 2008, Stellefson et al. 2008).

In addition to text, tailored content may include visual elements, like pictures or videos. The use of visual information in combination with tailoring is discussed, for instance, by Van Weert et al. (2011) and tailored health videos are discussed by Lee (2011) and Vandelanotte and Mummery (2011). This thesis
focuses mainly on tailoring information content, namely textual information and messages in the context of health promotion.

Cognate concepts of customisation, individual-centreing, individualising, matching, personalisation and tailoring are used differently in different fields. For instance, in the human-computer interaction field these concepts can be used to define interface customisation and computerised recommendation systems (used, for instance, by the Amazon online retailer) (see e.g., Sundar & Marathe 2010, Teevan et al. 2010). In this thesis the concept of tailoring health information is used in the manner it is used in the research field of Health Communication.

3.2 Tailoring health information in Information Studies

In Information Studies the concept of tailoring (i.e. personalisation or customising) has mainly been used concerning human-computer interactions or planning and delivering programs or services, mainly in relation to libraries (e.g., Juntunen et al. 2005). In Information Studies there is a lack of research on tailoring health information.

Lustria and her colleagues have carried out reviews of computer-tailored health interventions delivered via the web (Lustria et al. 2008, 2009, 2013, Lee & Lustria 2009). Additionally, some researchers have taken part and reported on projects where tailored health information has been utilised. For instance, researchers from the College of Communication and Information, Florida State University, participated in the development of an electronic reminder system for breast cancer screening (Lustria et al. 2010) and researchers from the Faculty of Information Technology, Monash University, took part in the Australian Breast Cancer Knowledge Online (BCKOnline) project, whose end product was an intelligent online portal (Manaszewicz et al. 2002, Williamson & Manaszewicz 2003, McKemmish et al. 2009). The findings of their reports on these projects affirm the importance of user-centred, contextual approaches as a means of understanding the continually changing information requirements of diverse target audiences. Moreover, MacDonald et al. (2010) have stated that there is a need for the traditional as well as new skills and expertise of information professionals in tailoring health information. They may take the role of health information advocate, health information evaluator, information need analyser, resource identifiers and evaluator or classification specialist. In fact, many of these roles were obvious for librarians in an analysis of The Personal Education
Plan (PEPTalk) research project (2005–2006) developing tailored education resources for individuals with chronic illnesses (MacDonald et al. 2010).

Furthermore, according to researchers of Information Studies individual differences in health information behaviour need to be considered in the development of tailored information services (e.g., Bar-Ilan et al. 2006, Fourie 2008, Ek & Heinström 2011). It has been argued that differences in individuals’ information seeking (e.g., Johnson & Case 2012: 207) should be used as a basis to tailor health information. Additionally, Lustria (2005: 30) states that understanding differences in the way health information seekers process similar content delivered using different levels of interactivity should be studied and used as a tailoring basis.

According to Moore (2002) a range of different mechanisms can be used to meet an individual’s information needs and one of these mechanisms is tailoring information. He continues that most people want information that is tailored to meet their particular needs. Similarly, other researchers of Information Studies (e.g., Harland & Bath 2008, Fourie 2008) have noticed that health information can be tailored to match an individual’s information needs. It has even been stated that information needs should be used as a basis for tailoring (Williamson & Manaszewicz 2002, Keselman et al. 2008) and, in fact, the analysis of the review by Lustria et al. (2009) showed that they are already being used.

### 3.3 Communication enhanced by tailoring

Tailoring enhances cognitive conditions for information processing and acceptance. A typical aim of tailoring is simply to increase attention and comprehension. Obviously, attention to information is a prerequisite for the information to have any impact. Attention is gained by communicating to the information receiver that the information addresses his or her preferences and needs. (Hawkins et al. 2008). Rimer and Kreuter (2006: 187–188) argue that at least four approaches to tailoring can be used to enhance health communication. The approaches are as follows:

- matching content to an individual’s information needs and interests,
- placing information in a meaningful context,
- using design, production and channel elements to capture attention and enhance message processing and
- presenting the type and structure of information preferred by the individual.
The third and fourth approach have to do with the design, structure and type of messages and these factors are considered important, particularly with regard to message processing (Noar et al. 2009: 422). Tailoring may influence the depth and nature of information processing, most often explained with the ELM (see subchapter 2.3.3). Tailoring usually aims to operate by enhancing the central route of processing and this may be achieved by enhancing perceived relevance and personal involvement (see Figure 3). (Kreuter et al. 1999: 25–26, Hawkins 2008).

![Diagram](image)

**Fig. 3.** The ways information tailoring enhances cognitive conditions for central information processing (as defined by the Elaboration Likelihood Model).

Tailoring may also encourage self-referential thinking by the individuals (Hawkins et al. 2008). By encouraging individuals to focus on themselves tailoring may help individuals to notice inconsistence between their actual and ideal behaviour. Such self-refential thinking is also related to the central processing of information. (Symons & Johnson 1997).

### 3.4 Basis to tailor health information

Tailored health information and messages can be based on any number and combination of individuals’ characteristics (Lustria et al. 2009). Information about individual’s characteristics can be obtained from an assessment or from
existing sources, such as medical records (Kreuter et al. 1999: 101–102, Brug & Oenema 2012: 151). Furthermore, the characteristics can be subjectively or objectively measured. Most of the intervention studies conducted use subjectively measured characteristics, in other words the information about the characteristics has been assessed with a self-report (e.g., Lustria et al. 2009). Generally speaking, subjective measurements are easier to conduct, but in several cases objective measurements, for example physiological or biochemical measurements, would provide more reliable results (Sallis & Saelens 2000, Michie & Abraham 2004, Adamo et al. 2009, De Cocker et al. 2012. This topic is further discussed in subchapter 3.9.2).

Subjective characteristics include sociodemographic information (e.g., age, gender, education) and psychosocial (or psychographic) characteristics (e.g., health information literacy level, risk perception, personality, attitudes, opinions, interests, stage of change, self-efficacy) (Rakowski 1999, Boslaugh et al. 2005, Lustria et al. 2009). Psychosocial characteristics refer to an individual’s psychological development in, and interaction with, a social environment.

 Behaviour change theories and models each posit a number of psychosocial characteristics that may influence behaviour change. (Noar et al. 2009: 419). For example, the stages of change by the TTM are commonly used as a basis to tailor health information (e.g., Vandelanotte & De Bourdeaudhuij 2003, see also Lustria et al. 2009). In an effective tailored health intervention, as proposed by the TTM, the health information provided is customised to the individual’s stage of change and the intervention helps the individual to move from one stage to the next. (See subchapter 2.1.1). Combining demographic and/or behavioural concepts with theoretical constructs in tailoring health information has been shown to be efficacious in tailored health interventions (discussed further in subchapter 3.10) (Noar et al. 2007).

Information needs and preferences can also be used as a basis to tailor health information. In fact, the use of information needs in particular is quite common (Lustria et al. 2009). According to Rimer and Kreuter (2006: 187–188) tailoring can enhance motivation to process health information, for instance, by matching content to an individual’s information needs. Similarly, providing information in the type and structure preferred by the individual enhances health communication. Studies have concluded that content with a high level of preference matching leads to greater elaboration than does content with a low level of preference matching (Tam & Ho 2005). Kreuter et al. (2000) found that the better the information was matched to the individuals’ needs and preferences, the more
positive individuals felt about themselves and about the information they received. In addition, it has been shown that an intervention is more likely to lead to behaviour change when tailored information is matched with the preference for the behaviour that individuals want to change first (Kremers et al. 2005, Kwak et al. 2010). In fact, it has been stated that this kind of “user tailoring” can be used to refine “expert tailoring” and combining these approaches can lead to higher levels of message relevance and interactivity (Shimoda & Stapel 2006). Additionally, other aspects of health information behaviour as a basis to tailor health information have already been discussed in subchapter 3.2.

Objectively measured physiological or clinical characteristics such as an individual’s aerobic fitness, genetic susceptibility, existing co-morbid conditions and results of laboratory tests can be used as a basis for tailoring (Rakowski 1999). Traditionally this kind of information has been received from medical archives or from physiological or biochemical measurements, but nowadays there are also mobile physiological sensing devices available, such as step counters, pedometers or activity monitors (Slootmaker et al. 2009, Rabbi et al. 2011, De Cocker et al. 2012, see also Discussion chapter of this thesis). Only a few computer-tailored interventions have used physiological sensing devices as a basis to tailor health information or feedback (e.g., Hurling et al. 2007, Slootmaker et al. 2009, De Cocker et al. 2012). In intervention studies many of the same characteristics that can be used as a basis to tailor health information can be used as outcome measurements that indicate the effectiveness of the intervention (see subchapter 3.9.2).

3.5 Tailoring process and channels of delivery

Improvement of ICT has increased the potential of tailored communication (Rimer & Kreuter 2006). Computer automation allows for the rapid processing of individual responses to an assessment and matches individuals’ answers with specific tailored messages or text contents, usually stored in a message library (Kreuter et al. 1999: 18, 43–52, Noar et al. 2011). In this kind of computer-generated tailored communication (also called computer-tailoring), the combined expertise of health promoters is translated into a computer expert system (Dijkstra & De Vries 1999). Content expertise is needed both to determine the correct information for different kinds of individuals and to formulate the decision rules on which the computer program is based (Brug et al. 1999). Moreover, tailoring can be static or dynamic. In static tailoring one baseline assessment is provided on
which all tailored information is based and in dynamic tailoring the assessment is repeated prior to providing pieces of tailored information or feedback. (Krebs et al. 2010).

Computer-generated tailored information can be delivered via various channels. Channel selection can be guided by audience preferences and campaign goals. For example, ingrained or addictive behaviours may be difficult to change using fliers or pamphlets, as these kinds of behaviours may require monitoring of progress, timely feedback and extensive interaction with the audience. (Rimal & Adkins 2003: 499–500). In addition, different channels may be more appropriate for raising awareness than changing behaviours (Rimal & Adkins 2003: 501).

Tailored information can be delivered via print (e.g., Dutton et al. 2008), telephone call (e.g., Wanyonyi et al. 2011), face to face (for a review see Wanyonyi et al. 2011), mobile phone text message (e.g., Woolford & Clark 2009), CD-ROM (e.g., Kroeze et al. 2008a), computer kiosk (e.g., Kreuter et al. 2006) or the Internet (e.g., Booth et al. 2008). Computer-tailored but print-delivered interventions, e.g. computer-generated printed pamphlets, are deemed the “first generation”, and interventions using interactive media are deemed the “second generation” of tailored health communication (Oenema et al. 2001, see also Study 4). The “third generation” interventions refer to interventions delivered via mobile and remote devices such as mobile phones and handheld computers (Norman et al. 2007).

The strength of print delivery is that it has a wider reach and acceptability in populations that have low access and use of the Internet, such as older adults. The characteristics of the Internet, such as interactivity and social media, may be especially useful for reaching “technology-native” users, who have been using the Internet for most of their lives. (Lustria 2005, Bull 2011: 15, Abbas & Agosto 2013: 67). Additionally new innovative channels, such as games and virtual communities, are further covered in the Discussion chapter of this thesis.

3.6 Effectiveness of tailored health information

Already by the turn of the millennium researchers were convinced that tailored health communication can be more effective than non-tailored health promotion (Skinner et al. 1999, De Bourdeaudhuij & Brug 2000, Kreuter et al. 2000, Ryan & Lauver 2002, Brug et al. 2003, Neuhouser & Kreps 2003). Many studies have concluded that tailoring makes information more satisfying, more interesting and personally relevant, that it is read more deeply, rated more highly, remembered
better, perceived more positively and is more often discussed with peers than general health information (Skinner et al. 1999, Kreuter & Wray 2003, Brug et al. 2003, Oenema et al. 2005, Noar et al. 2007). Furthermore, studies have indicated a preference for tailored information (de Vries & Brug 1999, Ryan & Lauver 2002) and tailored information has led to more permanent changes in attitudes as well as to greater elaboration of information (Cortese & Lustria 2012) than non-tailored health information. In general, tailored communication can stimulate greater cognitive activity (Kreuter & Wray 2003), which can also be detected by neural activity measurement and brain imaging (Chua et al. 2009, Kessels et al. 2011, see also subchapter 6.6 for suggestions for future studies). The results of studies on neural activity and brain imaging revealed that tailored information receives more attention than non-tailored information and that messages that were based on more rigorous tailoring lead to higher involvement of brain areas commonly implicated in self-related processing than message based on less rigorous tailoring.

Additionally, Wathen and Burkell (2002) emphasise that tailoring of information content may increase the credibility of an information source. Many systematic reviews have provided evidence of tailored health communication promoting health behaviour change (Broekhuizen et al. 2012, Lustria et al. 2013), although the statistical effect sizes that imply the strength of a phenomenon, are generally relatively small and follow-up periods relatively short (Noar et al. 2007, Broekhuizen et al. 2012).

Tailored messages may be more expensive to develop and implement as their design takes more time and work than general messages (Evans 2006). However, only a few studies have focused on the cost-effectiveness of tailored communications and the results have been inconsistent (e.g., Lipkus et al. 2000; Saywell et al. 2003, 2004, Van Keulen et al. 2010, Lewis et al. 2010, Lairson et al. 2011). Latimer et al. (2010) recommend that tailoring should be used when the messages can be tailored easily and with little additional financial cost.

### 3.7 Message strategies for tailoring health information

For the optimal results in tailoring health information, the style of presenting the health message content should be carefully considered (Ivanov 2012: 79). It has been stated that matching the information presentation (design, type and structure) to an individual’s preferences is one of the factors that may increase the effectiveness of tailoring (Rimer & Kreuter 2006). The degree to which the type
of health message differs from an individual’s preference is predicted to be inversely related to the effectiveness of the message in promoting healthy behaviours (Dailey et al. 2010). In health communication messages can be framed in several ways by using message strategies, and tailored health communication can also be based on these strategies. The choice of a message strategy is important because it has an impact, for instance, on behavioural intentions (Keller & Lehmann 2008). Feedback is one kind of a message strategy. It is also interpreted as a tailoring mechanism along with personalisation (defined as the inclusion of specific and personally identifiable information within the content) and content matching (or adaptation, defined as selection of larger information content based on the known determinants of the targeted behaviour) (Lustria et al. 2009, Hawkins et al. 2008, Dijkstra 2006, 2008). Personalisation and content matching are not further discussed as they are not under examination in this thesis.

Similarly to feedback, the use of emotional appeals is a message strategy. Although emotional appeals range from humour to sympathy, fear appeal has received the most attention from persuasion and communication researchers and practitioners. (Stiff & Mongeau 2003: 147–148). This thesis focuses on the feedback and fear appeal message strategies. The feedback message strategy is investigated in a more detailed manner through feedback message tactics. (See Studies 2 and 3).

3.7.1 Feedback

In tailored health communication information about the individual is collected and used as a basis for tailoring feedback. Generally speaking, the feedback message can be generic, targeted or tailored. A generic feedback message offers individuals relevant information that is true for an entire population. (DiClemente 2001). The feedback can be either implicit (the results of assessment are not shared explicitly, but they are used to shape the message) or explicit (the results are made known to the person and used to shape the message). (Ryan & Lauver 2002). In addition to textual, feedback can have graphical representation. Graphics and illustrations are especially useful in presenting quantitative information (Kreuter et al. 1999: 136), such as feedback of people’s amount of daily steps (measured with a pedometer) in the form of a bar chart (e.g., Toscos et al. 2006) or in a more complicated manner like the interactive computer game Fish’n’Steps, which represents the amount of physical activity with the growth
and facial expression of an individual’s virtual fish character (Lin et al. 2006). Textual feedback and feedback message tactics used in message tailoring are further discussed in this thesis.

According to Hawkins et al. (2008: 459) feedback involves presenting individuals with information about themselves obtained during assessment or by some other means. A key to providing tailored feedback is to refer back to how the individual answered certain assessment questions within the tailored message (e.g., “It seems from your responses that you believe that...”), evaluate this response and then provide tailored feedback. Feedback directs individuals’ attention to their own characteristics or behaviours (which are determined during assessment) that they need to address, improve or change. (Lustria et al. 2009).

There are different kinds of feedback tactics and different kinds of categorisations of these tactics. De Vries and Brug (1999) state that feedback can be either personal, normative or ipsative, whereas Hawkins et al. (2008) separate descriptive, comparative and evaluative feedback. Moreover, Lustria et al. (2009) define evaluative, motivational and normative feedback in their review. The concepts used partially overlap. In this thesis adapted categorisation of feedback message tactics is presented as follows: descriptive (factual), evaluative, motivational, ipsative, normative, theoretically-driven and action feedback message tactics. Regardless of what categorisation is used, it has to be noted, that different feedback message tactics are usually used in combination, even within individual messages (see e.g., Lustria et al. 2009).

**Descriptive (factual) feedback**

Tailored health communication often reports back to the individuals’ summaries of their attitudes, beliefs or behaviours, based on personal assessment or observational data. This kind of feedback is constructed with the descriptive feedback message tactic and it may range from simply restating or acknowledging information (e.g., “you said you drink two classes of soft drinks per day”) to providing information based on more factual information (e.g., “based on your answers, we determined that you eat 24 grams fat per day”). (Hawkins et al. 2008: 460). Factual feedback messages usually focus on the “current state” of the individual with regard to relevant health indicators, such as blood pressure or cholesterol levels (DiClemente et al. 2001). For example, when aiming to lower fat consumption, feedback on actual fat consumption has been proven to be effective (Oenema & Brug 2003). Descriptive (or factual) feedback may stimulate
self-referential thinking about behaviour. It may create a feeling of being understood that can lower resistance to persuasion. (Hawkins et al. 2008).

**Evaluative feedback**

According to Hawkins et al. (2008: 461) “tailored evaluative feedback messages add a level of interpretation, judgment and/or inference about an individual’s attitudes, beliefs or behaviours”. It may include a specialist’s evaluation of certain behaviours (e.g., “you need to eat more fruits and vegetables”) (Hawkins et al. 2008) or information about a person’s state of which he or she may not be fully aware (Dijkstra 2006). Feedback about one’s risk behaviour is a commonly used way to improve awareness and self-referential thinking, which are critical steps towards behaviour change (Hawkins et al. 2008, Kroeze et al. 2008a,b). Another commonly used way is informing an individual about the benefits associated with averting a health threat. Perceived benefits can range from benign (e.g., “this will make you feel better”) to the extravagant (e.g., “this will save your life”). Individuals may be unaware of the many potential benefits associated with different behavioural actions. (Valente et al. 1998). An example of evaluative feedback is: “You said you intend to start exercising regularly. That could be a good way to lower your blood pressure” (Hawkins et al. 2008: 461).

**Motivational feedback**

Tailored feedback messages can also include different kinds of elements that aim at motivating. For example, encouraging comments on progress of target behaviour can be seen as motivational feedback (Lustria et al. 2009). Motivational feedback messages were used in a study by Kroeze et al. (2008a), which involved a series of messages based on attitude, self-efficacy and readiness to reduce fat intake. In the literature feedback messages aiming to increase perceived self-efficacy have been called self-efficacy messages. According to Maibach et al. (1991) repetition of self-efficacy messages is needed during long-term interventions.

**Ipsative and normative feedback**

DiClemente et al. (2001: 2016) state that “feedback can provide normative comparison to a reference group or ipsative comparisons where the information is
self-referent”. An ipsative (i.e. iterative, longitudinal) feedback message is based on a comparison of the individuals’ current state to their prior state (Noar et al. 2007).

Normative feedback is based on normative beliefs. False normative beliefs can reduce perceived pressure to perform recommended behaviour and thus they need to be corrected. (Hawkins et al. 2008). In normative feedback an individual’s behaviour is compared with that of peers or a social norm (Lustria et al. 2009).

People have a tendency to evaluate their own behaviour by comparing themselves with others in a “self-serving manner” (see also subchapter 3.8). A normative feedback message can present, for example, the average fat intake levels of a peer group and thus make people aware of the suitability of their personal intake levels (Brug et al. 2003). At the same time, this kind of social comparison helps in interpreting the given information and in estimating how one’s own risk or behaviours compares with the risks or behaviours associated with another person (Kiviniemi & Rothman 2010: 74–75). An example of normative feedback is: “You tried to quit before, but you went back to smoking. On average, ex-smokers try to quit at least three times before succeeding” (Hawkins et al. 2008: 461). Feedback messages based on normative comparison may be especially effective among individuals for whom normative beliefs are important determinants of a given behaviour (Hawkins et al. 2008). Ipsative feedback, in turn, is most suitable for individuals who are motivated by their own achievements (Brunstein & Maier 2005). According to a review by Ryan and Lauver (2002) tailored informational interventions had a greater effect when ipsative feedback was a part of the intervention than when such feedback was not included. However, in a review by DiClemento et al. (2001) no difference in the effectiveness between normative and ipsative comparison was identified.

Theoretically-driven and action feedback

A theoretically-driven feedback message includes theory-based argumentations, for example, an explanation of the reasoning used to generate the feedback and justifications for the conclusions drawn (Lustria et al. 2009). The action feedback message provides practical information on what to do in difficult situations. This kind of feedback may be needed to improve skills and self-efficacy so that motivation can translate into actual behaviour change. (Kroeze et al. 2008b). An example of action feedback is: “When you would like to order a dish with a sauce, ask if they can serve the sauce in a separate bowl. That way, you can
decide yourself how much sauce you would like to take. In addition, red sauces usually contain less fat than white sauces” (Kroeze et al. 2008b: 231).

**Other categorisations**

Feedback messages can also be categorised according to their orientation. As factual descriptive feedback focuses on the current state of the individual with regard to a specific health indicator, some tailored feedbacks are risk- or problem-based and offer information mainly about the severity or extent of the problem or level of risk. (Kroeze et al. 2008b). Others offer feedback on psychosocial characteristics related to change – e.g. based on the assessment of stage of change, level of self-efficacy or barriers, and these messages could be called change-oriented (DiClemente et al. 2001). Feedbacks can also be categorised based on their topic. De Vries et al. (2012) give examples of tailored feedback messages they provided for promoting sunscreen use and the example feedbacks were categorised as skin type feedback, sunscreen use feedback, attitude feedback, social support feedback, self-efficacy feedback and intention feedback.

According to a review by Lustria et al. (2009) many health behaviour change interventions provide some form of tailored feedback to participants. Evaluative and motivational feedbacks were the most common types provided, but normative was not so common. It was commonly used among prevention-related interventions with target groups of younger individuals.

