Evaluation of National Interventions to Promote Physical Activity in Switzerland with a Focus on Internet-based Approaches

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Content

Summary

Background

The importance of physical activity for health is well documented in the literature: Reduced overall mortality, reduced risks of cardiovascular disease, colon cancer, and type 2 diabetes are just a few of the known positive effects. Furthermore, physical inactivity is estimated to cause 2800 premature deaths per year, 2 million cases of illness, and direct treatment costs of 1.5 billion Euros in Switzerland. Therefore, effective interventions are needed to increase physical activity levels in the population. In Switzerland, the physical activity recommendations for adults advocate at least 30 minutes of moderate intensity physical activity on most, preferably all days of the week, or at least 20 minutes of vigorous intensity activities on three or more days of the week. However, only 41.1% of adults adhere to at least one of these recommendations in Switzerland.

Traditional approaches to promote physical activity include population-based structured activities such as local physical activity courses, setting-specific approaches such as school-based physical activity promotion, events, or campaigns. More recently, computer and Internet technology has started to become popular for the delivery of so-called computer-tailored interventions that mimic a personal counselling situation by providing individualised motivational feedbacks.

Two national interventions in Switzerland targeting adults are Allez Hop, a more traditional approach offering local physical activity courses once a week during a three month period, and Active-online (www.active-online.ch) a Web-based individually tailored programme. Evaluation should play an important role in the development and implementation of health promotion programmes, however, there is no great tradition of evaluating physical activity interventions in Switzerland. Moreover, not much is known internationally about the effectiveness of computer-tailored interventions when they are delivered in a real-life setting directly over the Internet.

Objective

The overall goal was to evaluate the national physical activity promotion programme Active-online in a formative and summative way, and to contrast these scientifically thorough approaches with more pragmatic evaluation approaches used to evaluate Allez Hop.

Methods

Active-online

A review of the literature was carried out to collect existing evidence on the efficacy and effectiveness of computer-tailored interventions to change behaviour. For the summative evaluation, a randomised controlled trial (RCT) with 1531 volunteers was conducted over the Internet to assess the effectiveness of Active-online compared to a nontailored information website in a real-life setting (i.e. online delivery of the intervention, online assessment of study-related variables, minimal contact to study participants). In addition to the intervention (N=681) and the control group (N=688), spontaneous users were directly recruited from Active-online and included as a separate study arm (N=162). Information on physical activity levels was collected at baseline, and 6 weeks, 6 months and 13 months after baseline by self-report (using an online questionnaire) and objectively (using accelerometers in a subsample, N=133). For the formative part of the evaluation, data on user characteristics and patterns of intervention use in terms of adherence (defined as the extent to which individuals use the content of the Internet intervention, such as the number of pages viewed, the proportion of visits resulting in starting a tailored module, the proportion of visits resulting in getting tailored feedbacks, and the time spent in the tailored modules), attrition (referring to those individuals stopping to use the Internet intervention), and predictors of repeated intervention use were analysed over time from 2003 to 2009 and compared between spontaneous users and participants of the effectiveness trial.

Allez Hop

The different evaluation approaches used to evaluate Allez Hop during the whole implementation period from 1997 to 2008 were summarised. The most recent evaluation step was the introduction of routine Allez Hop course evaluations using a semiautomated Web-based approach, which allowed the provision of a feedback report to the course instructors. The feasibility of the Web-based tool was first tested in a pilot study and then in an open setting, when the system was available to all Allez Hop instructors in the German speaking part of Switzerland. The question of a population impact of Allez Hop was approached analysing data from a one sample pretest posttest evaluation survey carried out in course participants in 2005 and data from repeated cross-sectional representative population-based surveys (the Swiss Health Survey 1997, 2002, and 2007, and two sport surveys carried out in 1999 and 2007).