**3.7.2 Fear appeal**

The fear appeal message strategy is defined as a persuasive communication that presents threatening information to arouse fear in order to promote healthier behaviour (Janis & Feshbach 1953, Leventhal 1971, Rogers 1983). The health provider hopes that the threat will raise the individuals´ level of fear and convince them to seek out ways to reduce the fear and behave in a desired way in order to avoid the threat. (Basil & Witte 2012: 41). The study of fear appeals as a persuasive tactic to encourage audiences to engage in healthy behaviours has been ongoing for over 55 years (Maloney et al. 2011). Fear appeal is often used in marketing and social policy (see e.g., De Villiers 2008: 62–81) and is best known for being used in health warning texts on cigarette packs (Gygax et al. 2010) and in road safety campaigns (e.g., Tay et al. 2001). Fear and threat are conceptually distinct: fear is defined as a negative emotion accompanied by a high level of
arousal, whereas threat relates to cognition. They are associated with each other, as the higher the threat, the greater the fear experienced. Reviews of studies have found that fear appeal has a moderating effect on changing attitudes, intentions and behaviour. (Contento 2011: 84–85). Many social cognitive theories suggest that providing threatening information is effective in promoting safer and recommended behaviour, though empirical findings are less conclusive (Ruiter et al. 2003). It has been stated that the use of negative emotion, such as fear appeal, in communication tends to enhance the central route of information processing (Forgas 1992). An example of a persuasive message based on (high) fear appeal is: “A lack of exercise leads to psychological problems such as chronic depression. Individuals suffering from chronic depression are about 20 days a year more ill than healthy individuals and have a higher risk of suicide“ (Brengman et al. 2010: 587).

Use of fear appeal can be ethically problematic. Messages that use highly charged emotional appeals may fail to meet communication ethical stipulations for truthfulness and sincerity, as well as correctness and accuracy. However, generally speaking, in a world saturated with mediated messages the use of strong emotional appeals has been proven to enhance public response. Messages with fear appeals may increase awareness, but yet some individuals may find them offensive or too scary. (Guttman & Salmon 2004). This topic is further discussed in the next subchapter.

3.8 Sociodemographic and psychosocial characteristics affecting receptions of message strategies

Sociodemographic and psychosocial characteristics (or factors) affecting individuals’ reception (perceptions and preferences) of different message strategies are discussed in this subchapter (see also Studies 2 and 3). Generally speaking these characteristics have an impact on an individual’s information use and decision making and, on the other hand, whether the individual will be persuaded by the persuasive communication attempt.

Psychosocial characteristics are related, for example, to the notice that issues related to health typically tend to be anxiety-laden and thus associated with negative rather than positive feelings (Sairanen & Savolainen 2010). In addition, Western identity theories argue that individuals behave in certain ways to remain consistent with their social roles, norms and interpretations of self (Hecht & Choi 2012: 137). To begin with, it should be noticed that feedback, and health
messages in general, have affective consequences: they make individuals feel good or bad. It has been stated that the affective response is not a side effect of the feedback, but rather the underlying mechanism by which feedback influences behaviour. (Baumeister et al. 2007).

In health communication it is important to take into consideration that health messages may threaten an individual’s self-image and the processes of self-image maintenance affect the way an individual accepts personally relevant messages. The Self-Affirmation Theory by Steele (1988) states that the defensive reaction for a fear appeal is caused by a threat to an individual’s self-image. Individuals attempt to restore their self-image by denying that they are at risk and in need of modifying their behaviour (Sherman et al. 2000). Fear appeal, in general, is effective only if individuals feel that the threat is severe, they are vulnerable to the threat and that they can do something to protect themselves (Contento 2011: 85). According to Rimal (2001) an individual’s self-efficacy determines whether perception of health risk translates into healthier behaviours and information seeking on the health topic. Also Pálsdóttir (2008) suggests that there is a relationship between self-efficacy, health behaviour and health information behaviour. Increased self-efficacy may be the best means of coping with high fear (Witte & Allen 2000, Howell & Shepperd 2012) and thus, the fear appeal message should include a part that is designed to show that an individual can take specific actions that will reduce the threat or danger (Contento 2011: 247, Peters et al. 2013).

According to Bandura (1977) self-efficacy is promoted through self-affirmation. Self-efficacy can be strengthened through four main sources of influence: experiences of personal mastery by previous success in performing the behaviour, social verbal persuasion (e.g., providing encouragement that the individual can perform the behaviour), social modelling (e.g., showing that peers of the individual have succeeded) and modification of emotional or physical responses to the behaviour (e.g., fear can be relabelled as excitement and possible misperceptions can be corrected) (Bandura 1986, Contento 2011: 97). These sources of influence can be supported by tailored health information, that is, for example, an encouraging message or feedback. Sherman et al. (2000) suggest that, in general, employing self-affirmation techniques should be a part of a health campaign’s content to increase the effectiveness of health information. Success in behavioural performance of the target behaviour, can also be seen as a source of self-efficacy (Bandura 1986). Furthermore, self-affirmed individuals are more likely to accept information that they could view as threatening and they are also
more likely to subsequently engage in healthy behaviour (Steele 1988, Sherman & Cohen 2002).

According to Case et al. (2005), in studies on “fear appeal” information avoidance is many times seen as purposeful rejection of information. High levels of fear may easily inhibit persuasion through processes of denial and defensive avoidance (Ruiter et al. 2001, Keller & Lehmann 2008), especially when self-efficacy is low (Witte et al. 2001). An increase in fear in health messages increases health behaviour intentions among older adults but reduces them among young adults (Keller & Lehmann 2008). In fact, the severity of the threat in fear appeal has been under study for many years. Witte and Allen (2000) conclude in their review that the greatest behaviour change is achieved by combining strong fear appeal messages with high self-efficacy messages. Moreover, strong fear appeals with low-efficacy messages produce the greatest levels of defensive responses. In other words, fear appears to be a great motivator as long as individuals believe they are able to protect themselves from the threat. Moreover, according to Ruiter et al. (2001), the personal relevance of health threats should be highlighted and self-efficacy bolstered, but emphasising the severity of outcomes following risk behaviour does not appear to be as important.

Additionally, different feedback message tactics may work better for different people (Hawkins et al. 2008). For instance, individuals with high self-efficacy may have different information needs than those with low self-efficacy (Murray-Johnson & Witte 2003: 482). In addition, according to a review by Keller and Lehmann (2008) messages that persuade women differ from messages that influence men. Specifically, women respond to emotional messages with social consequences to oneself or to those close to them whereas men are more influenced by unemotional messages that emphasise personal physical health consequences.

An individual may regard his or her behaviour as more positive than it really is (Oenema & Brug 2003). Several studies have shown that misperception often occurs for behaviours like physical activity (Lechner et al. 2006) and nutrition (Oenema & Brug 2003). According to Lechner et al. (2006) individuals may lack explicit knowledge of what healthy behaviour actually entails and they are not able to review their own behaviour and estimate it correctly. One explanation suggested is that individuals with misperceptions more often compare themselves with people who behave less healthy (Oenema & Brug 2003, Lechner et al. 2006). This may also be a form of self-enhancement. Equal comparison to peers
by normative feedback can increase the accuracy of individuals’ self-perceptions and also risk perceptions (Schmiege et al. 2010).

It could be stated that normative comparison informs an individual about his or her commitment to the issue in relation to others, whereas ipsative comparison relates to an individual’s progress in a specific issue, such weight loss. Interestingly, studies have shown that in pursuing a goal individuals often start by evaluating their commitment and then shift to monitoring progress as they gain experience or expertise in a goal domain. At the same time a shift from positive to negative feedback happens as it has been argued that beginners are more likely to adhere to a goal after receiving positive feedback about their commitment; on the contrary, experts are likely to adhere to a goal after receiving negative feedback about their lack of successes. (Fishbach et al. 2010). Moreover, according to Brunstein and Maier (2005) achievement-motivated individuals usually prefer ipsative over normative feedback. Individuals with a strong achievement motive are those that enjoy doing something well or improving in a task.

3.9 Tailored health behaviour change programs and interventions

Tailored health behaviour change programs usually refer to computer-tailored programs commonly delivered by a computer or the Internet (Suggs et al. 2006). In a tailored program, for instance, tools for building self-regulatory skills can be combined with tailored health feedback messages (Lustria et al. 2009: 166). Goal setting and action planning (Brug et al. 2005) or observational learning, providing role models, supporting emotional coping and allowing reinforcement by virtual rewards (Toscos & Connolly 2010: 305), can support bridging the information-behaviour gap. Seeing or hearing that a similar person has performed the behaviour can raise the individual’s belief that they too are able to master the same activity (Bandura 1977). The meta-analysis of physical activity intervention studies by Ashford et al. (2010) revealed that interventions that used vicarious experience and feedback on past or others’ performance produced significantly higher levels of physical activity self-efficacy than interventions where these strategies were not included. Making individuals aware of their personal performance successes in the interventions may have served to enhance perceived self-efficacy (Ashford et al. 2010). In practice, goal setting tools, testimonials, sections of frequently asked questions, links to resources, self-monitoring tools (e.g., food diaries) and e-mail reminders could be included. These tools can also be tailored. (Toscos & Connelly 2010: 295–298).
3.9.1 Designing tailored health behaviour change interventions

The effectiveness and possible impact of tailored health communication and tailored health programs are usually studied in intervention studies (Ryan & Lauver 2002) (see also subchapter 2.2.1 for intervention studies). The randomised controlled trial is a commonly used experimental design of intervention studies. The effectiveness can be measured and estimated in various ways and this complicates evaluation and comparison of the intervention studies reported in the research literature. This observation justifies examination of how intervention studies can be carried out.

For instance, the intervention design of the studies can differ. The intervention group can be compared to a general information control group or to a no-information control group (control group that does not receive health information or feedback). (See Broekhuizen et al. 2012 and Study 4). Smeets et al. (2007) state that only studies where tailored materials are compared with similar, but non-tailored, materials, are reliable enough for comparison. However, the material provided has to be otherwise similar, because if a tailored information letter and a general information letter differ even in length, this might have an impact on the results.

The use of health behaviour change theories and models enhances the effectiveness of interventions (Webb et al. 2010). Other choices that have to be made when conducting tailored health intervention studies are the choice between concentrating on one behaviour or on multiple behaviours, number of contacts, choice of the target group and length of an intervention trial. For instance, when investigating physical activity, individuals who volunteer for studies often represent enthusiastic biased groups that are overrepresented by relatively healthy and active individuals. More research is needed to examine other strategies to reach and encourage inactive individuals who are in great need of behaviour change. Furthermore, as many intervention trials are short-term the effects of the intervention may not be sustained. (Plotnikoff & Karunamuni 2011). Because of the tendency to relapse once intervention support ends, the follow-up period should be long (Neville et al. 2009a,b, Short et al. 2011). Another important choice that has to be made when planning a tailored health intervention study is the choice of outcome measurements.
3.9.2 Outcome measurement

It is important to determine the outcome that is important enough to be measured. In many intervention studies the attitudes towards health behaviour or intentions to engage in behaviour are used as primary outcomes (Gallagher & Updegraff 2012). However, according to Webb and Sheeran (2006) there is often a gap between individuals’ attitudes, intentions and their behaviour. When studying the impact of tailored health messages, focusing on proximal (e.g., awareness), intermediate (e.g., attitudes and intentions) and distal (e.g., behaviour) outcomes can be essential (Bauman et al. 2006). It can be argued that if an intervention aims to change a particular behaviour, then change in that particular behaviour should be the primary outcome measured. However, very often the measured outcome is not behaviour itself, but a consequence of the behaviour, such as weight loss and, in fact, some behaviours are difficult to measure directly. (Michie & Johnston 2012). The same individual characteristics that can be used as outcome measures can be used as a basis for tailoring health information (see subchapter 3.4).

Many intervention studies have employed subjective self-reported outcome measures, such as dietary recalls (Eyles & Ni Mhurchu 2011). Self-reported assessments can be based on some ready-made questionnaires, such as the Short QUestionnaire to ASsess Health-enhancing physical activity (SQUASH) (Wendel-Vos et al. 2003) or self-efficacy scales (Bandura 2006: 320–335). In the review by Short et al. (2011) all reviewed studies relied upon subjective measurements of physical activity. However, self-reported health behaviour estimations may differ from the reality (Sallis & Saelens 2000, Michie & Abraham 2004). In the context of physical activity, it has been shown that 72% of the measures received by self-reports overestimated the objectively measured values (Adamo et al. 2009). It has been suggested that the differences between self-reported and objective measurements may be due to the possibility that study participation influenced the perception of physical activity behaviour and consequently reporting of physical activity levels (see e.g., Wanner et al. 2009). Generally speaking, self-reports are more susceptible to retrospective recall of behaviour and social desirability bias than objective measurements (Morgan et al. 2009). Therefore, the use of objective measurements may be important in determining whether the self-reported changes found, for example in health behaviour change, are real (Neville et al. 2009a,b). Assessments or measurements can increase self-monitoring and thus have an independent impact on behaviour
These issues advocate the use of control groups (Michie & Abraham 2004: 32).

In the context of nutrition objective outcomes of changes are difficult to study directly. Broekhuizen et al. (2012) point out that objective measurement of dietary intake can be achieved by monitoring biological dietary indicators, such as serum cholesterol or serum carotenoids, but this is relatively expensive and these indicators are subject to genetic differences. It has been stated that dietary behaviour could be measured also by measuring sales data (Eyles & Ni Mhurchu 2011), but this approach has limitations. Eyles and Ni Mhurchu (2011) claim that sales data may reflect food purchases of a household rather than an individual of interest. Change in self-reported or measured anthropometrics (e.g., BMI) and waist circumference are also commonly used as an outcome measurement in nutrition studies (Broekhuizen et al. 2012).

Objective physical activity measurements can be done with accelerometers and pedometers and they can be used in determining the pattern of physical activity behaviour (Plotnikoff & Karunamuni 2011, Short et al. 2011). In a systematic review by Broekhuizen et al. (2012) a fifth of the studies on physical activity included objective measurements of physical activity with a pedometer, actigraph or accelerometer and a fifth measured aerobic fitness by either the walking test, step test or submaximal exercise treadmill test. When these amounts were compared to a previous systematic review by Kroeze et al. (2006) it was found that the use of objective measurements in physical activity have increased, probably due to increased popularity of accelerometers and pedometers.

3.10 Systematic reviews on tailored health behaviour change interventions

There are various systematic reviews that have focused on general non-tailored Internet-based health behaviour change intervention studies with foci on physical activity, nutrition or weight management (e.g., Berg van den et al. 2007, Marcus et al. 2009). Some of these reviews focus on specific topics, such as on eHealth. For instance, a review by Norman et al. (2007) studied eHealth interventions for physical activity and dietary behaviour change.

Reviews focusing on tailored intervention studies aiming at behaviour change in physical activity, nutrition or weight management have also been conducted. For instance, a review by Brug et al. (1999) found positive outcomes for nutrition and a systematic review by Kroeze et al. (2006) scrutinised computer-tailored
intervention studies on physical activity and nutrition. Three of the 11 physical activity studies and 20 of the 26 nutrition studies found a statistically significant effect of the interventions. The evidence was most consistent for intervention studies on fat reduction. Neville et al. (2009a) conducted a literature analysis on computer-tailored dietary behavioural change intervention studies. Seven of 12 intervention studies found significant positive effects for dietary behaviour and one also for weight reduction outcomes. Krebs et al. (2010) reviewed computer-tailored intervention studies focusing on four health behaviours: physical activity, nutrition and diet, smoking cessation and receiving regular mammography screening. As a combined outcome for the physical activity studies, 43% of participants receiving tailored physical activity were adherent to official physical activity recommendations at follow-up versus only 34% in control groups.

In addition, some reviews focusing on “second” or “third generation” tailored intervention studies have been conducted. In the analysis of a review by Lustria et al. (2009) 30 “second generation” intervention studies were included. In the studies the focus was on four broad health areas: nutrition and diet, physical activity, alcoholism and smoking cessation. Moreover, differences in the level of sophistication of message tailoring were identified. Neville et al. (2009b) conducted a narrative systematic review of the “second” and “third generation” physical activity intervention studies targeting adults. According to them the evidence of the effectiveness of these interventions is inconclusive. (See Study 4). There is still a need for more research on this topic in order to confirm or disprove these results.

The TTM and the Social Cognitive Theory have been the most commonly used theories and models in tailored health programs and interventions (Lustria et al. 2009, Broekhuizen et al. 2012, Noar & Van Stee 2012: 209–229). In the systematic review by Broekhuizen et al. (2012) most studies provided tailored feedback or information on self-reported behaviour. In addition, most studies lack objective assessments of effects of nutrition interventions, but physical activity intervention studies often used objective assessments for behaviour changes. BMI and waist circumference were the most frequent objective indicators. Broekhuizen et al. (2012) state that the review confirms and further strengthens the evidence that computer-tailored physical activity and nutrition intervention is likely to be effective. Moreover, the strongest evidence and significant effects, especially in physical activity studies, came from the studies that compared intervention studies providing tailored information to no-information control groups instead of comparing them to general information control groups.
3.11 Summary of the theoretical background

A summary of the relationships between the concepts of the theoretical background is presented in Figure 4.

In the theoretical section of this thesis, that is Chapters 2 and 3, the concepts of health, health promotion and health information behaviour were discussed. Health behaviours related to physical activity, nutrition and weight management and the state of prediabetes were explained. Furthermore, the theoretical section addressed the concepts of health promotion, health communication and health interventions. Chapter 2 ended by providing an overview of health information and health information behaviour.

Chapter 3 discussed tailoring health information and communication. The chapter started by covering different health communication approaches and how tailoring health information has been brought up in Information Studies. After that, several aspects of tailoring health information were discussed, including message strategies for tailoring health information with particular attention given to the feedback and fear appeal message strategies. Moreover, sociodemographic
and psychosocial characteristics affecting the reception of message strategies are addressed. The chapter ends by providing an overview of tailored health behaviour change programs and interventions as well as a summary of systematic reviews on these interventions.
4 Research methodology

The following chapter presents an overview of the research methodology of the thesis. The chapter begins with a discussion of the research paradigm and metatheory of this thesis, followed by the synopsis of research designs and strategies. Methods for data collection and data analysis are considered on a general level in subchapters 4.3 and 4.4 and utilisation of these methods in Studies 1–4 of this thesis is discussed in subchapters 4.5–4.7.

4.1 Research paradigm and metatheory

Research paradigms are models or frameworks that are derived from a worldview or belief system about the nature of knowledge and existence. Paradigms guide how a researcher acts with regard to making decisions. (Morgan 2007). This thesis relies on the interpretivistic research paradigm and therefore the studies of this thesis are more descriptive than prescriptive. Research conducted from the interpretivistic paradigm strives to understand and interpret the world in terms of its actors and social interaction. Individuals are seen as deliberate and creative in their actions; they act intentionally and make meaning in and through their activities. (Cohen et al. 2007: 19–26). Most qualitative research emerges from the interpretivistic paradigm, but for example the widespread inclusion of questions about attitudes in social surveys suggests that quantitative researchers are also interested in matters of meaning (Bryman 2012: 617).

In this thesis the cognitive and socio-cognitive metatheories are applied. They are major metatheories in Information Studies. Cognitive metatheory “focuses on the cognition of information user: what they know and what they think and how this affects how they seek and use information” (Bawden & Robinson 2012: 44). Not all researchers share precisely the same definition of the cognitive viewpoint (Pettigrew et al. 2001), but, generally speaking, it has had a great influence on ideas of information behaviour (Savolainen 2007). Socio-cognitive metatheory is social at its basis and classifies Information Studies among the social sciences, rather than among psychological subjects, as might be implied by the cognitive metatheory (Bawden & Robinson 2012: 46). Moreover, it is a common approach in health promotion research. Socio-cognitive determinants are also seen as important factors in human behavioural change and in tailoring of health information. In the socio-cognitive metatheory both the human thinking and the social domain in which the individual operates are seen to influence the use of
information (Bates 2005: 12). In general, the information behaviour perspective of Information Studies assumes that information is a cognitive construction by humans during their behaviour within social, cultural and organisational environments (Spink & Cole 2005, 2007). In addition, Furner (2010) points out that the concept of information can be conceptualised through the socio-cognitive approach. In these conceptions the emphasis is on action and process, and especially on processes by which individuals become informed or inform others.

4.2 Research designs and strategies of the studies in this thesis

Research design gives direction and structure for the study. It incorporates the research methods most suitable to gather the required data and answer the research questions. Typically, research can be based on an experimental, quasi-experimental or non-experimental research design. The experimental design is intended to answer cause-and-effect questions about the relationship between two variables and is conducted with rigorous control. The quasi-experimental design contains a flaw that prevents the research from obtaining an absolute cause-and-effect answer, for example, it may lack random assignment to groups. The non-experimental study is intended to demonstrate a relationship between variables without attempting to explain the relationship. Thus it does not try to produce cause-and-effect explanations. (Gravetter & Forzano 2009: 152–154). Non-experimental research is commonly used to examine the knowledge, attitudes, beliefs and behaviours of individuals. Usually non-experimental research studies are easier to conduct than experimental studies. (Cottrell & McKenzie 2011: 195).

Cross-sectional studies are based on the non-experimental design and are used to gather data from a group of participants at only one point in time (Schmidt & Brown 2011: 157). Cross-sectional studies can be used to determine the current attitudes, opinions, beliefs, values, behaviours or characteristics of a given population or sample. In contrary to cross-sectional studies, longitudinal studies collect data multiple times from the same population at specific intervals. (Bryman 2012: 59–61).

Studies 1 and 2 of this thesis were conducted in the research environment provided by a physical activity promotion and type 2 diabetes prevention intervention study utilising randomised controlled trial. Even though the intervention study was based on experimental research design, Studies 1 and 2, as well as Study 3, were based on non-experimental research design, as they did not
include multiple measurements or an experimental research frame. Furthermore, Studies 1, 2 and 3 were cross-sectional studies.

The primary or secondary research strategy can be applied. In the primary research strategy empirical data are collected from, for example, study participants (Stewart & Kamins 1993: 3), whereas the secondary research strategy involves the summary and/or synthesis of existing research. The secondary research strategy is typical for medical or market research. Studies 1, 2 and 3 of this thesis are based on primary research strategies and the empirical data are collected from the study participants. Study 4 utilises the secondary research strategy by being a review of data collected from published research articles.

4.3 Methods for data collection

This thesis is based on research conducted by both subjective and objective methods. Additionally desk research was used. The methods are summarised in Table 2. Data collection of the studies of this thesis is discussed in more detail in subchapters 4.5 – 4.7.

Data collection methods are described as being subjective when they are open to interpretation by the study participant or by the researcher. Surveys are subjective methods, whose advantage is their inexpensiveness and effectiveness in collecting information. Objective methods are less open to interpretation or to influence of the subject or the researcher. Objective methods and measurements include those of physiology or biochemistry measured by laboratory or clinical equipment. For the sake of comparison it has to be noted that, for example, an individual’s weight can be also inquired by using subjective methods, such as a survey.

Table 2. The methods of Studies 1–4 of the thesis.

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<tr>
<td></td>
<td>Objective methods: physiological measurements of anthropometric and aerobic fitness and biochemical measurements of blood glucose levels</td>
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<tr>
<td>2</td>
<td>Subjective methods: survey on reception of message strategies</td>
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<tr>
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<td>Objective methods: physiological measurement of anthropometric and aerobic fitness and biochemical measurement of blood glucose levels</td>
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</tbody>
</table>
Research methods can be quantitative or qualitative. Quantitative methods focus on scores, usually numerical values that are submitted to statistical analysis for summary and interpretation. Conclusions are based on systematic observations. When a researcher’s primary concern is with explaining and predicting, then quantitatively oriented methods may be chosen. If, however, the researcher wants to understand the experiences of an individual (or a community) from a first-person perspective, a qualitative approach should be taken. (Wellington & Szczerbinsky 2007: 117). The methods used in this thesis are mostly quantitative or used in a quantitative manner. However, the results are discussed in an interpretative manner due to the nature of the research questions of this thesis.

The data collection methods used in this thesis are discussed by dividing them into the subjective, objective and desk research methods. The desk research method is discussed separately as it may include elements of subjectivity and objectivity.

### 4.3.1 Subjective methods

The survey is the most common method for carrying out research in Information Studies (Bawden & Robinson 2012: 308). A survey is a systematic method for gathering information from (a sample of) individuals for the purposes of describing the attributes of the larger population of which the individuals are members. A survey may focus on factual information about individuals or it may aim to collect the opinions and experiences of the survey takers. A questionnaire is one type of survey. (May 2011: 103). Most surveys conducted by researchers of information behaviour are small-scale, rarely involving more than 100 participants (Bawden & Robinson 2012: 308).

All subjective data in this thesis were collected through questionnaires. The most important factors assessed in the questionnaires of Studies 1, 2 and 3 are presented in Table 3.
Table 3. Most important factors assessed in the questionnaires of Studies 1, 2 and 3.

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Variable</th>
<th>Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-reported sociodemographic characteristics</td>
<td>Gender</td>
<td>1, 2</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td></td>
<td>Education</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td></td>
<td>Estimate of physical fitness</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Estimate of physical activity</td>
<td>3</td>
</tr>
<tr>
<td>Self-reported characteristics based on theoretical constructs</td>
<td>Exercise self-efficacy scale(^1)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Stages of exercise change(^2)</td>
<td>3</td>
</tr>
<tr>
<td>Self-reported characteristics related to health information behaviour</td>
<td>Interest in health information</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Searching for health information</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Impact of information obtained</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Desire for receiving tailored information</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Reception of message strategies -</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Perception of fear appeal</td>
<td>2, 3</td>
</tr>
<tr>
<td></td>
<td>Reception of message strategies -</td>
<td>2, 3</td>
</tr>
<tr>
<td></td>
<td>Preferences for feedback message tactics</td>
<td></td>
</tr>
</tbody>
</table>

\(^{1}\) Modified from the original scale by Bandura (2006), see Hirvonen et al. (2012).

\(^{2}\) Modified from Cardinal (1995), see Hirvonen et al. (2012).

Self-completion questionnaires are completed by the respondents themselves. They are a typical form of questionnaire. The purpose of a questionnaire and advice on how to fill in the questionnaire should be given to the responders (Bryman 2012: 232–235). Surveys can use qualitative (e.g., ask open-ended questions) or quantitative (e.g., use forced-choice questions) measures. Forced-choice questions are easier to process than open-ended questions and they enhance the comparability of answers. They are easy for respondents to complete. Forced-choice questions are usually used when the aim is to obtain results which can be analysed quantitatively. However, with forced-choice questions, there is a loss of spontaneity or chance to explain the answers. (Bawden & Robinson 2012: 308–309, Bryman 2012: 246–252). One of the most commonly used techniques for studying attitudes is the Likert scale, which is essentially a psychometric multiple-item scale. Its goal is to measure intensity of opinions and feelings about the area in question. (Bryman 2012: 166).

In Studies 1, 2 and 3 self-completion questionnaires were used. Individuals were asked to estimate their own health information behaviour including their
reception of message strategies. Forced-choice questions and the Likert scale were used.

Questionnaires have the advantage of being fast to conduct and easy to administer. Large amounts of information can be gathered in a relatively short time. Statistical techniques can be used to determine validity, reliability and statistical significance. Self-reports, as subjective measurements, are vulnerable to a number of sources of error and bias that can adversely affect the reliability and validity of the measurement (Krosnick 1999). A common factor affecting the validity is related to non-response and representativeness. People who choose to respond on the survey may be different from those who do not respond, thus biasing the estimates. In addition, how individuals say they are likely to behave and how they actually behave may be inconsistent. (Bryman 2012: 270–271). For the most part, surveys are not able to show causal relationships, they can only show the strength of statistical association between variables. (May 2011: 96). Furthermore, validity of the results is associated with survey design and depends on asking questions that measure what is supposed to be measured.

Reliability is associated with the consistency of the measurements, referring to the degree different questions or statements used in a survey elicit the same type of information each time they are used under the same conditions. The questions may be misunderstood or particular issues may be difficult to recall. How a question is asked can have sometimes subtle, sometimes substantial, effects on the responses. Variations in wording can affect how people respond and the context or order in which questions appear can also affect the responses. (Lee 2000: 3). Furthermore, two common subject biases are social desirability (trying to make a good impression) and obeying the study’s demand characteristics (trying to make the researcher look good by producing results that support the hypothesis) (Mitchell & Jolley 2010: 172). Researchers’ effects can bias the research when the researchers’ characteristics or behaviour influences the participants’ behaviour (Bryman 2012: 270–271).

4.3.2 Objective methods

The characteristics measured with objective measurements can be seen to reflect the individual’s physical health status. Improvement in the results of objective measurements can be seen to reflect the improvement of physical health status. Objective physiological or biochemical methods and measurements were applied
in Studies 1, 2 and 3. The objective methods, tests and measurement devices used in Studies 1, 2 and 3 of this thesis are presented in Table 4.

### Table 4. Objective methods, tests and measurement devices used for data collection in Studies 1, 2 and 3.

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Variables and measurement devices</th>
<th>Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthropometry – adiposity and body fat</td>
<td>Body mass index (BMI) calculated from weight measured by scale or impedance analysis device and height measured by ruler</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td></td>
<td>Body fat percentage by bioelectrical impedance analysis device</td>
<td>3</td>
</tr>
<tr>
<td>Aerobic fitness</td>
<td>VO\textsubscript{2max} by indirect submaximal oxygen uptake test in cycle ergometer</td>
<td>1, 2</td>
</tr>
<tr>
<td></td>
<td>OwnIndex (that is comparable to VO\textsubscript{2max}) by Polar Fitness Test\textsuperscript{TM} feature in heart rate monitor</td>
<td>3</td>
</tr>
<tr>
<td>Muscular fitness</td>
<td>Bilateral grip strength by dynamometer</td>
<td>3</td>
</tr>
<tr>
<td>Metabolic homeostasis - Blood glucose levels</td>
<td>Fasting blood glucose level by fasting plasma glucose test (FPG)</td>
<td>1, 2</td>
</tr>
</tbody>
</table>

Tests of anthropometry include measurements of body size, structure, and composition. A linear relationship exists between adiposity and most health conditions (Ortega et al. 2008). BMI is widely used as an estimate of body fat percentage in body composition. It is calculated as body weight (kg) divided by height (m) squared and it has to be noted that it does not capture all the variation in health outcomes related to excess adipose tissue. BMI cannot distinguish between body fatness, muscle mass, and skeletal mass and its use can result in large errors in the estimation of body fatness especially in the following situations: infancy and childhood, ageing, racial differences, athletes, weight loss with and without exercise, physical training and special clinical circumstances. (Prentice & Jebb 2001). Nonetheless, BMI has been considered the most appropriate measure for monitoring and comparing the prevalence of obesity at the population level (World Health Organization 2011a).

Bioelectrical impedance assessment provides information about body fat percentage. It is a commonly used method for estimating body composition (e.g., fat mass, fat free mass, BMI, weight) (Mikkola et al. 2009). The method determines the opposition to the flow of a small electric current through body tissues. The current flows more easily through the parts of the body that are composed mostly of water than it does through bone or fat. The method has been
validated against whole-body dual x-ray absorptiometry (DXA) (Lim et al. 2009, Thomson et al. 2007). The method is easy and quick to perform, but its results are greatly affected by, for example, body hydration status and body temperature; the measurement requires well controlled conditions to get accurate and reliable measurements. Age, gender, height and weight are taken into consideration when interpreting the results of the bioelectrical impedance. (Hu 2008: 60–61).

Physical fitness can be thought of as an integrated measure of most, if not all, body functions (skeletomuscular, cardiorespiratory, hematocirculatory, psychoneurological, endocrine-metabolic) involved in the performance of daily physical activity and exercise. Physical fitness is nowadays considered as one of the most important health markers, as well as a predictor of morbidity and mortality for cardiovascular disease. Cardiorespiratory fitness or aerobic fitness is the overall capacity of the cardiovascular and respiratory systems and the ability to carry out prolonged strenuous exercise. The maximal oxygen consumption \( \text{VO}_{2\text{max}, \ ml/kg/min} \) attained during a graded maximal exercise to voluntary exhaustion is considered the single best indicator of cardiorespiratory fitness. The \( \text{VO}_{2\text{max}} \) can be estimated using maximal or submaximal tests, by direct or indirect methods. (Ortega et al. 2008). The most commonly used tests are walking/running tests. In addition, Polar Fitness Test™ (Polar Electro, Finland), for example, is an indirect method of measuring aerobic fitness that is conducted while resting comfortably during ca. 5 minutes. It gives the OwnIndex value (that is comparable to \( \text{VO}_{2\text{max}} \)) from the resting heart rate, heart rate variability, gender, age, height, body weight and self-assessment of the level of long-term physical activity. (Crouter et al. 2004).

Muscular fitness is the capacity to carry out work against a resistance. There is no single test for measuring muscle strength. The handgrip test (bilateral grip strength test) is one of the most used tests for assessing muscular fitness in epidemiological studies. (Ortega et al. 2008). In adults it has been reported to be a strong predictor of morbidity and life expectancy (Metter et al. 2002).

Following an individual’s adiposity and aerobic fitness is important in the prevention of type 2 diabetes. In addition, biochemical measurements of blood provide an indication of metabolic homeostasis. Blood glucose levels indicate the state of an individual’s metabolism and are used for diagnosis of prediabetes and type 2 diabetes. (American Diabetes Association 2012). To determine whether an individual has prediabetes or type 2 diabetes, a doctor can perform one of three different blood tests – the fasting plasma glucose (FPG) test, the oral glucose tolerance test (OGTT) or the Hemoglobin A1C (or average blood sugar) test. If
the blood glucose is abnormal following the FPG, the individual has impaired fasting glucose (IFG) and if the blood glucose is abnormal following the OGTT, the individual has impaired glucose tolerance (IGT). (American Diabetes Association 2012).

Some indicators of physical health can be directly measured, but most of the indicators, such as body adiposity, can only be measured indirectly. The reliability and validity of indirect measurements are examined by validating the measurement in different conditions and with different target groups as well as by comparing their results with the results of other measurements. A measuring device is reliable if it gives the same result every time when the condition has not changed. Measurement validity refers to whether one is measuring what one claims to be measuring (Mitchell & Jolley 2010: 172), and a measurement device is valid when it really measures what it should. When compared to subjective methods objective methods reduce subject and researcher biases (Peat 2002: 83–84) but biases concerning representativeness also apply to studies utilising objective methods.

4.3.3 Desk research

Different kinds of reviews are examples of “desk research”. According to Bawden and Robinson (2012: 316) desk research methods cover the varied forms of research carried out by some kind analysis of documents. A review can be objective, in simply reporting what is in the literature, or subjective, in that the reviewer judges the quality of the material and its content. The review in Study 4 is objective.

The review in Study 4 can be categorised somewhere between a narrative and a systematic review. A narrative review (also called critical or literature review) aims to demonstrate that the writer has researched the literature and critically evaluated the quality of literature. It does not include a description of the systematic process of identifying material for inclusion to the review and therefore, its conclusions are open to bias. (Grant & Booth 2009).

A systematic review seeks to search for, appraise and synthesise research evidence (Grant & Booth 2009). It is more commonly used in subjects such as Healthcare than Information Studies (Urquhart 2010, Bawden & Robinson 2012: 316). A clear set of rules is used to search for studies, and then to determine which studies will be included in or excluded from the analysis. The aim is to have the mechanisms of review transparent and reproducible. (Borenstein et al. 2009: 83)
XXIII). The results can be presented as summary tables and a narrative that brings together the key findings. If the study attributes are quantitative, a meta-analysis can be conducted. (Bryman 2012: 103). In meta-analyses individual studies addressing a common issue are statistically combined to arrive at a conclusion about the body of research (Sacks et al. 1987, Urquhart 2010). The process of a review is similar to content analysis (Case 2012: 262) which is summarised in subchapter 4.4.2.

4.4 Methods of data analysis

In data analysis raw data are examined and organised to answer the research questions. In Studies 1, 2 and 3 of this thesis statistical analysis is used. Study 4 is a review where contents of study articles were analysed. The method in reviews closely relates to a content analysis and thus also content analysis is covered here.

4.4.1 Statistical analysis

The data of Studies 1, 2 and 3 were analysed statistically by univariate, bivariate and multivariate analysis with categorical (ordinal) and continuous (interval) variables. Univariate analysis refers to the analysis of one variable at a time. For example, a basic frequency table is an example of univariate analysis. Bivariate analysis is concerned with the analysis of two variables in order to uncover whether or not the two variables are related. In other words, evidence is sought on whether the variation in one variable coincides with variation in another. The technique for examining these relationships is chosen on the basis of the nature of the two variables being analysed. For example, chi-square, Fisher’s exact test, contingency coefficient (C), Student’s t-test, Mann-Whitney exact U test, Cramer’s V and Spearman’s rho ($r_s$) are examples of bivariate analysis. In multivariate analysis three or more variables are simultaneously analysed. Logistic regression analysis is an example of multivariate analysis. (Bryman 2012: 337–350). By using multiple tests to analyse the same data more trustworthy results are obtained.

In the studies of this thesis non-parametric tests were primarily used. Non-parametric tests are commonly used if the sample size is small, the expected cell counts are low due to unequally distributed data among the cells of the cross-tabulation table and if the distributions do not follow a normal distribution. For example, the chi-square test gives an approximation of the results from the exact
test and thus, if the chi-square test is conducted for small sample sizes the results could be erroneous. When the sample is small or in doubt about normality, the non-parametric tests should be used. (McKllup 2006: 224–245). The statistical tests applied in Studies 1, 2 and 3 of this thesis are summarised in Table 5. (See also subchapters 4.5.2 and 4.6.2).

Table 5. Statistical analyses used in the studies of this thesis.

<table>
<thead>
<tr>
<th>Statistical test</th>
<th>Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-square test or Fisher’s exact test</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Contingency coefficient</td>
<td>1</td>
</tr>
<tr>
<td>Cramer’s V</td>
<td>1</td>
</tr>
<tr>
<td>Spearman’s correlation coefficient</td>
<td>1</td>
</tr>
<tr>
<td>Mann-Whitney exact U test</td>
<td>2</td>
</tr>
<tr>
<td>Student’s t-test</td>
<td>3</td>
</tr>
<tr>
<td>Multivariate logistic regression analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

The significance of associations between two categorical variables can be analysed using cross-tabulation with a chi-square test or Fisher’s exact test. Fisher’s exact test is a nonparametric analog for the chi-square test. The contingency coefficient is a chi-square-based measure of the strength of association of two categorical variables. Its advantage over the ordinary chi-square is that it is more easily interpreted, since its range is always limited between 0 and 1. Student’s t-test is a hypothesis test to assess group differences and Mann-Whitney U test is a non-parametric analog of the t-test. Student’s t-test measures for equivalence of means and the Mann-Whitney exact U test for equivalence of medians. Cramer’s V is a non-parametric chi-square-based measure of the effect size and Spearman’s correlation coefficient ($r_s$) is a non-parametric measure of dependence between two variables; they both provide information about the strength of the relationship. (See e.g., Bryman 2012: 337–350, McKllup 2005: 224–245). The multivariate logistic regression analysis can be used to determine which of the investigated exploratory variables are independently associated with the response variable. The analysis is referred to as binary logistic regression (instead of multiple logistic regression), when the response variable is of the dichotomic type. The analysis can be done with categorical or continuous (interval) variables. Logic transformation can be used for the distribution of continuous variables to follow normal distribution. (Domínguez-Almendros et al. 2011).
The aim of the statistical analysis is to calculate the probability that the observed differences could be due to chance. Statistical analysis provides a way to quantify the confidence we can have in our inferences. The level of statistical significance is the level of risk that we are prepared to take when inferring that there is a relationship between two variables in the population from which the sample was taken, when in fact no such relationship exists. The maximum level of risk that is conventionally taken in social research is to say that there are up to 5 chances in 100 that our conclusion might be false. Therefore the significance level is denoted by \( p < 0.05 \). (Bryman 2012: 347–349).

**4.4.2 Content analysis**

Study 4 of this thesis is a literature review and its data was analysed with content analysis. According to Bryman (2012: 289) content analysis is an approach to the analysis of documents and texts that seek to quantify content in terms of predetermined categories and in a systematic and replicable manner. It has been stated that content analysis is not exactly a research method, because it is an approach to the analysis of documents and texts rather than a means of generating data. Content analysis is firmly rooted in the quantitative research strategy; its aim is to produce quantitative accounts of the raw material in terms of the categories specified by the rules in question. However, ethnographic or qualitative content analysis refers to an approach to documents and texts that emphasises the role of the researcher in the construction of the meaning of and in texts. (Bryman 2012: 289–293).

The decisions about what should be included in a content analysis are bound to the research questions under consideration. The unit of analysis can differ widely. In a content analysis the researcher creates a coding schedule. It is a form onto which all the data relating to an item being coded is entered. A coding manual can also be used. A coding manual is a statement of instructions to coders that also includes all the possible categories for each dimension being coded. (Bryman 2012: 294–304). In systematic reviews the researcher also creates a schedule, which is a cross-case summary table in which the rows are case studies and the columns are variable-related findings or other study attributes (e.g., length of the study, study design type) (McNabb 2010: 89). The analysis in reviews is closely related to a content analysis, but a coding manual is not usually used. One of the disadvantages of content analysis is that it can be extremely time-consuming (Cook & Farmer 2011: 113). When used properly, content analysis is a
powerful data reduction technique. It is a systematic, replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding (Cook & Farmer 2011: 118).

4.5 Research setting and data collection and analysis in Studies 1 and 2

The aim of Study 1 was to find potential differences between prediabetic individuals in their human information behaviour as such, and in relation to their physical health status. Health information behaviour was scrutinised as interest in health information, searching for information and a self-estimate of the impact of information as well as the desire for information. The aim of Study 2 was to specify individual differences in the preference of message strategies, in particular, perceptions of a fear appeal message strategy and preferences for feedback message tactics as such, and also in relation to physical health status and changes in physical health status during the intervention period. Additionally, gender and age were factors in the analysis. A supplementary aim of both of these studies was to identify factors that could be used as a basis for tailoring health information or information presentation.

The empirical study was carried out in a secondary prevention setting provided by a physical activity promotion and type 2 diabetes prevention intervention trial (PreDiabEx). The trial was conducted under the auspices of health promotion and type 2 diabetes prevention programmes. The setting was Northern Finland, the University of Oulu (Medical Technology, Public Health Science and Physiology) and the Oulu Deaconess Institute. The trial lasted for three months at the beginning of 2010. The target group consisted of individuals with a high risk for type 2 diabetes, more specifically, prediabetic individuals. The intervention study was a randomised controlled trial. The study aimed at finding an effective form of physical activity to prevent type 2 diabetes. Another aim was to promote and help maintain physical exercise as an everyday activity.

In the study a convenience sampling was applied to select a sample of prediabetic individuals. An estimated sample size of 80, allowing for a dropout of 10 participants per group, was assessed to detect a statistically significant change in glucose levels if such would occur. Study subjects were recruited in the autumn of 2009 from the register of individuals at high risk for diabetes in the Oulu region in Northern Finland (administered by the Department of Public Health Science and General Practice, University of Oulu) and from the medical records
of health centers in the City of Oulu. Of the 113 subjects screened with oral glucose tolerance or impaired glucose tolerance tests, 78 fulfilled the inclusion criteria and were willing to participate in the trial. At the baseline 72 of them took part in the intervention trial. They were adults and lived in the Oulu region. They all fulfilled the World Health Organization’s criteria of impaired fasting glucose or impaired glucose tolerance and so they all were diagnosed with prediabetes at the point of selection in the fall of 2009. The participants were informed for the first time about their impaired glucose levels. The exclusion criteria were any functional limitations or chronic disease that might have limited participation in training and testing of cardiovascular and respiratory system, any medication for diabetes and current vigorous physical activity as revealed by a questionnaire or physician’s examination. The procedure was in accordance with the Declaration of Helsinki that consists of ethical principles for medical research involving human subjects. The protocol of the intervention trial was approved by the Ethical Committee of the Northern Ostrobothnia Hospital District. All the participants gave written consent for participating in PreDiabEx. The trial registration number was NCT01649219 (clinicaltrial.gov).

In the trial the participants were randomised into control and intervention groups by using block design. Age and gender were chosen as the randomisation blocks (or strata) since these characteristics affect glucose balance the most. Computer-generated random numbers were used in the randomisation. The intervention group received structured exercise training and the control group was asked to continue their way of life as usual. Structured exercise training consisted of walking indoors 3 times per week for 50 min at a speed of 2–4 km/h, with 10 min of warming up and stretching supervised by an athletic instructor and physician. Three of the 72 participants withdrew from the trial (two from the intervention group, one from the control group).

### 4.5.1 Data collection

The data of Studies 1 and 2 of this thesis were collected through self-completion questionnaire surveys by the prediabetic individuals and physiological and biochemical measurements of their physical health status. Physiological and biochemical measurements were conducted in the beginning of the intervention trial and repeated after the trial. Aerobic fitness was measured by an exercise physiologist and weight, height and blood glucose levels were measured by nurse researchers from the Oulu Deaconess Institute.
Study 1 is based on the results of a questionnaire conducted in the beginning of the trial and Study 2 is based on the results of a questionnaire conducted at the end of the 3-month trial. These questionnaires are different from each other. Parts of these questionnaires are utilised in the studies of this thesis. The data collection is presented as a flowchart in Figure 5.

![Flowchart for data collection in Studies 1 and 2.](image)

In the questionnaire the purpose of the study was explained and advice on how to fill in the questionnaire was given. The paper questionnaires were filled in by the participants in the same occasion when the objective measurements were taken. The responses were collected by the nurse researchers from the Oulu Deaconess Institute and they assisted the participants to fill in the questionnaires, if necessary. The researchers from Information Studies designed and administrated the surveys and analysed the data. The participants’ personal data are protected using number codes. The collected information was only used by the research group. The questionnaire questions utilised in Studies 1 and 2 are presented in Appendices 1 and 2.

**Subjective measurements**

In the beginning of the intervention trial sociodemographic information (age, sex, marital status, education) of the participants, their estimations of their own physical activity and of their health information behaviour were collected with a self-completion questionnaire. Of the 72 participants, 69 returned and completed
the questionnaire, giving a response rate of 95.8%. The data related to health information behaviour contained statements on the individuals’ interests in and searching for information on physical activity, nutrition and type 2 diabetes, and also the participants’ assessment about the impact of information obtained on their eating and physical activity habits. The responses were made on a four-point Likert scale (strongly agree – strongly disagree) with a “not sure” alternative. In addition, the participants’ willingness to receive information about physical activity or nutrition that would take into account personal characteristics and situation of life (delivered e.g., by using computer or mobile phone) was examined. The response alternatives were “never”, “couple times a year”, “about once a month” and “about once a week”.

After the 3-month intervention trial, in May-June 2010 the second self-completion questionnaire survey was conducted (see Appendix 2). Of the 72 original participants, 68 responded to the survey; the response rate was 94.4%. Previous literature was reviewed, but suitable validated questionnaire instruments were not found. The survey questions were formulated to address the individuals’ health information behaviour and particularly their reception of the two message strategies. Three statements related to fear appeal and type 2 diabetes were presented to the participants. The statements were based on the ways an individual can respond to threatening information or mental images related to a disease. Individuals can be scared or disheartened, but in some cases they may become active and motivated. It was assumed that individuals are able to recall their reaction to threatening information or mental images related to type 2 diabetes.

In addition, to investigate preferences for ipsative, normative and theoretically driven feedback message tactics, the participants were further asked how strongly they agree with statements constructed in terms of the assumptions on which the three selected feedback message tactics were based. For example, it can be assumed that individuals who prefer their behaviour to be compared with that of peers would prefer messages based on the normative feedback message tactic. The participants’ agreement with the statements was evaluated with a four-point Likert scale (strongly agree - strongly disagree) with a “not sure” alternative.

In addition, the participants were given five examples of feedback messages representing descriptive (factual), evaluative, ipsative, normative and theoretically driven message tactics. The messages were designed to present a realistic situation for the participants and to imitate tailored feedback messages by
summarising typical information about the individual’s exercise behaviour and attempts to promote physical activity. The participants were asked to choose the one that would be the most motivating for them. The messages presented by Hawkins et al. (2008: 461) were applied in the design. The five examples of messages utilising different feedback message tactics were related to physical activity, because promoting physical activity was an aim of the PreDiabEx trial. The messages were designed to present a realistic situation for the participants and to imitate tailored feedback messages by summarising typical information about the individual’s exercise behaviour and attempts to promote physical activity. An example of evaluative feedback by Hawkins et al. (2008: 461): “You said you intend to start exercising regularly. That could be a good way to lower your blood pressure”. This example was taken to an even more general level and rephrased to: “This week you have attended a lot of moderate exercise. It has been beneficial to your health”.

**Objective measurements**

Objective measurements reflecting the individuals’ physical health status were conducted in the beginning and after the 3-month intervention trial. The participation rate for different measurements differed. In the beginning of the trial 72 participants, and in the end 69, took part in the glucose measurements. Aerobic fitness was measured for 67 in the beginning and for 64 in the end, and the corresponding figures for weight and height measurements were 69 and 64.

Weight and height were measured and BMI was used as an estimate of body fat percentage in body composition as follows: normal (from 18.5 to 24.9), overweight (from 25 to 29.9), obese classification I (from 30.0 to 34.9), II (from 35 to 39.9) and III (40 or over) (World Health Organization 2006).

Maximal oxygen uptake (VO$_{2\text{max}}$) was measured by an indirect submaximal oxygen uptake test on a bicycle ergometer that records heart rate. Measurement was done by an exercise physiologist from the Oulu Deaconess Institute. VO$_{2\text{max}}$ is reported relative to a person’s weight (ml/kg/min). Because gender and age affect the VO$_{2\text{max}}$ values, a fitness classification by Shvartz and Reibold (1990) was used to compare the individual fitness test results on a seven-point Likert scale (very poor – excellent).

Fasting plasma glucose (FPG) was determined in the oral glucose tolerance test (OGTT) objectively by Advia 1800, Siemens (Tarrytown, NY, USA). Measurement was done by the nurse researchers of the Oulu Deaconess Institute.
Oral glucose tolerance test was carried out in the morning after overnight (8- to 10-h) fast according to the instructions of the World Health Organization. FPG was analysed according to World Health Organization’s diagnostic classification (World Health Organization 2010b).

4.5.2 Data analysis

The data were analysed with the SPSS statistics 18 software. Univariate analyses of subjective and objective measurement results were done. Bivariate analyses included the cross-tabulation of subjectively and objectively measured factors and statistical tests. No multivariate analysis was conducted because the number of participants was small, resulting in a small number in each cell of analysis. Physiological and biochemical measurement data were treated as categorised ordinal-level variables. Survey data were mostly treated as ordinal variables, except gender and age. In Study 2 the participants were divided into two groups according to their age: participants born in 1950 or before and those born after 1950. Age was used as a dichotomous variable as was gender. The year 1950 was chosen as the basis for the division because it divided the participants into two almost equally large groups, and in 2010 individuals born in 1950 were 60 years old.

In Study 2 the survey data were studied in relation to changes in the participants’ fitness, BMI and FPG classifications during the intervention period of 3 months. Even though the members of the control group were asked to continue their way of life as usual during the intervention trial, some of them had improved their physical health status during the three-month period. The potential differences between those who had improved their physical health status and those who had not, were not under examination. The possible improvements in health status is treated as a dichotomous-level variable and the participants were divided into those who improved their health status and those who did not, independent of their belonging to the intervention group or control group.

Non-parametric tests were mainly used because of the skewed distributions and small number of study participants (see subchapter 4.4.1). The statistical analysis of Study 1 included the calculation of distributions, dependence analysis using cross-tabulation and Chi-square tests ($\chi^2$, two-sided) and Fisher’s exact test (FET, two-sided). However, $\chi^2$ was calculated when it was possible to combine classes in a feasible manner. $P$-values $0.05 < p < 0.1$ were considered as indicative and $p < 0.05$ as statistically significant. Cramer’s $V$, Contingence
coefficient and Spearman’s rho were also calculated. These tests were used to increase the understanding of the nature of the association between two variables.

Statistical analysis of Study 2 included calculation of distributions, dependence analysis using cross-tabulation, Fisher’s exact test (2-sided) and a statistical hypothesis test to assess group differences using an independent-sample Mann-Whitney U test (two-tailed). The responses to the presented statements were studied by investigating the possible difference between, for example, individuals whose BMI had improved during the intervention period and individuals whose BMI had not changed or had impaired. For the Mann-Whitney exact U test the “not sure” response alternative was ignored. The values of Fisher’s exact test and the Mann-Whitney test were reported when the values of statistical probability ($p$) were statistically significant ($< 0.05$). In the Mann-Whitney test the $z$-value related to standardised test statistics is reported. The different questions of the questionnaire and different objective measurements had somewhat different response and participation rates and this is taken into consideration in reporting the results.

4.6 Research setting and data collection and analysis in Study 3

In Study 3 preferences for ipsative, normative and theoretically-driven feedback message tactics were investigated as such, and in relation to objectively measured indicators of physical health status. Furthermore, preferences were examined in relation to self-reported education, self-estimate of physical activity, stage of exercise behaviour change and exercise self-efficacy. A supplementary aim was to identify factors that could be used as a basis for tailoring health information or information presentation.

Study 3 was conducted in the setting of a larger MOPO study (MOPO study 2012, Ahola et al. 2013), which aims to promote physical activity among young men and prevent their social marginalisation. In the MOPO study health promotion, modern game technology and measurement of physical activity are combined into a novel wellness coaching service for promoting physical activity and health in young military conscription aged men in the region of Oulu, Finland. Moreover, tailored health information and feedback will be provided in the service. The operators of the study are: University of Oulu, Oulu Deaconess Institute Department of Sports and Exercise Medicine, City of Oulu, Virpiniemi Sport Institute, Finnish Defence Forces and wellness technology companies from Northern Finland. A great deal of information about young men’s attitudes,
preferences and behaviours has been collected in military call-ups during 2009–2012. Notice of the statement in favour of the MOPO study has been received from the Ethics Committee of the Northern Ostrobothnia Hospital District and the procedure is in accordance with the Declaration of Helsinki. The study protocol’s registration number is NCT01376986 (clinicaltrials.gov).

The empirical data of the study were collected with a questionnaire survey and physiological measurements administered at the compulsory Finnish Defense Forces’ call-ups for military service in the City of Oulu, Finland, in September 2011. All the men attending the call-ups (n = 1260) were invited to participate in the study. In Finland all men turning 18 the current year are annually called for military or civil service except those whose physical or mental health or psychological capacities do not allow independent living. Additionally, young men who have been commanded to participate again at previous occasions and under thirty-year-olds who have not reported to previous call-ups and who have not been separately evaluated, take part in the call-ups. As the result, at the call-ups a large, population-based, representative sample of young men can be reached. In call-ups the fitness for conscript service is evaluated and the service location is determined. (The Finnish Defence Forces 2012).

4.6.1 Data collection

The data of Study 3 of this thesis were collected through a self-completion questionnaire survey among young men and objective physiological measurements of their health status. Study 3 utilises part of the data of a large MOPO questionnaire. All men attending the call-ups were encouraged to fill in the questionnaire and to participate in the objective measurements. The participants were given both oral and written information about the study and they gave a written consent for participating. The information for participants described the study and their right to refuse to take part or withdraw from the study without it affecting their future in military service. Advice on how to fill in the survey was given in the questionnaire. The responses were collected by MOPO study researchers and they helped the participants fill in the questionnaires, if necessary. Objective measurements were conducted under the guidance of researchers educated for the purpose and participants also received information and interpretation of their results. The collected data was administrated by the Oulu Deaconess Institute. The participants’ personal data
was protected using number codes and the collected information was only used by
the MOPO study researchers.

**Subjective measurements**

The questionnaire included an assessment of age, self-estimated physical
activity, exercise self-efficacy and stage of change as well as preferences for
feedback message tactics. The questions and statements utilised in Study 3 of this
thesis were designed and analysed by researchers of Information Studies. Of the
1260 men attending call-ups 65.8% (n = 829) responded to the questionnaire.
Additionally, the level of education was assessed in a previous questionnaire
conducted during a medical examination arranged by the Defence Forces and
conducted before the call-ups. The questionnaire questions utilised in Study 3 are
presented in Appendix 3.

The self-efficacy scale was translated and modified from the original scale by
Bandura (2006). This 18-item scale measures participants’ confidence in their
ability to sustain regular exercise in varying situations. The original scale, from 1
to 100 (not confident at all - extremely confident), was modified to a scale of 1 to
5 (not confident at all - extremely confident). It consisted of descriptions of
situations that can make it hard to persevere with regular exercise and the
participants rated their confidence in their ability to exercise on a regular basis.
(Hirvonen et al. 2012).

The stage of change scale (modified from Cardinal 1995) contained a picture
of a ladder with four rungs and five descriptors corresponding to each stage of
change (0 = pre-contemplation, 1 = contemplation, 2 = preparation, 3 = action,
4 = maintenance). The participants were instructed to select a rung that best
described their regular exercise behaviour and intentions to exercise. (Hirvonen et
al. 2012).

To investigate preferences for ipsative, normative and theoretically driven
feedback message tactics the participants were asked how strongly they agreed
with three statements constructed in terms of the assumptions on which each of
the three feedback message tactics were based, on a five-point Likert scale
(strongly agree, moderately agree, neutral, moderately disagree, strongly
disagree) with a “not sure” alternative. These statements related to preferences for
the feedback message tactics were the same as in the questionnaire utilised in
Study 2 (see Appendix 2).
**Objective measurements**

At the call-ups anthropometric, aerobic fitness and muscle strength measurements were conducted and 70.4% (n = 887) of young men participated in these measurements. The measurements were conducted by trained MOPO study researchers. The data analysis for Study 3 was done by researchers of Information Studies.

The weight and height of the participants were measured and BMI was calculated (World Health Organization 2006). According to the World Health Organization the BMI classifications for adults also apply to 18-year-olds (World Health Organization 2007) and therefore the classification for adults was used (see subchapter 4.5.1).

Body composition was measured using bioelectrical impedance analysis technology with an InBody 720 device (Biospace Co, Ltd, Seoul, Korea). Body weight and total body fat percentage were recorded and utilised in this study. Body composition classification according to total body fat percentage was used. The applied classification of total body fat percentage for men at the age of less than 19 years was: underweight < 3%, excellent < 12.0%, good 12.1–17.0%, moderate 17.1–22.0%, overweight 22.1–27.0%, significantly overweight/obese > 27.1% (Hoeger & Hoeger 2011: 126).

Aerobic fitness (maximal oxygen uptake) was estimated with the Polar Fitness Test™ feature of an FT 80 device (Polar Electro, Finland). To obtain the measures for heart rate and heart rate variability, 255 heart beats (3–5 min) were measured during the test. The result of the test is an OwnIndex, which is comparable to maximal oxygen uptake (VO2max ml/kg/min). The categories of OwnIndex for 18-year-old men are: poor (≤ 44), moderate (45–52), good (53–58), very good (59–64) and excellent (≥ 65) (modified from Shvartz & Reibold 1990).

Muscle strength was assessed with a bilateral grip strength test using a handgrip dynamometer (Saehan, SAEHAN Corporation, Korea) (Bohannon et al. 2006). During the examination the participants stood with their legs apart and an elbow bent at a 90° angle and they were asked to grip the instrument with maximum strength. The result was the better of two attempts per hand. The mean grip strengths for the right and left hands were used in the analysis. Cut-offs for quartiles of grip strength were calculated and the participants were categorised according to the quartiles as low (≤ 43 kg), moderate (44–48 kg), high (49–54 kg) or very high (≥ 55 kg).
4.6.2 Data analysis

Statistical analyses were performed using the IBM SPSS statistics 19.0 software. The participants’ preferences for the examined feedback message tactics were based on their self-report and treated as ordinal-level variables. Exercise self-efficacy and physiological measurement data were treated as ordinal-level (when categorised) and as continuous variables. Non-normally distributed data (BMI, body fat percentage, aerobic fitness) were analysed following logarithmic transformation.

The questionnaire and measurement data of individuals’, that had answered at least one of the questions concerning the feedback message tactics and participated in at least one physiological measurement, were included in the analysis. Based on these criteria data from 525 participants, 41.7% of the whole study population (n = 1260) were included and comprise the sample of Study 3. There were somewhat different response rates to different questions (from 489 to 501 responses per question i.e. 38.8 to 39.8%). In question-specific analysis non-responses were excluded and the percentages reported are calculated from the amount of responses per question.

Univariate descriptive analyses were done using mean and standard deviation for continuous variables and percentage for categorical variables. Associations between the categorical responses and explanatory variables were analysed using bivariate analysis, particularly cross-tabulation with a two-sided Fisher’s Exact Test. The exact version of the test was used whenever possible, but if the data set was too large for the exact algorithms, a Monte-Carlo simulation was performed. The Monte-Carlo simulation provides an unbiased estimate of the exact $p$-value, without the requirements of the asymptotic method and produces a 99% confidence interval for the exact $p$-value (Mehta & Patel 2010: 3–5). The mean values of the continuous variables were compared by Student’s t-test to investigate whether there were differences between participants responding positively or neutrally and those responding negatively to the given statements related to feedback message tactics. “Not sure” answers were excluded. The level of significance for all the tests ($\alpha$) was set at $p < 0.05$.

In addition, multivariate analysis was used to determine which of the investigated variables independently predict preference for feedback message tactics in a large data set. The variables were entered into each of three logistic regression models to determine whether they were significantly, and independently, associated with preference for each of the three feedback message
tactics: ipsative (yes or no), normative (yes or no) and theoretically driven (yes or no). Independent variables were entered into the model using a stepwise method of variable selection in which variables were added to the model if they had a $p$ value $< 0.05$ and were removed from the model if they had a $p$ value $> 0.1$. Odds ratios (OR), 95% confidence intervals (CI) and $p$ values were calculated for each continuous independent variable and for each category within a categorical variable relative to a reference category in relation to the dependent variable.

4.7 Data collection and analysis in Study 4

Study 4 is a review of the studies on “second generation” tailored interventions aimed at behaviour change in nutrition, physical activity or weight management. Its data were collected from published scientific articles by literature searches and the articles included in the study were analysed by means of content analysis (see subchapter 4.4.2).

The literature searches were performed between January and August 2009. Research literature on health communication and tailoring was sought from the following databases: Pubmed and Ovid (MEDLINE), Science Direct (Elsevier), Google Scholar, Library and Information Science Abstracts (LISA) (CSA), Academic Search Premier (EBSCO), Library, Information Science & Technology Abstracts (LISTA) (EBSCO), Emerald Journals (Emerald), Educational Resources Information Centre database (ERIC) (CSA), Scopus, Sociological Abstracts (CSA), Web of Science (ISI), and ABI/Inform (ProQuest). The search terms were: health, health communication, tailor*, Internet, WWW, web, net, online, nutrition, diet*, vegetable/fruit consumption/intake, fat intake, weight, weight management, obesity, overweight and physical activity or exercise. (An asterisk was used to include all terms that began with a particular spelling, such that “diet*” would include dietary and dieting, for example). The Boolean search queries were based on the following formulations: (tailor* [Title/Abstract/Keywords]) AND (weight OR “weight management” OR obesity OR overweight OR “physical activity” OR exercise OR “fat intake” OR nutrition OR diet* OR “vegetable consumption/intake” OR “fruit consumption/intake” [Title/Abstract/Keywords]) AND (Internet OR WWW OR web OR net OR online [Title/Abstract/Keywords]).

The searches were not limited by publication date, but the availability of full-text articles was taken into account. The so-called pearl-fishing, or chaining, strategy was also used by taking a closer look at the articles cited in other articles.
and at recent articles citing certain older relevant articles. Most of the articles retrieved were published in high quality, peer-reviewed, international journals of psychology, health promotion, health education, nutrition, medicine, nursing and communication.

In order to find examples of intervention studies for the content analysis, articles were included if they:

- focused on “second generation” interventions,
- focused on health behaviour related to nutrition, physical activity, or weight management, alone or in combination,
- measured or assessed behavioural, psychological, or physiological outcomes,
- were randomised controlled trials or quasi-experimental designs with pretest and posttest and
- were available in full text.

Articles were excluded if they, for example, measured only the feasibility and acceptability of computer-delivered tailored health communication, focused on diabetes self-management or gave advice at a computer kiosk or on an online Internet shopping site. The numbers of the search results were not written down and thus a flow chart of studies included in the review cannot be presented. Finally, 23 articles that clearly met the criteria were selected for the content analysis.

Data were analysed by categorising them according to the themes of the research questions. The study attributes were both quantitative and qualitative and the results were presented in the form of summary tables and a narrative (coding schedule). The approach of the analysis was interpretative and no statistical analysis was conducted.

### 4.8 Summary of the data collected in Studies 1–4

Table 6 presents a summary of the research strategies utilised, target groups, research environments and data collected in Studies 1–4.
Table 6. Summary of the research strategies utilised, target groups, research environments and data collected in Studies 1–4 of the thesis.

<table>
<thead>
<tr>
<th>Study</th>
<th>Research strategy</th>
<th>Target</th>
<th>Research environment</th>
<th>Data collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 and 2</td>
<td>Primary</td>
<td>Finnish women and men with high risk for type 2 diabetes</td>
<td>PreDiabEx study</td>
<td>Questionnaire survey and physiological and biochemical measurements</td>
</tr>
<tr>
<td>3</td>
<td>Primary</td>
<td>Young Finnish men</td>
<td>MOPO study</td>
<td>Questionnaire survey and physiological measurements</td>
</tr>
<tr>
<td>4</td>
<td>Secondary</td>
<td>Studies on “second generation” tailored interventions aimed at behaviour change in nutrition, physical activity or weight management</td>
<td>Literature search</td>
<td></td>
</tr>
</tbody>
</table>

Studies 1–3 utilised the primary research strategy, while Study 4 relied on the secondary research strategy. Studies 1–3 were empirical with target groups of prediabetic individuals (Studies 1 and 2) and young men (Study 3). The methods of these studies included questionnaires as well as physiological and biochemical measurements. Study 4 was a literature review of studies on “second generation” tailored interventions aimed at behaviour change in nutrition, physical activity or weight management.
5 Results

The aim of this thesis is to increase understanding about the user of health information and factors that could be used as a basis to tailor health information. In this chapter the results of Studies 1–4 are presented in numerical order. The results of Studies 2 and 3 are partly combined because both studies focused on investigating preferences for the feedback message tactics. The results of univariate statistical analysis are presented and mainly the statistically significant results of bivariate and multivariate analyses are covered. In Studies 1 and 2 the individual differences in health information behaviour were observed according to age, gender and physical health status indicated by fitness, BMI or FPG classifications. In Study 1 also self-estimate of physical fitness was scrutinised. Additionally, in Study 2 the receptions of the feedback and fear appeal message strategies were examined in relation to potential improvement of the participants’ physical health status during the intervention period. This also reflects the change in participants’ health behaviours. The results are reported with concentration on indicators of physical health status.

In Study 3 it was analysed how preferences vary in terms of the objectively measured indicators of physical health status, that is aerobic fitness, BMI, body fat percentage and grip strength. In this thesis the reporting of the results focuses on these indicators, but also the self-reported factors of the analyses are examined. These are education, self-estimate of physical activity, the stage of exercise behaviour change (according to the TTM) and exercise self-efficacy.

Due to the small number of participants in Studies 1 (questionnaire filled by 69) and 2 (questionnaire filled by 68) the results are presented by reporting first the number of the participants and then the percentage. On the contrary, in Study 3 the total number of participants was high since 826 filled in the questionnaire. Thus, percentages provide more information for the reader and the results are presented by reporting first the percentages and then the number of the participants.

5.1 Characteristics of the study populations

The empirical studies of this thesis focus on two target groups of the population: prediabetic individuals (Studies 1 and 2) and young men (Study 3). Studies 1 and 2 of this thesis were carried out in a setting provided by the physical activity
promotion and type 2 diabetes prevention intervention trial (PreDiabEx) and Study 3 in a setting provided by the MOPO study.

5.1.1 Characteristics of the study population in Studies 1 and 2 (PreDiabEx intervention)

The majority (45, 62%) of the 69 participants responding to the survey conducted before the intervention trial were 60 years or older, and 52 (75%) were women. The majority (80%) were married or living with a partner. Over half (56%) had only a primary-level education. The levels of education were lower for over 60-year-old participants, which is in line with the distribution of the Finnish population (Kumpulainen 2009). Almost all were overweight or obese. The majority (57, 83%) of the participants estimated their physical fitness to be fair or average. However, the objectively measured fitness classification revealed that as in fact, 24 (36%) belonged to the classifications “very poor” or “poor”, but also that the physical fitness of 16 (24%) was “good”, “very good” or even “excellent”. At the time of the trial, some of the selected participants had high glucose test values indicating that they were already diabetic. The level of education, self-estimate of physical fitness and BMI, aerobic fitness and FPG levels of the participants of Studies 1 and 2 are presented in Appendix 4.

The self-estimated physical fitness and the objectively measured fitness classifications were to some extent, but not significantly, associated; that is, the poorer the estimate the poorer the fitness classification (FET \( p = 0.086 \), Cramer’s \( V = 0.382 \), \( C = 0.552 \), \( r_s = 0.286 \)). It was interesting that participants aged 60 or older estimated their physical fitness to be better than did the younger participants (FET \( p = 0.005 \), Cramer’s \( V = 0.420 \), \( C = 0.387 \)). This was confirmed by the objectively measured VO2\(_{max}\) results and the fitness classifications based on them (FET \( p = 0.018 \), Cramer’s \( V = 0.379 \), \( C = 0.473 \)). In addition, high BMI values were associated with poorer fitness \( (p = 0.072 \), Cramer’s \( V = 0.377 \), \( C = 0.602 \), \( r_s = -0.524 \)), and all with morbid obesity (obesity classification III) had very poor or poor physical fitness.

During the 3-month trial the aerobic fitness classification had improved for 40 (63%) participants. The BMI classification had improved for 26 (41%) participants and the FPG classification had improved for 25 (36%) participants.
5.1.2 Characteristics of the study population in Study 3 (MOPO study)

The target group of Study 3 was young, conscription aged men in the Oulu area of Finland. Thus the participants were all male and homogenous in terms of their ethnicity and age (mean 17.9, SD 0.6). Most of the participants were currently studying in a vocational or academic track of an upper secondary school. The majority of the study participants had normal body mass, either a good or excellent body fat percentage, had moderate aerobic fitness and had at least moderate grip strength. More detailed information about characteristics of the study sample is presented in Appendix 5.

Most of the participants who reported being physically active for one or two hours daily, were classified into the maintenance stage of exercise behaviour change according to the five stages of the TTM and had at least a moderate level of self-efficacy. The distributions of these variables for participants were all within 2 per cent of the overall sample of men who participated in the physiological measurements in the call-ups (data not presented).

5.2 Interest in and search for information about diabetes, nutrition and physical activity (Study 1)

The participants’ degrees of interest in information related to diabetes, nutrition and physical activity were examined as well as their information searching behaviour related to these three areas. With only a few exceptions, the participants strongly or moderately agreed with the statement “I am interested in information” related to type 2 diabetes (68, 99%), nutrition (66, 96%) or physical activity (55, 80%). About a third (28, 40%) agreed that they often searched for information on physical activity and the same number disagreed. Of the participants 23 (34%) strongly and 32 (46%) moderately agreed with the statement “I have searched for information about the symptoms and care of diabetes”. Only 5 (8%) of them reported not having found interesting information related to diabetes, a quarter (24%) were not sure and two thirds (68%) moderately or strongly agreed that they had found interesting information.

The interest in and search for information related to diabetes, nutrition and physical activity were examined in relation to the individuals’ physical health status. The results reveal that the higher BMI levels were significantly associated with a greater interest in searching for information about nutrition (FET
In addition, individuals with impaired FPG levels were most likely and those with diabetic levels least likely to look for information about physical activity ($\chi^2(4) = 12.27$, $p = 0.015$, Cramer’s $V = 0.307$, $C = 0.398$, $r_s = -0.048$).

5.3 Self-reported impact of the information obtained (Study 1)

Over two thirds (70%) of the participants strongly or moderately agreed that the information found on nutrition had changed their eating habits. However, only 28 (40%) of them reported that information about physical activity had had an impact on their physical activity habits. Furthermore, the differences between the fitness classification groups in relation to whether the information obtained had made participants change their physical activity (FET $p = 0.525$) or eating habits (FET $p = 0.769$) were not statistically significant.

On the other hand, a better self-reported estimate of physical fitness level was associated with a greater likelihood of the obtained information having caused a change in physical activity habits (FET $p = 0.048$, Cramer’s $V = 0.402$, $C = 0.571$, $r_s = 0.280$). However, the result for the objectively measured fitness level was not statistically significant. Furthermore, the analysis indicates that the estimated likelihood of changing eating habits based on information obtained increases as the BMI value grows (FET $p = 0.053$, Cramer’s $V = 0.354$, $C = 0.448$, $r_s = 0.185$) (see Figure 6), but no such effect was found for physical activity habits (FET $p = 0.196$).
5.4 Desire to receive tailored information (Study 1)

The participant’s desire to receive information about physical activity, nutrition and diabetes taking into account his or her personal characteristics and situation in life was also examined. Information was planned to be delivered using a computer or mobile phone. All participants were willing to receive this kind of tailored information, but there were some differences in the preferred frequency. On the average, the poorer the fitness classification, the more frequently the participants were ready to receive information on nutrition and physical exercise ($\chi^2(4) = 10.63, p = 0.031$, Cramer’s $V = 0.286$, $C = 0.375$, $r_s = -0.370$). In total, half (54%) of the participants with the fitness classification “very poor” and three fourths (73%) of the fitness classification “poor” were willing to receive information “about once a week”. This is in sharp contrast with the result that, for example, only a fourth (25%) of participants with an “average” fitness classification were willing to receive information “about once a week” (see Figure 7).
Fig. 7. Prediabetic individuals’ fitness classifications in relation to their desire to receive tailored information delivered by a computer or mobile phone.

In addition, there seems to be a connection between BMI score and the desire to receive health information. The higher the BMI value, the more frequently the participants were willing to receive health information ($\chi^2(4) = 12.60, p = 0.013$, Cramer’s $V = 0.314$, $C = 0.406$, $r_s = 0.376$, with the “normal” classification with three participants removed from the calculations). (See Figure 8).
Fig. 8. Prediabetic individuals’ body mass index classifications in relation to their desire to receive tailored information delivered by a computer or mobile phone.

For example, the majority of the participants in the obese classification were willing to receive information a couple of times a year or about once a month, whereas the majority (69%) in the combined obese classifications II and III were willing to receive information about once a week.

5.5 Perception of fear appeal message strategy (Study 2)

In the second questionnaire, conducted after the 3-month trial, the perception of fear appeal was investigated. Participants were asked whether they perceive that “information related to diabetes raises fears”. Sixteen of the participants (25%) strongly and 15 (23%) moderately disagreed, 4 (6%) were not sure, 25 (39%) moderately and 4 (6%) strongly agreed.

Furthermore, the study participants were asked whether “threatening mental images about the onset of diabetes are able to promote physical activity and healthy eating behaviour”. Two of the participants (3%) strongly and 8 (12%) moderately disagreed, 3 (5%) were not sure, and 32 (49%) moderately and 20
(31%) strongly agreed. All participants who disagreed with the statement were women, but this result was not statistically significant. The participants who did improve their BMI classification were more likely to agree (22/24, 92%) with the statement than those whose BMI classification did not improve (27/37, 73%) (Mann-Whitney p = 0.019).

In addition, it was examined whether the study participants agreed with the statement “threatening mental images about the onset of diabetes dishearten me”. Twenty-four of the 65 participants (37%) strongly and 20 (31%) moderately disagreed, 10 (15%) were not sure, and 9 (14%) agreed moderately and 2 (3%) strongly.

To summarise the statements related to the fear appeal message strategy, the results of the Mann-Whitney exact U test are presented in Table 7. The only statistically significant result in the Mann-Whitney exact U test was observed when the participants whose BMI classification had improved and those whose classification had not improved were compared in relation to their perceptions of whether threatening mental images about the onset of diabetes are able to improve their behaviour. No statistically significant results were observed in Fisher’s exact test. (See Table 7).

Table 7. Results of the Mann-Whitney exact U test on statements related to perceptions of a fear appeal message strategy in relation to gender, age (two groups: born in 1950 or before, and born after 1950) and improvement in physical health status (physical fitness, body mass index or fasting blood glucose level classifications).

<table>
<thead>
<tr>
<th></th>
<th>&quot;Information related to diabetes raises fear&quot;</th>
<th>&quot;Threatening mental images about the onset of diabetes are able to promote physical activity and healthy eating behaviours&quot;</th>
<th>&quot;Threatening mental images about the onset of diabetes dishearten me&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>z</td>
<td>p</td>
<td>z</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men / women</td>
<td>-1.49</td>
<td>N.S.</td>
<td>-0.89</td>
</tr>
<tr>
<td>Age</td>
<td>-0.09</td>
<td>N.S.</td>
<td>-0.90</td>
</tr>
<tr>
<td>Born in 1950 or before / born after 1950</td>
<td>-0.06</td>
<td>N.S.</td>
<td>-0.87</td>
</tr>
<tr>
<td>Change in physical fitness²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved / no change or impaired</td>
<td>-0.86</td>
<td>N.S.</td>
<td>-2.38</td>
</tr>
<tr>
<td>Change in body mass index³</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved / no change or impaired</td>
<td>-1.11</td>
<td>N.S.</td>
<td>-1.19</td>
</tr>
<tr>
<td>Change in fasting blood glucose level³</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved / no change or impaired</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N.S. = not significant, ¹ Men / women, ² Born in 1950 or before / born after 1950, ³ Improved / no change or impaired
5.6 Preferences for ipsative, normative and theoretically-driven feedback message tactics in relation to indicators of physical health status and self-reported factors (Studies 2 and 3)

In Study 2, the differentiating factors according to the relationship between preferences for the ipsative, normative and theoretically-driven feedback message tactics and physical health status, were investigated. This topic was also investigated, by using the same questionnaire statements, in Study 3 (see subchapter 5.6.2). Thus, the results of Studies 2 and 3 are combined in subchapter 5.6.3. Additionally, regarding Study 2, possible connections between preferences and age, gender and self-estimate of physical activity are shortly covered.

5.6.1 Preferences for ipsative, normative and theoretically-driven feedback message tactics (Study 2)

The argument related to ipsative comparison “information about the improvement of my physical fitness motivates me” was mostly agreed upon. No one disagreed, 2 (3%) participants were not sure, 24 (36%) moderately and 41 (61%) strongly agreed. Normative feedback is based on a comparison with peers or a norm. Preference for a normative feedback message tactic was examined with a related statement “I get motivated when I have done better than others”. Twelve of the participants (18%) strongly and 7 (10%) moderately disagreed, 17 (25%) were not sure, and 22 (33%) moderately and 9 (14%) strongly agreed with the statement. More of the participants born after 1950 disagreed with the statement (11/26, 46%) than did the older participants (8/39, 21%) (Mann-Whitney $p = 0.026$). The participants whose BMI classification stayed the same or became more impaired during the intervention period were more likely to prefer a normative comparison and thus also normative feedback message tactic (Mann-Whitney $p = 0.019$). (See Figure 9).
When FPG classifications and preferences for the normative statement were cross-tabulated, participants with the classification “impaired” had chosen the alternative “not sure” more often (9/21, 43%) than those with the classifications “normal” (7/39, 18%) or “type 2 diabetes” (1/7, 14%). In the classifications “normal” (22/39, 56%) and “type 2 diabetes” (4/7, 57%), the participants more likely agreed with the normative statement (FET p = 0.008).

Preference for the theoretically driven feedback tactic was investigated by the statement “I don’t desire scientific facts about health information”. Twenty-three of the participants (34%) strongly and 22 (33%) moderately disagreed, 9 (13%) were not sure, while 10 (15%) moderately and 3 (5%) strongly agreed with the statement.

To summarise, the results of the Mann-Whitney exact U test are presented in Table 8. Statistically significant results in the Mann-Whitney test were observed in relations to change in BMI as well as age and preference for the normative feedback message tactic. The only statistically significant result of Fisher’s exact
test was observed when the FPG classifications and perceptions of a normative comparison were cross-tabulated.

Table 8. Results of the Mann-Whitney exact U test on statements related to preference for feedback message tactics in relation to gender, age (two groups: born in 1950 or before, and born after 1950) and improvement in health status (physical fitness, body mass index and fasting blood glucose level classifications).

<table>
<thead>
<tr>
<th></th>
<th>Ipsative feedback message tactic</th>
<th>Normative feedback message tactic</th>
<th>Theoretically driven feedback message tactic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$z$</td>
<td>$p$</td>
<td>$z$</td>
</tr>
<tr>
<td>Gender$^1$</td>
<td>-</td>
<td>N.S.</td>
<td>-</td>
</tr>
<tr>
<td>Age$^2$</td>
<td>-</td>
<td>N.S.</td>
<td>-2.21</td>
</tr>
<tr>
<td>Change in physical fitness$^3$</td>
<td>-</td>
<td>N.S.</td>
<td>-</td>
</tr>
<tr>
<td>Change in body mass index$^3$</td>
<td>-</td>
<td>N.S.</td>
<td>-2.29</td>
</tr>
<tr>
<td>Change in fasting blood glucose level$^3$</td>
<td>-</td>
<td>N.S.</td>
<td>-</td>
</tr>
</tbody>
</table>

N.S. = not significant, $^1$ Men / women, $^2$ Born in 1950 or before / born after 1950, $^3$ Improved / no change or impaired

5.6.2 Preferences for ipsative, normative and theoretically-driven feedback message tactics (Study 3)

In Study 3, differentiating factors according to the relation to preferences for the ipsative, normative and theoretically-driven feedback message tactics and the indicators of physical health status, were investigated. Additionally, possible statistically significant associations of these preferences and self-reported education, self-estimated physical activity, stage of exercise behaviour and exercise self-efficacy are shortly covered.

Preference for an ipsative feedback message tactic was investigated by presenting to the participants a statement related to ipsative comparison: “information about improvement in my physical fitness motivates me”. Of the 492 participants, 42% (n = 206) strongly and 30% (n = 145) moderately agreed, 15% (n = 75) were neutral and 6% (n = 27) moderately and 5% (n = 26) strongly disagreed with this statement. Of the participants 3% (n = 13) chose the “not sure” option.
Fisher’s exact test showed that participants whose aerobic fitness was good were more likely to prefer the ipsative comparison than those with lower aerobic fitness classification (FET \( p < 0.000 \)). In addition, a high body fat percentage was associated with not preferring the ipsative comparison and thus neither the ipsative feedback message tactic (FET \( p = 0.030 \)).

Preference for normative comparison was measured using the statement: “I get motivated when I have done better than others”. Of the 492 participants, 28% (n = 138) strongly and 35% (n = 170) moderately agreed, 21% (n = 105) were neutral and 8% (n = 38) moderately and 5% (n = 23) strongly disagreed with this statement. Four per cent (n = 18) chose the “not sure” option. Fisher’s exact test showed that being overweight or obese (according to the BMI measure) (FET \( p = 0.016 \)) and having good, very good or excellent aerobic fitness (FET \( p < 0.000 \)) were associated with preference for the normative comparison and thus the normative feedback message tactic. This result was supported by the t-test; according to it aerobic fitness was significantly poorer in participants who did not prefer normative comparison (t-test \( p = 0.022 \)).

Furthermore, grip strength was associated with a preference for normative comparison (FET \( p = 0.020 \)). Participants with moderate or strong grip strength were more likely to prefer the normative feedback than those with poor or very strong grip strength.

Preference for the theoretically driven feedback tactic was investigated with a reversed statement “I don’t desire scientific facts about health”. Of the 489 participants, 5% (n = 25) strongly and 10% (n = 51) moderately agreed, 39% (n = 192) selected the “neutral” option, 25% (n = 121) moderately and 16% (n = 76) strongly disagreed with this statement. Five per cent (n = 24) chose the “not sure” option. Fisher’s exact test showed an association between preference for the theoretically driven feedback tactic and a grip strength (FET \( p = 0.038 \)), but not with any other investigated variables. The participants with very good grip strength were least likely to desire scientific facts about health.

Multivariate logistic regression analyses (n = 387) were done to find out which of the investigated variables independently predicted preference for different message tactics. However, none of the objectively measured variables independently predicted preference for the ipsative, normative or theoretically-driven feedback message tactic, although BMI remained the final variable in the logistic regression model for the theoretically-driven tactic (\( p = 0.119 \)).

With regards to self-reported individual characteristics, individuals with high exercise self-efficacy (FET \( p < 0.000 \)) or studying in an academic track of an
upper secondary school (FET $p < 0.000$) were more likely to prefer the ipsative feedback message tactic than those with low self-efficacy or lower education. Similarly, high exercise self-efficacy (FET $p < 0.000$) or studying in an academic track of an upper secondary school (FET $p < 0.000$) was associated with preferring normative comparison. Additionally, according to the t-test, participants who did not prefer ipsative (t-test $p = 0.001$) and normative (t-test $p = 0.011$) message tactics had significantly lower self-efficacy than those who preferred them or responded neutrally.

The logistic regression analyses showed that education and stage of exercise behaviour change were significantly associated with preference for ipsative and normative comparison and thus to preference for the ipsative and normative feedback message tactics. Men who had attended a vocational track of an upper secondary school were 4.9 times (OR = 4.9; 95% CI = 2.4–10.1) more likely to disagree with the ipsative statement and 2.7 times (OR = 2.7; 95% CI = 1.5–5.1) more likely to disagree with the normative statement than men who had been to an academic track of an upper secondary school. Men who were in the pre-contemplation stage of exercise behaviour change were 5.8 times (OR = 5.8; 95% CI = 2.1–15.6) more likely to disagree with the ipsative statement than men in the maintenance stage. Moreover, men who were in the contemplation stage of exercise behaviour change were 3.3 times (OR = 3.3; 95% CI = 1.4–7.9) more likely to disagree with the normative statement than men in the maintenance stage, and men who were in the pre-contemplation stage were 3.0 times (OR = 3.0; 95% CI = 1.1–8.2) more likely to disagree.

### 5.6.3 Combined results on preferences for feedback message tactics in relation to health status (Studies 2 and 3)

Studies 2 and 3 both investigated individuals’ preferences for feedback message tactics in relation to their physical health status, measured by physiological and biochemical measurements.

According to Fisher’s exact test preference for the ipsative feedback message tactic was associated with good aerobic fitness and low body fat percentage in young men. In Study 2 particularly the prediabetic individuals who did not lose weight during the 3-month trial perceived the normative comparison as motivational. Prediabetic individuals whose fasting blood glucose level was normal or diabetic were more likely to prefer the normative feedback message tactic than individuals with an impaired (prediabetic) glucose level. In Study 3
preference for the normative feedback message tactic was associated with overweight and good aerobic fitness in young men. The result for aerobic fitness was parallel for the t-test. Moreover, young men with moderate or very good grip strength were more likely to prefer the normative feedback message tactic than those with poor or very good grip strength. An association between preference for the theoretically driven feedback tactic and grip strength was observed, but not for any other of the investigated variables. The participants with very good grip strength were least likely to desire scientific facts about health. In logistic regression analysis none of the investigated objectively measured variables significantly predicted preference for the ipsative, normative or theoretically-driven feedback message tactics among young men. The results are presented in Table 9.
Table 9. Combined results of Studies 2 and 3 regarding preferences for feedback message tactics in relation to health status.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Ipsative</th>
<th>Study 2</th>
<th>Study 3</th>
<th>Normative</th>
<th>Study 2</th>
<th>Study 3</th>
<th>Theoretically-driven</th>
<th>Study 2</th>
<th>Study 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FET</td>
<td>FET</td>
<td>FET</td>
<td>FET</td>
<td>FET</td>
<td>FET</td>
<td>FET</td>
<td>p</td>
<td>FET</td>
</tr>
<tr>
<td>BMI</td>
<td>-</td>
<td>N.S.</td>
<td>-</td>
<td>N.S.</td>
<td>-</td>
<td>N.S.</td>
<td>27.0</td>
<td>0.016</td>
<td>-</td>
</tr>
<tr>
<td>Aerobic fitness</td>
<td>-</td>
<td>N.S.</td>
<td>48.3</td>
<td>&lt; 0.000</td>
<td>-</td>
<td>N.S.</td>
<td>45.8</td>
<td>&lt; 0.000</td>
<td>-</td>
</tr>
<tr>
<td>Fasting glucose level</td>
<td>-</td>
<td>N.S.</td>
<td>39.1</td>
<td>0.008</td>
<td>-</td>
<td>N.S.</td>
<td>-</td>
<td>N.S.</td>
<td>-</td>
</tr>
<tr>
<td>Body fat percentage</td>
<td>37.8</td>
<td>0.030</td>
<td>-</td>
<td>N.S.</td>
<td>-</td>
<td>N.S.</td>
<td>-</td>
<td>N.S.</td>
<td>-</td>
</tr>
<tr>
<td>Grip strength</td>
<td>-</td>
<td>N.S.</td>
<td>48.0</td>
<td>0.020</td>
<td>-</td>
<td>N.S.</td>
<td>46.2</td>
<td>0.038</td>
<td>-</td>
</tr>
</tbody>
</table>

FET = Fisher’s exact test
N.S. = Not significant

1 The participants whose BMI classification stayed the same or became impaired during the 3-month trial were more likely to agree with the normative statement (Mann-Whitney test, z = -2.29, p = 0.022) (Study 2).

2 The participants who preferred normative comparison had better aerobic fitness (t-test p = 0.22) (Study 3).
5.7 "Second generation" tailored intervention studies aiming at behaviour change in physical activity, nutrition or weight management

Study 4 was a review focusing on “second generation” tailored behaviour change intervention studies. Their study design, objectives, applied theories, intervention design, tailoring mechanisms and outcomes were examined. Additionally, possible biases related to “second generation” tailored intervention studies were looked at in more detail. See Study 4 for information about target groups, sample sizes, lengths of the studies and attrition rates and a discussion about the possible biases related to these issues (Enwald & Huotari 2010).

5.7.1 Study design and objectives

The study design provides the basis for an intervention study. Of the 23 studies selected, 21 were randomised controlled trials. Only two of the selected studies used quasi-experimental designs, that is, these were nonrandomised controlled trials (Block et al. 2004, Frenn et al. 2005). The objectives of selected interventions were studied. It was found that combining fruit and vegetable consumption and fat intake in the same study was quite common (Block et al. 2004, Irvine et al. 2004, Oenema et al. 2005). Of the 23 studies selected, ten focused on behaviour change in nutrition, seven on change in physical activity, two on change in both nutrition and physical activity, and four on behaviour change related to weight management. Possible changes in health behaviour or in related factors can be monitored by self-reported indicators or by objective physiological measurements conducted in controlled conditions. In 15 of the 23 studies, the measures were only self-reported. Objectively measured variables included weight, physical activity, blood pressure, body fat percentage, blood lipids (e.g., cholesterol), waist circumference, flexibility and cardiorespiratory fitness (e.g., maximal oxygen uptake (VO2max)). In addition, of all these variables, physical activity and weight were self-reported in 13 of the studies.

5.7.2 Theories applied

In many of the intervention studies selected for Study 4, the assessments and information given to participants were based on theories of behaviour change or information processing. The TTM and related theoretical concept of stages of
change and the concept of self-efficacy, which is connected to several theories, such as the Social Cognitive Theory, were mentioned most often in the selected articles. The TTM, including the concept of stages of change, was the most commonly mentioned theory, cited in 14 of the 23 studies. Multiple interventions gave participants stage-tailored information (e.g., Irvine et al. 2004, Frenn et al. 2005, Spittaels et al. 2007, Di Noia et al. 2008, Park et al. 2008, de Vet et al. 2008), and many measured the stage of change in the beginning and monitored any possible improvement (e.g., Napolitano et al. 2003, Block et al. 2004, Booth et al. 2008, Dunton & Robertson 2008, Wanner et al. 2009). Other theories or models mentioned in the studies were the ELM, the Precaution Adoption Model, the Goal Setting Theory, the Theory of Planned Behaviour, the Theory of Reasoned Action and the Health Promotion Model. Some other theoretical concepts were also mentioned, for example, motivation, awareness of risk behaviour, goals and intentions. These are not presented here in detail. In four studies no theories were mentioned. More detailed information about the studies is presented in Appendix 6.

5.7.3 Intervention design, tailoring mechanisms and outcomes

The intervention designs of 13 of the 23 studies included a general information control group. Four studies included a, so-called, no-information control group. Furthermore, in five studies a waiting list control group was used. The participants in the waiting list groups received health information or feedback after the intervention period was over, and thus waiting list groups were considered a no-information control group during the intervention period. The intervention design of only one of the studies included an intervention group, a general information control and a no-information control group (Oenema et al. 2005). Some of the studies only compared groups receiving different kinds of tailored information or feedback or compared different delivery channels (e.g., Internet versus print). (See Appendix 6 and subchapter 3.5).

A positive outcome from the perspective of tailoring would be a statistically significant increase in self-reported fruit consumption, a bigger decrease in objectively measured weight or a significant improvement in the stage of change of the intervention group compared with the control group. Almost all studies, 21 of the 23, measured indicators connected to behavioural or physiological outcomes; the two that did not, measured only psychosocial factors (Oenema et
The majority of the studies (17/23) ended up with behavioural, physiological, or psychological between-group effects.

In six studies [two on nutrition (Park et al. 2008, de Vet et al. 2008), three on physical activity (Marcus et al. 2007, Spittaels et al. 2007, Wanner et al. 2009), one on weight management (Booth et al. 2008)] tailoring did not increase the effectiveness of the intervention and consequently the overall outcome, from the perspective of tailoring, can be regarded as negative. By this it was meant that some similar positive, neutral, or negative behavioural, physiological, or psychological outcomes were observed in both the tailored and nontailored interventions.

Furthermore, in some studies the effectiveness of the intervention was reported as mixed from the perspective of tailoring (Tate et al. 2001, 2006, Hageman et al. 2005, Oenema et al. 2005, Kroeze et al. 2008b). This means that change in some measured variables may have been better and in others worse when compared with the control group. For example, Hageman et al. (2005) observed a significant between-group effect on secondary outcomes but not on the primary outcome, namely, physical activity. Moreover, Tate et al. (2001) showed that the self-reported and objectively measured results might not always be in line. The tailored intervention group ended up with significantly greater objectively measured weight loss and greater reduction in waist circumference. However, the participants in both groups reported changes in diet of similar magnitude despite significantly different magnitudes of weight loss.
6 Discussion

In the beginning of this chapter the aims of this thesis are repeated. The most important findings of the thesis will be discussed and the research questions answered. The discussion is continued by scrutinising the studies’ overall contribution to theory and implications for practice. The limitations of the studies of this thesis are also discussed. Finally, ideas for future research are suggested.

The aim of this thesis is twofold: to increase understanding about the user of health information and about tailoring health information. Firstly, the thesis aims to indicate differences in the health information users’ characteristics that focus on their health information behaviour. The differences are investigated in human information behaviour as such, and in relation to indicators of physical health status with an aim to explore the potential to tailor health information on the basis of these differences. Secondly, the thesis aims to examine intervention studies investigating the effectiveness of tailoring in the context of physical activity, nutrition or weight management.

6.1 Health information behaviour in relation to physical health status

The relation of individuals’ information behaviour and self-reported health status or health behaviours has been under research in Information Studies (See subchapter 2.3.5). The focus of this thesis is on the relation of health information behaviour and objectively measured physical health status of individuals. Research question 1 was set as follows: What kind of differentiating factors can be identified in prediabetic individuals’ interest in and searching for health information as well as in the frequency prediabetic individuals wish to receive tailored health information in relation to their objectively measured physical health status? Study 1 of this thesis answers this research question.

Research question 2 was set as follows: What kind of differentiating factors related to health information use can be identified? This question is answered through subquestions 2a-2e. From them subquestion 2a related to Study 1 and was set as follows: Does prediabetic individuals’ self-estimated impact of obtained health information differ in relation to their objectively measured physical health status? The findings of Study 1 and answers to questions 1 and 2a are discussed and combined in subchapter 6.1. The answers to subquestions 2b-2e are summarised in subchapter 6.1.1.
The interest in information about nutrition and type 2 diabetes was evident for prediabetic individuals, but information about physical activity does not seem to attract them to the same extent (Study 1). In a similar vein, behaviour changes related to nutrition were more likely than changes related to physical activity. Seventy percent of the prediabetic individuals estimated that the obtained information had made them change their eating habits, whereas only 40% of them reported similar changes in physical activity habits. This finding is in line with previous research as it has been concluded that eating habits are usually easier to change than behaviour related to physical activity (Kroeze et al. 2006, Neville et al. 2009b, see also Study 4 of this thesis).

Obese individuals were most likely to seek information about nutrition. Additionally the results suggest that the likelihood of changing eating habits based on obtained information increased with higher BMI levels. This may indicate that obese individuals seek information related to nutrition and the found information can lead to attempts to change their health behaviours.

The desire to receive tailored information about physical activity, nutrition and diabetes is evident for the prediabetic individuals. Moreover, research on traditional health counselling shows that there is a strong “dose–response relationship” between the number and intensity of counselling sessions and behaviour change outcomes (Verheijden et al. 2007) and so the frequency of provision of tailored health information is also important. According to the findings of this thesis prediabetic individuals with poor fitness classifications and high BMI values desire to receive tailored information frequently and repeatedly. However, it should be noted that all participants were at high risk for type 2 diabetes, and they were also aware of the risk. This raises the question whether individuals with better fitness and lower BMI do not really internalise the risk and therefore do not think that they would need tailored health information frequently.

### 6.1.1 Information reception and message strategies

According to Rimer and Kreuter (2006) tailoring can enhance motivation to process health information, for instance, by matching content to an individual’s information needs and also by providing information and health messages in the design, structure and type preferred by the individual. The degree to which a health message’s type differs from an individual’s preference is predicted to be inversely related to effectiveness of messages in promoting healthy behaviours (Dailey et al. 2010). Additionally, Ivanov (2012: 79) states that the health message presentation should
be carefully considered for the best results in tailoring health information. The message structure and type may be important particularly with regard to message processing (Noar et al. 2009: 108) and thus also for an individual’s information reception. Information reception can be defined as the first stage of the information use process (Nahl & Bilal 2007: 4–8).

In this thesis, information reception relates to information users’ perceptions of and preferences for different kinds of message presentations, that is to ways in which the information provider can construct a message by using different message strategies. The focus of this thesis is placed on the fear appeal and feedback message strategies (see subchapter 3.7).

An individual’s reception of message strategies could be used as a tailoring variable. In this study, however, the purpose was not, straightforwardly, to investigate the utilisation of reception of information as a basis to tailor, but to focus on the differentiating factors in the relation to, for instance, preference for different feedback message tactics and physical health status.

**Fear appeal**

Fear appeal is one of the most commonly used appeals in the construction of health messages. Individual differences have been found to relate with the response to the severity of the threat in fear appeal (e.g., Keller & Lehmann 2008) but other factors causing individual differences have not been widely studied. Therefore research question 2b was set as follows: *Do the prediabetic individuals’ perceptions of the fear appeal message strategy vary according to their objectively measured physical health status?* Further 2c was as follows: *Do the prediabetic individuals’ perceptions of the fear appeal message strategy vary according to possible improvements in their physical health status during a three-month health behaviour change intervention trial?* These subquestions are answered by Study 2 of this thesis.

The answer to subquestion 2b is that no statistically significant results were found. However, as an answer to subquestion 2c, an interesting observation was made according to whether prediabetic individuals had improved their physical health status during the intervention trial. The prediabetic individuals who succeeded in losing weight during the 3-month intervention trial were significantly more likely to perceive that threatening mental images about the onset of diabetes were able to promote their physical activity and eating behaviour. This indicates that individuals with successful behavioural experiences—observed as weight loss—may respond in a more flexible manner to threatening information than
individuals who did not succeed in improving their health status by losing weight. An explanation for this result could be, that by participating in the PreDiabEx intervention trial, some of the prediabetic individuals had improved their self-efficacy through self-affirmation. According to Bandura (1977), successful performance of target behaviour increases self-efficacy, and on the other hand self-efficacy has been stated to predict the behaviour in the context of exercise (Rimal 2001). Self-affirmation allows individuals to respond in a more flexible manner to threatening health information that is phrased in such a way that it is not too frightening to them (Sherman & Cohen 2002). (See also subchapter 3.8).

Additionally, it has been stated that fear appeal messages should be accompanied by encouraging messages or feedback (Sherman et al. 2000, Ruiter & Kok 2012: 125–126, Contento 2011: 247). In Study 3 young men’s high exercise self-efficacy was associated with a preference for the ipsative and normative feedback message tactics. Thus, it could be argued that for individuals with high exercise self-efficacy (increased, for instance, by successful experiences in exercise) the fear appeal messages could be accompanied by the comparative feedback messages.

However, it has to be remembered that no statistically significant differences in the perceptions of the fear appeal message strategy were found in association to current aerobic fitness, BMI or FPG levels as already stated as a result for research subquestion 1b. With regard to BMI, the reason for this may be that at the end of the intervention 90% of the participants were still overweight or obese, and consequently, the scatter of BMI values is quite small.

**Feedback**

In Studies 2 and 3 of this thesis, the majority of participants had a preference for the ipsative, normative and theoretically-driven feedback message tactics (that is, they preferred ipsative or normative comparison as motivational or were interested in scientific health facts). This suggests that the ipsative, normative and theoretically-driven feedback message tactics can generally be considered suitable for representing health promotion feedback for prediabetic individuals as well as young men. However, individual differences based on physical health status were found in preferences for these feedback message tactics. In the research literature, individual differences have been found to relate to preference for the normative compared to ipsative feedback message tactic (e.g., Brunstein & Maier 2005). In this thesis subquestion 2d was stated as follows: Do the preferences for the feedback message tactics vary according to objectively measured physical health status among
prediabetic individuals or young men? Studies 2 and 3 of this thesis answer this research question. Additionally, Study 2 answers subquestion 2e that is as follows: Do the preferences for the feedback message tactics vary according to possible improvements in prediabetic individuals’ physical health status during a three-month health behaviour change intervention trial? These subquestions are answered in this section.

Statistically significant differences between individuals were observed in relation to their preferences for the feedback message tactics and objectively measured indicators of physical health status. Particularly, the prediabetic individuals who did not lose weight during the trial, perceived the normative comparison as motivational (Study 2). This result was supported by Study 3, in which being overweight or obese was associated with preference for the normative feedback message tactic. The results indicate that overweight and obese individuals, and particularly those who have not progressed in weight loss (regardless of whether it was their explicit goal or not), seemed to prefer the normative comparison and thus also normative feedback message tactic.

This finding is supported by the ideas of Fishbach et al. (2010). When pursuing a goal, individuals often start by evaluating their commitment and then shift to monitoring progress as they gain experience. In addition, in the early stage a positive feedback about the individuals’ commitment will increase their possibilities to reach the goal. Hereby, it could be stated that normative comparison informs an individual about his or her commitment to the issue in relation to others, and in turn, ipsative comparison relates to monitoring the progress.

Furthermore, it has been stated that achievement-motivated individuals usually prefer the ipsative over normative feedback (Brunstein & Maier 2005). Overweight and obese young men as well as prediabetic individuals may be less motivated by their own achievements than by those not belonging to these groups. The situation described by a normative statement “I get motivated when I have done better than others” may feel more distant but at the same time more significant for overweight or obese individuals than for individuals with normal BMI. However, current BMI levels of prediabetic individuals did not stand out as a statistically significant differentiating factor. This may be due to the smaller scatter in prediabetic individuals’ BMI values than in young men’s BMI values. Almost all prediabetic individuals were overweight or obese, while the BMI level for most of the young men was normal.
Young men with a low body fat percentage preferred the ipsative feedback message tactic more than men with a high fat percentage (Study 3). However, BMI level was not a statistically significant differentiating factor relating to preference for ipsative feedback. This may be due to the fact that an individual is able to have at the same time a low fat percentage according to InBody measurement and a high BMI level as a result of muscular body composition. Furthermore, young men with good aerobic fitness preferred both the ipsative and normative feedback message tactic more than individuals with poor fitness (Study 3). Men with good aerobic fitness may be more active and also achievement-motivated. They may desire all kinds of comparative information related to their physical health status and its progress.

Although the statements concerning the ipsative and normative comparison were positively framed and emphasised improvement in the individual’s performance, feedback messages may entail a threat to individuals with poor aerobic fitness. Overall, people are considered to be motivated to possess, enhance and maintain a positive self-image (Steele 1988). If an individual anticipates that the feedback he/she will be receiving would be negative, that information may pose a threat to the receiver’s self-image and can lead to processing the threatening information defensively (Sherman et al. 2000).

Among prediabetic individuals, aerobic fitness was not a statistically significant differentiating factor regarding preference for the investigated feedback message tactics. This may be due to the fact that more of the prediabetic individuals had poor aerobic fitness levels (19%) than did the young men (5%). According to these studies prediabetic individuals, in general, may be less keen to be compared with others. Furthermore, among prediabetic individuals, the relationship between preferences for the theoretically-driven feedback message tactic and the indicators of physical health status was not statistically significant. On the other hand, among young men, an association was observed for the grip strength, but not for any other investigated variables.

Nevertheless, it has to be taken into account that, in the logistic regression analysis of Study 3, none of the investigated objectively measured variables independently predicted preference for the ipsative, normative or theoretically-driven feedback message tactic, even though the BMI remained as the final variable in the analysis.
6.1.2 Differentiating factors that could be taken into account in tailoring health information

Tailoring is based on differentiating factors between individuals and this thesis provides a new insight into the use of differentiating factors in health information behaviour as basis for tailoring health information. The responses to questions 1 and 2 form the basis for answering research question 3: *How can the identified differentiating factors be taken into account in tailoring health information and information presentation?*

According to Study 1 prediabetic individuals were interested in information about nutrition and type 2 diabetes and they had also searched for information related to these topics. In contrary, information about physical activity did not attract prediabetic individuals to the same extent. Similarly, the self-reported impact of information about physical activity on individuals’ behaviour was smaller than the impact of information about nutrition.

The reasons for these results can be speculated, for example, as follows: Is the available information about physical activity too difficult to understand, too hard to find or presented uninterestingly? Is the prediabetic individuals’ level of health information literacy lower when it comes to the topic of physical activity? Furthermore, research literature concludes that eating habits are usually easier to change than behaviours related to physical activity (*Kroeze et al.* 2006, *Neville et al.* 2009, see also Study 4 of this thesis). Thus, it could be argued that the change in physical activity habits may demand more help, support and encouragement. All things considered, it can be suggested that tailored physical activity information should be delivered to prediabetic individuals. In other words, individuals should receive relevant information that is provided and presented in a suitable manner and amount, through an effective and easy-to-use channel.

Moreover, in Study 1 it was also perceived that especially individuals with poor fitness classifications and high BMI values desire to receive tailored information about nutrition, physical activity and type 2 diabetes frequently. Hereby, it could be stated that even prediabetic individuals with poor physical health status do not seem to have a tendency to avoid health information. However, as pointed out already in the answer to subquestion 1a, other prediabetic individuals, without clear signs of poor physical health status, are also at high risk for type 2 diabetes. Therefore, they should also be willing to receive tailored health information frequently, because it has been argued that providing information to those at high risk for diabetes is important in preventing type 2
diabetes (Van Esch et al. 2006). Even though these specific individuals participate in a diabetes prevention intervention, they still may not internalise their risk utterly and because of this they form an intriguing group that should be considered when tailoring health information.

Studies 2 and 3 increase our knowledge of the relationship between reception of information (in particular, perception of the fear appeal message strategy and preferences for the feedback message tactics) and physical health status. The findings of this thesis indicate that different kinds of health messages could be given to those who have succeeded in improving their health behaviours and to those who yet have not. Improvement of physical activity is also relevant in health behaviour change theories that include stages of change (e.g., Transtheoretical Model). The results of Studies 2 and 3 also elucidate how different feedback strategies should be used in tailoring messages for individuals at different stages. For instance, according to the results, the fear appeal message strategy needs to be used with caution, especially for those who have not yet succeeded in improving their health behaviours and consequently may also have a low self-efficacy. This view is supported by research literature as it has been argued, that success in performing the behaviour can strengthen self-efficacy (Bandura 1977) and fear appeal is effective only if individuals feel that they can do something to protect themselves (Witte 1994, Rimal 2001, Contento 2011: 85, Howell & Shepperd 2012).

Similar caution as with the fear appeal strategy might also be taken when using feedback based on normative comparison. According to the results of Study 2, prediabetic individuals who have not lost weight during a 3-month intervention trial period prefer the normative feedback message tactic. In addition, overweight or obese young men in Study 3 preferred this tactic. It must be noted that, in these studies, the statement related to normative comparison was phrased in a positive manner and positive feedback related to commitment is most effective for individuals who are in an early stage in changing their behaviour (Fishbach et al. 2010), in this case related to weight-loss. In conclusion, tailored health information provided to these individuals that are in their early stages of weight loss behaviour change (i.e., are overweight or obese) should be positively framed and structured with the normative feedback message tactic. Of course this kind of information can only be given in situations where the individual’s commitment to behaviour change (or behaviour itself) has been better than his or her peers or the norm. In most situations the negatively framed normative feedback should be avoided.
On the other hand, the results of Study 3 indicate that young men with good aerobic fitness (as well as high self-efficacy, studying in the academic track of an upper secondary school) were more likely to prefer both the ipsative and normative feedback message tactics than men with poor aerobic fitness (as well as lower self-efficacy or education). These men should be provided all sorts of tailored comparative feedback as messages on their lack of success may also enhance their efforts towards their goals (see Fishbach et al. 2010).

6.2 Intervention studies investigating the effectiveness of tailored health communication

Intervention studies are used to study the effectiveness of tailoring. In these studies the outcomes can be measured by using subjective or objective measurements (see subchapter 3.9.2). The objective measurements are typically physiological measurements. In randomised controlled trial studies the measurements are repeated at the beginning and after the trial. So it would be possible to use the physiological measurements also as a basis to tailor health information as they are generally more reliable and valid compared to self-reports. However, individual differences based on objective measurements have rarely been used as a basis for tailoring health information. The reason for this neglect is that tailoring usually relies on self-assessment (Kreuter et al. 1999: 89).

Study 4 of this thesis is a literature review focusing on “second generation” tailored behaviour change intervention studies. In the end 23 studies were included into the analysis. Research question 4 was set as follows: What kind of tailored intervention studies, which use a computer as the medium of delivery and aim at behaviour change in physical activity, nutrition or weight management, have been conducted? The analysis focuses on objectives set for the behaviour change, theories or theoretical concepts used for building theoretical background, intervention design, outcomes measured, statistically significant evidence related to the difference between the intervention and control group and possible biases in the selected intervention studies.

Of the 23 studies included into the review analysis, ten aimed at behaviour change in nutrition, seven in physical activity, two in both nutrition and physical activity and four on behaviour change related to weight management. The TTM and related theoretical concept of stages of change as well as the concept of self-efficacy, which is connected to several behaviour change theories, were mentioned most often in the articles of the studies. This finding is supported by other reviews, as the TTM
and the Social Cognitive Theory, as well as the theoretical constructs related to them, have been found to be the most commonly used for background building in tailored health programs and interventions (Lustria et al. 2009, Broekhuizen et al. 2012, Noar & Van Stee 2012: 209–229). Theories applied in the studies included to Study 4 have already been further discussed in subchapter 5.7.2.

The intervention designs of 13 of the 23 studies included a general information control group. In contrast, a no-information control group (or waiting list group) was used in nine studies. (See also subchapter 5.7.3). The effectiveness of the intervention study is measured by outcome measures. Outcomes can be monitored by subjective (e.g., self-reports) or objective measures (i.e. physiological measurements). Fifteen studies of the 23 relied only on self-reports (see subchapter 5.7.1). This confirms previous findings (e.g., Lustria et al. 2009) and has been given support by a more recent review by Broekhuizen et al. (2012). In their systematic review, most of the studies in the analysis provided tailored feedback or information based on self-reported behaviour. In addition, most lacked objective assessments of effects of nutrition interventions, whereas physical activity intervention studies more often used objective measures for behaviour changes. In the review of Study 4 of this thesis, objectively measured variables included weight, physical activity, blood pressure, body fat percentage, blood lipids (e.g., cholesterol), waist circumference, flexibility and cardiorespiratory fitness (e.g., VO_{max}). In the review by Broekhuizen et al. (2012) BMI and waist circumference were the most frequently used objective indicators.

Almost all studies reviewed in Study 4 of the thesis, 21 of 23, measured indicators connected to behavioural or physiological outcomes. Two of 23 studies measured only psychological factors. The majority of the studies (17/23) ended up with behavioural, physiological or psychological between-group effects. In five of these studies the effectiveness of the intervention was reported as mixed from the perspective of tailoring. Consequently, this review as well as more recent reviews by Broekhuizen et al. (2012) and Lustria et al. (2013) confirm and further strengthen the previous evidence that computer-tailored interventions are effective.

However, when assessing outcomes, it is important to consider possible biases in the studies. For example, it must be noted that all studies selected for the review in Study 4 relied on voluntary participants, which may cause a self-selection bias. Moreover, the most common biases identified in the studies were:

- Self-reporting as the only method of data collection, in 15 of the 23 studies.
- Lack of a pure no-information control group, as in 14 of the studies.
Overrepresentation of one gender even though the target group included both genders, for example, more women than men, as in ten of the studies, or more men than women, as in two of the studies.

Moreover, in ten of the studies, the participants were reported to differ from the national average in terms of their socioeconomic background (e.g., education and income), while in three of the studies, participants were more physically active than the national average. In this analysis of the study articles’ content causalities are not investigated further.

The outcomes of the studies were more positive regarding nutrition interventions, and it has been proposed that fruit and vegetable consumption is a relatively easy behavioural change to use as a first step (Smeets et al. 2007). However, the outcomes were less positive regarding physical activity interventions as many studies ended up with negative outcomes from the perspective of tailoring (see Appendix 6). In four of nine physical activity (as well as both physical activity and nutrition) intervention studies, the outcomes were mixed (Hageman et al. 2005) or negative (Marcus et al. 2007, Spittaels et al. 2007, Wanner et al. 2009) from the perspective of tailoring. This result is in line with the studies by Neville et al. (2009b) and Kroeze et al. (2006). Furthermore, the observation of mixed results of physical activity studies has been confirmed by more recent reviews (Broekhuizen et al. 2012, Lustria et al. 2013).

Biases affecting the outcomes of the studies focusing on physical activity were perceived. The intervention design and methods used for outcome measurements seemed to cause biases. Moreover, a bias effect in the intervention designs was identified, that may partly explain the differences in the outcomes of the physical activity interventions examined. Physical activity (as well as both physical activity and nutrition) intervention studies that did not end up with a significant between-group effect on physical activity measurements (Hageman et al. 2005, Marcus et al. 2007, Spittaels et al. 2007, Wanner et al. 2009) used a general information control group, whereas those whose outcome was positive from the perspective of tailoring (Napolitano et al. 2003, Frenn et al. 2005, Spittaels et al. 2007, Dunton & Robertson 2008, Oenema et al. 2008) had a no-information control group. Additionally, in a review by Broekhuizen et al. (2012), the strongest evidence and significant effects, especially in physical activity studies, came from the studies that compared intervention studies providing tailored information to no-information control groups instead of comparing them to general information control groups.
The studies of this analysis used both objective (physiological measurements) and subjective measurements (self-reports). It must be noted that outcomes of the self-report and physiological measurements of the same type of behaviour do not always match, which was the case in two studies (Tate et al. 2001, Wanner et al. 2009) included in the analysis. In the study by Wanner et al. (2009), self-reported changes in physical activity levels were not confirmed by objective measures. Tate et al. (2001) state that this was also the case in other studies. Participation itself may influence the perception of physical activity behaviour and thus influence the levels of the self-reported physical activity (Wanner et al. 2009). Moreover, it has been stated that “reported behaviour change can also occur in the absence of actual behaviour change due to social desirability effects” (Michie & Abraham 2004). Therefore, the use of objective measures of physical activity may be important in determining whether the self-reported changes that are found are real (Neville et al. 2009a,b).

The most interesting observation was made when the intervention design and outcome measurements were scrutinised together. Physical activity (as well as both physical activity and nutrition) intervention studies, which included only a no-information control group, used only self-reports as outcome measurements. Moreover, studies including a general information control group used both self-reports and objective measurements as outcome measurements. As the former resulted in positive outcomes from the perspective of tailoring and the latter resulted in negative or mixed outcomes, the intervention design and outcome measurement choices seem to have a great impact on the outcomes of the studies. It cannot be concluded whether the difference in the outcomes of the former and latter studies was caused purely by the intervention design or outcome measurement choices or by their cooperative action.

6.3 Contribution to theory

The findings of this thesis make several contributions to the current fields of health information behaviour, tailoring health communication and health promotion research. The thesis contributes to the body of research by focusing on the user of health information and his/her individual characteristics in the context of health promotion. It provides new insights into the health information behaviour of prediabetic men and women of different ages as well as conscription aged young men. The information behaviour of these target groups has not received a lot of attention in the context of health related research of Information Studies. In the thesis health information behaviour is scrutinised as interest in health information,
searching for information, self-estimates of the impact of information, desire for information and reception of different message strategies. In Information Studies health information seeking has been a more popular research subject than health information use (Vakkari 2008, Savolainen 2008, 2009, Wilson 2009). In this particular research the self-estimated impact of information and reception of different message strategies are considered to relate to health information use. This supports the viewpoint suggested by Nahl and Bilal (2007: 4–8) that information reception can be defined as the first stage of the information use process. Therefore, the thesis contributes particularly to the research area of health information use. Additionally, it continues the research work done on health information behaviour of Finnish individuals initiated by, for example, Mariam Ginman, Kristina Eriksson-Backa and Stefan Ek (see e.g., Ginman 2000, Ginman & Eriksson-Backa 2001).

Tailoring health information has mainly been studied by researchers of Communication, Social Psychology and Public Health (see chapter 3). Hereby, the thesis adds to the limited body of research on tailoring health information conducted in Information Studies. At the same time, this particular research aims at addressing the gap in knowledge on relations between health information behaviour and tailoring health information. Understanding the reasons behind individual differences in health information behaviour, especially in information use, is essential for health promotion (Ginman 2000: 181, 187, Case 2012: 206) and for the further development of tailored information services (Ek & Heinström 2011). Accordingly, the thesis contributes to the restricted amount of research that investigates factors relating to health information behaviour as a basis of tailoring health communication.

The thesis increases our knowledge of health information users´ individual differences related to their health information behaviour that could be used as a basis to tailor health information. Furthermore, the thesis gives insight into further investigation of the relationship between self-estimated health information behaviour and objectively measured physical health status and health outcomes. Thus, it provides new knowledge on this relationship as in previous studies the information about individuals’ physical health status or individuals’ health behaviours have been obtained through self-reports (see subchapter 2.3.5). Moreover, the thesis emphasises the importance of objective measurements as a critical form of data collection (see subchapters 3.4 and 3.9) and brings up the novel idea of utilising the possible connections between individuals’ health information behaviour and physical health status in tailoring health information.
The findings of Study 4 of this thesis add to a growing body of review literature on intervention studies that investigate the effectiveness of tailored health communication. Study 4 increases our knowledge of “second generation” tailored health interventions aiming at behaviour change in physical activity, nutrition and weight management. The review confirms and further strengthens the previous evidence (e.g., Broekhuizen et al. 2012, Lustria et al. 2013) that computer-tailored interventions are effective. Anyway, similarly to previous research the outcomes of the analysed studies were more positive regarding nutrition interventions and less positive regarding physical activity interventions (see also Kroeze et al. 2006, Neville et al. 2009b). Mixed results of physical activity have also been confirmed by more recent reviews than Study 4 (see Broekhuizen et al. 2012, Lustria et al. 2013). However, in Study 4 a bias effect in the intervention design was identified, that may partly explain the differences in the outcomes of the physical activity interventions examined. This finding relates to whether a general information control group or no-information control group was used in interventions (see subchapter 6.2). Consequently, this novel finding adds to our knowledge of the role of information in intervention studies and is therefore interesting also from the viewpoint of Information Studies.

6.4 Implications to practice

The findings of this thesis will be of particular significance to those seeking to understand information users and to optimise the approach for communicating health messages and information. Some implications to practice have already been discussed in subchapter 6.1.2 as a response to research question 3.

This thesis adds to the literature on the relationship between health information behaviour and physical health status. However, exceptionally, in this thesis the indicators of physical health status are measured by objective physiological and biochemical measurements instead of self-reporting (see subchapter 2.3.5). Nowadays it is becoming more common to use objectively measured factors to measure the outcomes of an intervention study (Broekhuizen et al. 2012, see subchapter 3.9.2). This means that, for instance, aerobic fitness is measured in the beginning and at the end of the intervention. However, tailoring is still usually conducted by using only self-reported assessment data (Kreuter et al. 1999: 89, Lustria et al. 2009), even though objectively measured data would also be available at the beginning of the intervention. In this thesis it is suggested that this objectively measured data and especially the relations between
individuals’ health information behaviour and their physical health status should also be utilised in tailoring health information. The premise for this is that self-reported health behaviour estimates and results on physiological measurements may differ from the reality (Michie & Abraham 2004, Adamo et al. 2009, Wanner et al. 2009). Utilisation of the outcome measures as tailoring variables would be possible, especially for static tailoring, where tailored information is based on the baseline measurements (Krebs et al. 2010). Moreover, this approach could be combined with a more dynamic tailoring, where iterative data collected with mobile physiological sensing devices or self-reported assessments would also be used as a basis for tailoring during the intervention trial period.

In this thesis some interesting connections between health information behaviour and physical health status were found. They constitute differentiating factors between individuals. The identified differentiating factors are noteworthy from the point of view of health communication in general and also from the stance of targeting. Additionally, if objectively measured indicators of physical health status are used as a basis to tailor health information, the findings of this thesis provide a more accurate and theoretically-based portrayal of how health information should be presented for individuals with different physical health status.

The findings of Study 3 have been applied to the design of the information content in the MOPO study. In the MOPO study an interactive, gamified activation method, based on tailored health information, peer networks and participation was developed and examined. Through different kinds of message strategies, essentially the same health information content can be presented in a different manner to different kinds of individuals. For example, according to the findings of this thesis, overweight or obese individuals (that is, individuals that are in an early stage of changing weight loss behaviour) are more likely to prefer messages structured with the normative feedback message tactic than individuals with normal weight. Consequently, if the BMI is used as a basis to tailor health information, the information provider is now aware that individuals with higher BMI values should be given positively framed health messages structured with a normative feedback message tactic. More exact examples based on the thesis findings are presented in subchapter 6.1.2.

Furthermore, this thesis provides new insight into the significance of intervention design, particularly the choice of control group, as well as outcome measure choices in intervention studies. In Study 4 the most interesting observation was made when the intervention design and outcome measures were
scrutinised together (see subchapter 6.2). These factors seem to have a great impact on the observed effectiveness of tailoring, especially in studies aiming at behaviour change in physical activity. Consequently, it is argued that both a general information control group and a no-information control group (e.g., a waiting list group) should be used in intervention studies. The general information provided to the general information control group should also match the tailored information given to the intervention group in its length, amount and quality. Additionally, both subjective and objective outcome measures should be used. The use of encompassing intervention design and outcome measures would increase the credibility of the results of intervention studies by removing related biases.

6.5 Limitations

Finally, the most important limitations of Studies 1–4 need to be considered. These issues relate to, for example, reliability and validity of the studies and to potential systematic biases that can be caused, for example, by sampling, a researcher or a study subject (Peat et al. 2002: 61–64). Limitations may influence the ability to answer the research questions and play a role in estimating the credibility of the findings of the thesis.

6.5.1 Study sample

Selection or sampling bias occurs when there is a systematic difference between the characteristics of the individuals selected for a study and the characteristics of those who are not. Sampling bias may occur, for instance, when participants are volunteer. Those volunteering may differ from the basic population in their characteristics. (Bonita et al. 2006: 52–54).

In Studies 1 and 2 of this thesis the sample was a convenience sample of relatively small size (n = 72). However, the sample size was chosen based on the amount of participants needed to detect a statistically significant change in glucose levels when investigating the effectiveness of the intervention (results relating to intervention effectiveness are not reported in this thesis). Study participants were volunteer prediabetic individuals. The participants were mostly over 60 years and women. Thus, this might reflect the previous findings that women are generally more health-oriented than men (Bech-Larsen & Scholderer 2010) or that women are more likely than men to participate in health promotion
programs (Assaf et al. 2003, Pagoto et al. 2012). Additionally, older individuals are more likely than young to be prediabetic and retired individuals have more time to participate into studies.

Although the large study sample of study 3 was population-based and representative, it also was based on voluntariness. Not all the young men participating in the call-ups were willing to participate in the study. Those volunteering may differ from the basic population in their characteristics. However, the main characteristics of the participants and non-participants did not differ (data not presented).

The sample in Study 4 can be considered a convenience sample because only articles available as full text were chosen. Generally speaking, as with any review of published literature, the present update may have been affected by publication or distorted reporting bias that may have caused an overestimation of the positive findings (Broekhuizen et al. 2012).

6.5.2 Measurements

Measurement error occurs when the individual measurements or used methods are inaccurate, that is, their measurement validity is poor. Measurement error can be reduced by tight protocols and by making individual measurements as precise as possible. (Bonita et al. 2006: 52–54).

Studies 1, 2 and 3 rely partly on subjectively measured self-reported survey data collected by questionnaires. Furthermore, all the topics of surveys were assessed with only a few questions. Previous questionnaires in the literature were reviewed, but no validated questionnaire instruments were found for studying issues related to reception of information from the aspect of this thesis. (See also subchapter 4.3.1 for the limitations of questionnaires). Moreover, the results can be affected by the wordings of the questions, statements and alternatives given, the length of the questionnaire or the situation where self-reporting is conducted.

6.5.3 Data analysis, generalisation and repetition

Because of the small sample size and convenience sampling in Studies 1 and 2 the results of the statistical tests have to be considered as indicative and the generalisation of the results into a broader population of prediabetic individuals should be carefully considered. The participants of Study 3 presented a population-based sample of young Finnish men. However, sociocultural factors may influence their health information
behaviour and thus the found results could be best transferable to other Western countries. The results of Study 4 add substantially to our understanding of “second generation” tailored intervention studies, but the study cannot be repeated as such because it does not meet the requirements of a systematic review.

6.6 Ideas for future studies

This research has identified many questions in need of further investigation. Further work needs to be done to establish the most optimal basis for tailoring health information in different contexts. Additionally it should be examined whether objective measurements, such as physiological and biochemical measurements, should be more often used for the purpose. To accomplish this we must have an understanding of the information behaviour and information practices of the targets of the tailored information. The discipline of Information Studies has the potential to fill the gap in the existing knowledge and contribute to theory building within this multidisciplinary research area, as pointed out also by MacDonald et al. (2010).

Health information use and health information reception have not been under vigorous study. More research is needed to better understand individuals’ information reception and also information avoidance. Additionally, the relationship between an individual’s health information behaviour, particularly information use, and physical health status should be further studied. In the context of tailored health behaviour change programs and interventions, more attention should be paid to the interaction between information provider and information user.

6.6.1 Study sample and generalisation

Moreover, these studies should rely on large sample sizes and focus on different kinds of target populations. For instance, gender and age may be important predictors of feedback preference and specific age groups of prediabetic individuals should be further investigated. Reception of message strategies should be studied also in other population subgroups than among prediabetic individuals or young men. Additionally, more emphasis should be placed on engaging men to participate as usually women more actively take part in research studies. This phenomenon may bias the sample when participants include both women and men.

Additionally, a sampling bias may occur when participants are volunteers. In Study 3 information was available on the whole population sample taking part in the call-ups in the Oulu region, not only those willing to fill in the questionnaire and
participate in the physiological measurements. Through comparison of the volunteer participants and the whole population sample the self-selection bias can be investigated and even ruled out. However, for most studies, population values are not available. In any case, a statistical analysis also offers opportunities to diminish sampling biases. (Bose 2001).

Many articles written on tailoring studies lack a detailed description of how tailoring has been conducted and how feedback messages have been constructed. Therefore, it is suggested that future studies should include a thorough analysis of the feedback message tactics used in health communication to enable effective health promotion. Furthermore, as the amount of studies using “second” and “third generation” tailoring increase, more systematic reviews, outlining the results of these studies, should be conducted. By these reviews additional evidence can be received regarding the effectiveness of tailoring as well as the optimal means of delivery and information presentation.

6.6.2 Measurements and channels

In Study 4 biases affecting the outcomes of the intervention studies were found. These biases related to the intervention design and outcome measurement used in the studies. It would be interesting to know which of these biases have a bigger impact on the outcomes of the studies, and this should be studied further by systematic analysis. In this thesis intervention studies aiming at behaviour change in physical activity came to the fore.

In this thesis health information behaviour of individuals is studied by self-reports. This is a very typical way of studying this subject. However, new objective methods should be tested in investigating health information behaviour and reception of information in particular. The disciplines of Communication and Marketing have already used a wide range of new technologies. For example, the emotion of fear can be indicated by increased heart rate and perspiration that can be measured by the galvanic skin response (Gravetter & Forzano 2009: 90). Neural activity measurements and brain imaging can be conducted by positron-emission tomography (PET), electroencephalography (EEG) or the traditional and functional magnetic resonance imaging (MRI, fMRI) (Blackman & Kvaska 2011: 208). In recent years, fMRI has provided an abundance of insights into the localisation of emotional brain activities (e.g., Phan et al. 2002). Moreover, Communication Neuroscience has examined the effectiveness of tailoring with these methods (e.g., Chua et al. 2009, Kessels et al. 2011). Other examples of
methods that could be utilised in examining health information behaviour are tracking of eye movement or use of lifelogging cameras like SenseCam.

From the viewpoint of Information Studies the provision of preventive, tailored health information via a library network would be an interesting subject for research, and this could be explored as a part of public health policy (see also Birkenhead 2012). Furthermore, technological advantages allow new channels for delivering tailored health information and feedback. The use of these channels should be investigated. For example, avatar counsellors (e.g., Lisetti et al. 2012), games (Johnson & Case 2012: 205) and virtual communities (Toscos & Connelly 2010: 295–298) can be used to deliver tailored health communication and interventions. In the future, ubiquitous computing technologies and mobile devices may fill the digital divide (Bull 2011: 15). These technologies provide just-on-time support and information at where and when it is needed most (Toscos & Connelly 2010: 299) and thus can help to achieve “kairos”, that is, the opportune moment to persuade (see e.g., Räisänen et al. 2008). Moreover, combining second and third generation channels may prove successful, as it has been suggested that the use of multiple methods of interaction enhances the effectiveness of tailored health interventions (Webb et al. 2010).

Feedback on an individual’s physical health status and performance can be given through mobile-sensing devices and systems (Fortier et al. 2011). The sensory data collection and usage possibilities are only just beginning to be explored (Clarke & Steele 2012). Mobile physiologic sensing devices provide a considerable amount of information on individuals’ physical health status and the idea of continuously monitoring well-being using mobile-sensing devices is gaining popularity (Rabbi et al. 2011). In the future, for example, information about an individual’s electrocardiogram, oxygen saturation, temperature, blood flow and water retention may be available through these devices (Fortier et al. 2011).

Further studies should investigate new ways to gain objectively measured information that can be used as a basis to tailor health communication. Some studies have already used information from mobile-sensing devices as a basis to tailor health communication. For example, Slootmaker et al. (2009) provided intervention participants with an accelerometer that measured their total daily physical activity. Additionally, self-quantification, self-tracking, biohacking and self-surveillance are part of an emerging area of human activity that encourage individuals to collect (and share) data about themselves (Shilton 2012).
Further studies investigating possibilities to use biochemical measurements as a basis to tailor health information would be very interesting. For instance, the hormones ghrelin and leptin play central roles in the regulation of appetite, energy expenditure and body weight. Some individuals, due to their physiological or genetic makeup, have problems in the production of these hormones. Therefore, these individuals have difficulty recognising feelings of satiety or their appetite is overstimulated and they consume more calories than their body requires. (Blackman & Kvaska 2011: 8). It could be stated that these individuals need different kinds of support and information about nutrition as well as different kinds of feedback about their eating habits than other individuals.

It has been predicted that the future of medicine is the personalised medicine approach. Our genetic and proteomic information will be utilised to optimize our health care and medication as well as in the prevention of diseases. (Williams 1998, Weston & Hood 2004, Chen & Snyder 2012). Additionally, this versatile data could be used as an objectively obtained basis for tailoring health information. For example genetic studies have shown a genomic contribution to exercise responsiveness. Individuals respond to exercise in different ways and in different sensitivities. (Buford & Pahor 2012, Buford et al. 2013). Therefore, tailored physical activity interventions (Buford & Pahor 2012, Buford et al. 2013) and also tailored health information should be provided according to this individual difference.
7 Conclusions

It has been stated that tailored health communication is more effective than the general health communication. However, there is a need to identify evidence-based factors to be used as a basis for tailoring when providing tailored health information. (Duncan 2006, Noar et al. 2011). In this thesis differentiating factors in health information behaviour in relation to information users’ physical health status has been investigated. Additionally, tailored interventions utilising a computer in information delivery and focusing on physical activity, nutrition or weight management were examined.

This thesis is among the first studies conducted in Information Studies focusing on tailored health information. It also contributes to the restricted amount of research investigating factors related to health information behaviour as a basis to tailor health information. Furthermore, the methodological approach is novel. This study is among the first in Information Studies to combine subjective methods with objective physiological and biochemical measurements.

In this thesis it is suggested that objectively measured data should be more commonly used as a basis to tailor health information. The analysis of the data of the thesis revealed some important differentiating factors in health information behaviour in relation to physical health status of prediabetic individuals and young men. These factors could be taken into account in tailoring health information. For instance, different feedback message strategies could be utilised when providing health information for individuals with different physical health statuses.

Moreover, the thesis provides noteworthy information about “second generation” tailored intervention studies aiming at behaviour change in physical activity, nutrition or weight management. According to the findings, one of the most important issues to consider is biasing of these studies. In this thesis biases affecting the outcomes of the studies focusing on physical activity were identified. The intervention design as well as methods used for outcome measurements seemed to cause these biases.

The thesis contributes to the current field of research on both health information behaviour and tailoring health communication. It increases knowledge on how differences in information users’ health information behaviour in relation to their physical health status can be acknowledged in tailoring health information and information presentation. The findings support the development of health promotion and programs informed by evidence-based practice as well as the design and implementation of better tailored health interventions and intervention studies.
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Appendices

Appendix 1 PreDiabEx survey I – questions used in Study 1

PREDIABEX STUDY – SURVEY

1* Name ________________________________

Please answer the following questions by CIRCLING (e.g., 1 ) the correct alternative. The information is confidential and will be used in study analyses in a manner that preserves the anonymity of the individuals.

2 Personal identity code _____________

3 Gender
   1 man
   2 woman

4 What is your level of education?
   1 less than comprehensive school
   2 graduated from comprehensive school
   3 graduated from vocational track of secondary school
   4 graduated from academic track of secondary school
   5 graduated from vocational track of tertiary school
   6 graduated from academic track of tertiary school

5 What is your current marital status?
   1 married or common-law marriage
   2 unmarried
   3 widow / widower
   4 divorced

6 Give an estimate of your current level of physical fitness
   1 poor
   2 fair
   3 average
   4 good
   5 excellent

The following questions are concerned with information about physical activity, nutrition and diabetes

The answer choices are as follows:
1= strongly disagree
2= moderately disagree
3= not sure
4= moderately agree
5= strongly agree

The information related to physical activity (for example, information about different kinds of ways to exercise, information about the benefits of physical activity or information about specific forms of physical activity, e.g., instructions for gymnastics etc.)

7 - I am interested in information related to physical activity.

   1 2 3 4 5
8 - I often search for information related to physical activity.
   1 2 3 4 5
9 - I have found interesting information related to physical activity as a result of my information searching.
   1 2 3 4 5
10 - The information I’ve gained about physical activity has changed my physical activity habits.
      1 2 3 4 5
11 - I am willing to receive information about physical activity that would better take into account my personal
     characteristics and situation in life.
      1 2 3 4 5

The information related to nutrition (for example, information about food ingredients or diets, information about benefits of nutrition to your health)

12 - I am interested in information related to nutrition.
       1 2 3 4 5
13 - I often search for information related to nutrition.
       1 2 3 4 5
14 - I have found interesting information related to nutrition as a result of my information searching.
       1 2 3 4 5
15 - The information I’ve gained about nutrition has changed my eating habits.
       1 2 3 4 5
16 - I am willing to receive information about nutrition that would better take into account my personal
     characteristics and situation in life.
       1 2 3 4 5

Information related to diabetes (for example, information about symptoms and treatment)

17 - I am interested in information related to diabetes.
       1 2 3 4 5
18 - I have searched for information about the symptoms and care of diabetes.
       1 2 3 4 5
19 - I found it difficult to understand information related to diabetes.
       1 2 3 4 5

20 How often would you be willing to receive information about physical activity or nutrition that would take into
    account your personal characteristics and situation in life (delivered e.g. by using computer or mobile phone)?
    0 never
    1 a couple of times a year
    2 about once a month
    3 about once a week

*Only the questions used in the study are presented. Numbering is not the same as in the original questionnaire.
Appendix 2 PreDiabEx survey II – questions used in Study 2

SURVEY ON WELL-BEING AND HEALTH

1* Name: ________________________________________

Please answer the following questions by CIRCLING (e.g., 1 ) the correct alternative. The information is confidential and will be used in study analyses in a manner that preserves the anonymity of the individuals. Please fill in the whole survey. Thank you!

2 Read the following messages carefully. Which one of the following messages do you consider as the most motivating? Choose one of the alternatives!

"This week you have burned 1200 kcal by attending moderate exercise."

"This week you have attended a lot of moderate exercise. It has been beneficial to your health."

"This week you have consumed more calories than last week through moderate exercise."

"You have attended moderate exercise on three days this week. That is more than Finnish people of your age exercise, on average."

"This week you have attended moderate exercise on three days. This has been beneficial to your health, because according to general guidelines, moderate exercise can prevent the onset of type 2 diabetes."

"Not sure."

3 The statements below are concerned with information related to diabetes.

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Moderately disagree</th>
<th>Not sure</th>
<th>Moderately agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information related to diabetes raises fears</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Threatening mental images about the onset of diabetes dishearten me</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Threatening mental images about the onset of diabetes are able to promote physical activity and healthy eating behaviour</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4 The statements below relate to factors individuals may find motivating.

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Moderately disagree</th>
<th>Not sure</th>
<th>Moderately agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information about the improvement of my physical fitness motivates me</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I get motivated when I have done better than others</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I don’t desire scientific facts about health information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Only the questions used in the study are presented. Numbering is not the same as in the original questionnaire.
Appendix 3 Survey of Defence Forces and survey of MOPO study – questions used in Study 3

A question from a survey related to a medical examination conducted by Finnish Defence Forces:

1* Education
- comprehensive school
- upper secondary school’s vocational track
- / classes of upper secondary school’s academic track
- graduated from upper secondary school or studies in a higher educational institute

Questions from a survey of the MOPO study:

Survey: Physical activity, health and media use

1* ID= ____________
2 Date __/___ 2011

You have the opportunity to influence the MOPO study by answering the following questions. We investigate the health and physical activity of young adults and develop new ways to promote their well-being.

This survey is confidential and the information provided will not be shared with outsiders. The questions are answered by circling or checking the right alternative.

Please answer every question.

3 How old are you? ________ years old

4 What is the amount of your physical activity per day (for example, at work, on the way to school by cycling/walking, school breaks, bustling at home, sports)?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>less than 1 hour a day</td>
</tr>
<tr>
<td>2</td>
<td>1-2 hours a day</td>
</tr>
<tr>
<td>3</td>
<td>over 2 hours a day</td>
</tr>
</tbody>
</table>

5 How confident are you that you will be able to exercise regardless of the following obstacles?

1= not confident at all, 2= quite unconfident, 3= not sure or unsure, 4= quite confident, 5= extremely confident

I would attend to physical activity even though…

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>... I would be feeling tired</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>... I would be feeling under pressure from work</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>... the weather would be bad</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>... I would be experiencing personal problems</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>... I would feel depressed</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>... I would feel anxious</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

... I would be recovering from an illness or injury that caused me to stop exercising

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>... I would feel physical discomfort when I exercise</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>... I had been on vacation</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>... I would have too much work to do at home</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
...there would be visitors present
...there would be other interesting things to do
...I had not reached my exercise goals
...I would not have support from my family or friends
...I would be on a vacation
...I would have other time consuming commitments
...I would be experiencing family problems

6 Choose (circle) the alternative that in your opinion best describes you (a-e).

Below, exercise refers to that which causes rapid breathing and increased sweating, for example brisk walking, jogging, swimming or ball games 20 minutes or more at a time at least three times a week.

I presently exercise on a regular basis and have been doing so for longer than 6 months.
I presently exercise on a regular basis, but I have only begun doing so within the past 6 months.
I presently do not exercise, but I have been thinking about starting to exercise within the next month.
I presently do not exercise, but I have been thinking about starting to exercise within the next 6 months.
I presently do not exercise and do not plan to start exercising in the next 6 months.

7 Choose and circle the alternative after the statements that in your opinion best describes your thoughts.

1= strongly disagree, 2= moderately disagree, 3= Unsure, 4= moderately agree, 5= strongly agree, 0= not sure

Information about the improvement of my physical fitness motivates me
I get motivated when I have done better than others
I don’t desire scientific facts about health information

*Only the questions used in the study are presented. Numbering is not the same as in the original questionnaire.*
## Appendix 4 Characteristics of the study sample in Studies 1 and 2

<table>
<thead>
<tr>
<th>Variable</th>
<th>Information about participants before the intervention (n = 69)</th>
<th>Information about participants after the intervention (n = 69)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>number of participants (n)</td>
<td>per cent (%)</td>
</tr>
<tr>
<td><strong>Level of education</strong></td>
<td>(n = 69)</td>
<td></td>
</tr>
<tr>
<td>Higher level</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>Secondary level</td>
<td>17</td>
<td>24</td>
</tr>
<tr>
<td>Primary-level or lower secondary level</td>
<td>39</td>
<td>56</td>
</tr>
<tr>
<td><strong>Self-estimate of physical fitness</strong></td>
<td>(n = 69)</td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Good</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Average</td>
<td>26</td>
<td>38</td>
</tr>
<tr>
<td>Fair</td>
<td>31</td>
<td>45</td>
</tr>
<tr>
<td>Poor</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td><strong>Body mass index (BMI)</strong></td>
<td>(n = 69)</td>
<td></td>
</tr>
<tr>
<td>Normal weight (18.5-24.9)</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Overweight (25.0-29.9)</td>
<td>26</td>
<td>38</td>
</tr>
<tr>
<td>Obesity class I (30.0-34.9)</td>
<td>24</td>
<td>35</td>
</tr>
<tr>
<td>Obesity class II (35-40)</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>Obesity class III (over 40)</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td><strong>Aerobic fitness</strong></td>
<td>(n = 67)</td>
<td></td>
</tr>
<tr>
<td>Excellent, very good or good</td>
<td>16</td>
<td>24</td>
</tr>
<tr>
<td>Average or fair</td>
<td>27</td>
<td>40</td>
</tr>
<tr>
<td>Poor or very poor</td>
<td>24</td>
<td>36</td>
</tr>
<tr>
<td><strong>Fasting plasma glucose (FPG) levels</strong></td>
<td>(n = 72)</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>28</td>
<td>39</td>
</tr>
<tr>
<td>Impaired</td>
<td>33</td>
<td>46</td>
</tr>
<tr>
<td>Diabetic</td>
<td>11</td>
<td>15</td>
</tr>
</tbody>
</table>

1 Assessed only in the first questionnaire conducted at the beginning of the 3-month intervention
Appendix 5 Characteristics of the study population in Study 3

<table>
<thead>
<tr>
<th>Variable</th>
<th>number of participants (n)</th>
<th>per cent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest level of education / studying currently (n = 5041)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduated from upper secondary school or studies in a higher education institution</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Academic track of upper secondary school</td>
<td>289</td>
<td>57.3</td>
</tr>
<tr>
<td>Upper secondary school's vocational track</td>
<td>199</td>
<td>39.5</td>
</tr>
<tr>
<td>Comprehensive school</td>
<td>11</td>
<td>2.2</td>
</tr>
<tr>
<td>Self-estimated physical activity (n = 524)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;2 hours a day</td>
<td>136</td>
<td>26.4</td>
</tr>
<tr>
<td>1-2 hours a day</td>
<td>256</td>
<td>49.6</td>
</tr>
<tr>
<td>&lt; 1 hour a day</td>
<td>123</td>
<td>23.8</td>
</tr>
<tr>
<td>Exercise self-efficacy (n = 459)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>147</td>
<td>32.0</td>
</tr>
<tr>
<td>Moderate</td>
<td>199</td>
<td>43.4</td>
</tr>
<tr>
<td>Weak</td>
<td>113</td>
<td>24.6</td>
</tr>
<tr>
<td>Stage of exercise behaviour change (n = 509)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance</td>
<td>304</td>
<td>59.7</td>
</tr>
<tr>
<td>Action</td>
<td>64</td>
<td>12.6</td>
</tr>
<tr>
<td>Preparation</td>
<td>58</td>
<td>11.4</td>
</tr>
<tr>
<td>Contemplation</td>
<td>51</td>
<td>10.0</td>
</tr>
<tr>
<td>Precontemplation</td>
<td>32</td>
<td>6.3</td>
</tr>
<tr>
<td>BMI (n = 523)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight (&lt; 18.4)</td>
<td>41</td>
<td>7.8</td>
</tr>
<tr>
<td>Normal weight (18.5-24.9)</td>
<td>365</td>
<td>69.8</td>
</tr>
<tr>
<td>Overweight (25.0-29.9)</td>
<td>87</td>
<td>16.6</td>
</tr>
<tr>
<td>Obese (&gt; 30.0)</td>
<td>30</td>
<td>5.7</td>
</tr>
<tr>
<td>Body fat % (n = 525)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight (&lt; 3.0)</td>
<td>2</td>
<td>0.4</td>
</tr>
<tr>
<td>Excellent (3.1-12.0)</td>
<td>200</td>
<td>37.7</td>
</tr>
<tr>
<td>Good (12.1-17.0)</td>
<td>147</td>
<td>28.0</td>
</tr>
<tr>
<td>Moderate (17.1-22.0)</td>
<td>75</td>
<td>14.3</td>
</tr>
<tr>
<td>Overweight (22.1-27.0)</td>
<td>52</td>
<td>9.9</td>
</tr>
<tr>
<td>Obese (&gt; 27.1)</td>
<td>51</td>
<td>9.7</td>
</tr>
<tr>
<td>Variable</td>
<td>number of participants (n)</td>
<td>per cent (%)</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td><strong>Aerobic fitness (n = 520)</strong>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>42</td>
<td>8.1</td>
</tr>
<tr>
<td>Very good</td>
<td>99</td>
<td>19.0</td>
</tr>
<tr>
<td>Good</td>
<td>105</td>
<td>20.2</td>
</tr>
<tr>
<td>Average</td>
<td>249</td>
<td>47.9</td>
</tr>
<tr>
<td>Poor</td>
<td>25</td>
<td>4.8</td>
</tr>
<tr>
<td><strong>Grip strength (n = 503)</strong>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very good</td>
<td>78</td>
<td>15.5</td>
</tr>
<tr>
<td>Good</td>
<td>111</td>
<td>22.1</td>
</tr>
<tr>
<td>Average</td>
<td>128</td>
<td>25.4</td>
</tr>
<tr>
<td>Weak</td>
<td>186</td>
<td>37.0</td>
</tr>
</tbody>
</table>

*numbers do not match due to missing data, ^assessed before the call-ups during a medical examination conducted by the Defence Forces.
### Appendix 6 Objectives of behaviour change, theories applied, intervention design and outcomes in the review in Study 4

<table>
<thead>
<tr>
<th>Study Authors and Year of Publication</th>
<th>Objectives of behaviour change</th>
<th>Theories or theoretical concepts mentioned</th>
<th>Intervention design</th>
<th>Outcomes</th>
<th>Statistically significant evidence related to difference between intervention and control group was found?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dunton &amp; Robertson 2008</td>
<td>Physical activity</td>
<td>Transtheoretical Model (TTM) / stages of change</td>
<td>1. Tailored information group 2. No-information control group (waiting list)</td>
<td>Physical activity, determinants of physical activity (self-report)</td>
<td>Yes</td>
</tr>
<tr>
<td>Hageman et al. 2005</td>
<td>Physical activity</td>
<td>Self-efficacy, Health Promotion Model</td>
<td>1. Tailored information group 2. General information control group</td>
<td>Physical activity (self-report) Cardiovascular fitness, body fat percentage, weight, flexibility (objective measurements)</td>
<td>Mixed</td>
</tr>
<tr>
<td>Marcus et al. 2007</td>
<td>Physical activity</td>
<td>-</td>
<td>1. Tailored Internet-delivered information group 2. Tailored print-delivered information group 3. General information control group</td>
<td>Physical activity (self-report) Cardiovascular fitness (objective measurements)</td>
<td>No</td>
</tr>
<tr>
<td>Study Authors and Year of Publication (n = 23)</td>
<td>Objectives of behaviour change</td>
<td>Theories or theoretical concepts mentioned</td>
<td>Intervention design</td>
<td>Outcomes</td>
<td>Statistically significant evidence related to difference between intervention and control group was found?</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>--------------------------------</td>
<td>------------------------------------------</td>
<td>-------------------</td>
<td>----------</td>
<td>------------------------------------------------------</td>
</tr>
<tr>
<td>Napolitano et al. 2003</td>
<td>Physical activity</td>
<td>TTM / stages of change</td>
<td>1. Tailored information group  2. No-information control group (waiting list)</td>
<td>Physical activity (self-report)</td>
<td>Yes</td>
</tr>
<tr>
<td>Spittaels et al. 2007b</td>
<td>Physical activity</td>
<td>TTM / stages of change, self-efficacy</td>
<td>1. Tailored advice + nontailored emails group  2. Tailored advice group  3. No-information control group (waiting list)</td>
<td>Physical activity (self-report)</td>
<td>Yes</td>
</tr>
<tr>
<td>Study Authors and Year of Publication (n = 23)</td>
<td>Objectives of behaviour change</td>
<td>Theories or theoretical concepts mentioned</td>
<td>Intervention design</td>
<td>Outcomes</td>
<td>Statistically significant evidence related to difference between intervention and control group was found?</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>---------------------------------</td>
<td>-------------------------------------------</td>
<td>---------------------</td>
<td>----------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Block et al. 2004</td>
<td>Nutrition</td>
<td>TTM / stages of change</td>
<td>1. Tailored fruit and vegetable consumption information group 2. tailored fat information group</td>
<td>Fruit and vegetable consumption, fat intake, determinants of fruits and vegetable consumption and fat intake (self-report)</td>
<td>Yes</td>
</tr>
<tr>
<td>de Vet et al. 2008</td>
<td>Nutrition</td>
<td>TTM / stages of change</td>
<td>1. Tailored precontemplation feedback group 2. Tailored contemplation feedback group 3. Tailored action feedback group</td>
<td>Fruit and vegetable consumption (self-report)</td>
<td>No</td>
</tr>
<tr>
<td>Di Noia et al. 2008</td>
<td>Nutrition</td>
<td>TTM / stages of change, self-efficacy</td>
<td>1. Tailored information group 2. General-information control group</td>
<td>Fruit and vegetable consumption, determinants of fruit and vegetable consumption (self-report)</td>
<td>Yes</td>
</tr>
<tr>
<td>Irvine et al. 2004</td>
<td>Nutrition</td>
<td>TTM / stages of change, self-efficacy, Theory of Reasoned Action</td>
<td>1. Tailored intervention 2. No-information control group (waiting list)</td>
<td>Fruit and vegetable consumption, fat intake, determinants of dietary intake (self-report)</td>
<td>Yes</td>
</tr>
<tr>
<td>Study Authors and Year of Publication (n = 23)</td>
<td>Objectives of behaviour change</td>
<td>Theories or theoretical concepts mentioned</td>
<td>Intervention design</td>
<td>Outcomes</td>
<td>Statistically significant evidence related to difference between intervention and control group was found?</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>--------------------------------</td>
<td>--------------------------------------------</td>
<td>---------------------</td>
<td>----------</td>
<td>---------------------------------------------------</td>
</tr>
</tbody>
</table>
| Kroeze et al. 2008b | Nutrition | TTM / stages of change | 1. Tailored CD-ROM-delivered intervention  
2. Tailored print-delivered intervention  
3. General information control group | Fat intake, dietary intake (self-report) | Mixed |
| Luszczynska et al. 2007 | Nutrition | Self-efficacy | 1. Tailored self-efficacy group  
2. Tailored self-efficacy + action planning group  
3. General information control group | Fruit and vegetable consumption, determinants of fruit and vegetable consumption (self-report) | Yes |
| Oenema et al. 2001 | Nutrition | Self-efficacy, Precaution Adoption Model | 1. Tailored information group  
2. General information control group | Determinants of fruit and vegetable consumption and fat intake (self-report) | Yes |
| Oenema et al. 2005 | Nutrition | Precaution Adoption Model, Elaboration Likelihood Model (ELM) | 1. Tailored information group  
2. General information control group  
3. No-information control group | Fruit and vegetable consumption, fat intake, determinants of fruit and vegetable consumption and fat intake (self-report) | Mixed |
| Study Authors and Year of Publication (n = 23) | Objectives of behaviour change | Theories or theoretical concepts mentioned | Intervention design | Outcomes | Statistically significant evidence related to difference between intervention and control group was found?

<p>| Papadaki &amp; Scott 2008 Nutrition | - | 1. Tailored information group 2. General information control group | Mediterranean diet score, fruit and vegetable consumption (self-report) Blood lipids (objective measurements) | Yes |
| Park et al. 2008 Nutrition | TTM / stages of change, self-efficacy | 1. Tailored information group 2. General information control group | Determinants of fruit and vegetable consumption (self-report) | No |
| Frenn et al. 2005 Nutrition and physical activity | TTM / stages of change, self-efficacy | 1. Tailored information group 2. No-information control group | Fat intake, physical activity (self-report) | Yes |
| Oenema et al. 2008 Nutrition and physical activity | TTM / stages of change, self-efficacy | 1. Tailored information group 2. No-information control group (waiting list) | Fat intake, physical activity (self-report) | Yes |
| Booth et al. 2008 Weight management | TTM / stages of change, Goal Setting Theory | 1. Tailored advice + exercise 2. No-information control group (exercise only) | Dietary intake, physical activity (self-report) Weight, waist circumference (objective measurements) | No |
| Rothert et al. 2006 Weight management | Self-efficacy | 1. Tailored information 2. General information control group | Weight (self-report) | Yes |</p>
<table>
<thead>
<tr>
<th>Study Authors and Year of Publication (n = 23)</th>
<th>Objectives of behaviour change</th>
<th>Theories or theoretical concepts mentioned</th>
<th>Intervention design</th>
<th>Outcomes</th>
<th>Statistically significant evidence related to difference between intervention and control group was found¹</th>
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<tbody>
<tr>
<td>Tate et al. 2001</td>
<td>Weight management</td>
<td></td>
<td>1. Tailored information</td>
<td>Fat intake, dietary intake (self-report)</td>
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<td>2. General information control group</td>
<td>Weight, waist circumference (objective measurements)</td>
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<tr>
<td>Tate et al. 2006</td>
<td>Weight management</td>
<td></td>
<td>1 Computer-automated tailored information group</td>
<td>Dietary intake, fat intake, physical activity (self-report)</td>
<td>Mixed</td>
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<td>2. Human email information group</td>
<td>Weight (objective measurements)</td>
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<td>3. No-information control group</td>
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</tbody>
</table>

¹ Yes = Statistically significant evidence related to difference between intervention and control group were found by main outcome measures.  
Mixed = The evidence was mixed.  
No = No evidence was found. (For further outcome results see Enwald & Huotari 2010).
Original publications


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Original publications are not included in the electronic version of the dissertation.
102. Sarkki, Simo (2011) ‘The site strikes back’: multi-level forest governance and participation in northern Finland

103. Kurttila-Matemo, Eeva (2011) School library: a tool for developing the school’s operating culture

104. Taivalanta, Marjo (2012) Kukkoseit, jatkuvuudet ja sairausselitykset kainuulaisnaisten sepelvaltimautskertomuksissa


110. Törölä, Helena (2013) Vocalisation and feeding skills in extremely preterm infants: an intensive follow-up from birth to first word and first step

111. Spoolman, Marianne (2013) Prior linguistic knowledge matters: the use of the partitive case in Finnish learner language


114. Hautala, Terhi (2013) Liskääntynenä kyntälöiden puheen ymmärtäminen kognitiivisesti vaativassa tilanteessa


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Heidi Enwald

TAILORING HEALTH COMMUNICATION

THE PERSPECTIVE OF INFORMATION USERS’ HEALTH INFORMATION BEHAVIOUR IN RELATION TO THEIR PHYSICAL HEALTH STATUS

Heidi Enwald