Results

Active-online

The literature of the evidence regarding the effectiveness of Web-based tailored physical activity interventions was scarce. The few existing studies were mostly carried out in a controlled setting, testing the efficacy rather than the effectiveness of the intervention under real-life conditions. Evidence on the efficacy in these controlled studies was equivocal. According to our RCT (summative evaluation), Active-online was not more effective in increasing self-reported physical activity levels compared to the nontailored website, and the self-reported

increases observed in all three groups were not supported by accelerometer data. Analysis of user data as part of the formative evaluation revealed that the individual use of Active-online was low during the study period in trial participants, but also in open access users of the programme between 2003 and 2009. Highest adherence (based on the first visits) was found in registered open access users (longest visit duration, and highest proportions starting a tailored module, spending at least three minutes in a module, and getting a tailored feedback). On the other hand, trial participants were more likely to use Active-online repeatedly. Over time, the proportion of women using Active-online increased from below 50% in 2003 to over 60% in 2009, while adherence remained relatively stable during that time period.

Allez Hop

Several evaluations were conducted on different levels (course participants, instructors, partners, stakeholders, population) during the implementation period of Allez Hop from 1997 to 2008. More than 18 000 courses were realised attracting around 200 000 participants over a decade. Around 90% of course participants were women with a mean age of just under 50 years. The programme has succeeded in reaching a high proportion of insufficiently active individuals (around 70% in 2005) and has reached a high degree of acceptance and appreciation in participants as well as in the general population. The Web-based routine course evaluation tool proved to be feasible, and data collected in the open setting was not different from data collected during the pilot study. However, participation on the course level was much lower in the open setting than during the pilot phase where instructors were strongly encouraged to participate. Evidence on the effectiveness of Allez Hop based on repeated data assessments in course participants in 2005 was limited due to methodological limitations. However, changes in physical activity at the population level between 1997 and 2007, especially in the main user group of Allez Hop (middle-aged women), and large increases in the proportion of individuals regularly walking (which was one of the main course disciplines), indicated a potential "Allez Hop effect".

Conclusions

Active-online and Allez Hop are among the best evaluated national physical activity promotion programmes in Switzerland. Even though the programmes and the evaluation approaches differ, both evaluations have contributed valuable information for the development and optimisation of the programmes. Our RCT was one of the first studies which assessed the effectiveness of an intervention like Active-online in a real-life setting using a minimal contact strategy, open access online delivery of the intervention, and online assessment of baseline and follow-up data. The findings from the summative and formative evaluation of Active-online, showing that the programme was not effective in a sample of volunteers when offered under real-life conditions and that the individual use of the programme was low in general, provide important evidence for researchers in this field and highlight the potential and the limitations of Web-based approaches in physical activity promotion.

Approaches used in the evaluation of Allez Hop, which started as an implementation and not as a research project, may be described as pragmatic. The evaluation of population-based public health programmes is associated with specific methodological challenges, and thorough designs like RCTs are mostly not feasible.

Therefore, researchers are encouraged to use other approaches for the evaluation of public health programmes, as this was the case in Allez Hop. Despite high levels of appreciation and acceptance of Allez Hop and indications of behaviour changes at the population level, which may be attributable to programmes like Allez Hop (even though no causal relationship can be established based on these data), the programme has been terminated on the national level by the end of 2008.

It is recommended that evaluation should be an integral part of future physical activity promotion projects in Switzerland both during their development and implementation.

Zusammenfassung

Hintergrund

Die positiven Auswirkungen von Bewegung auf die Gesundheit sind vielfach aufgezeigt worden: Genügend Bewegung senkt unter anderem die Gesamtsterblichkeit, sowie das Risiko für Herz-Kreislauferkrankungen, Diabetes Typ 2, und Darmkrebs. Es wird geschätzt, dass körperliche Inaktivität allein in der Schweiz 2800 frühzeitige Todesfälle, 2 Millionen Krankheitsfälle, sowie direkte Behandlungskosten von 1.5 Milliarden Euro pro Jahr verursacht. Wirksame Interventionen in der Bewegungsförderung sind deshalb dringend nötig. Gemäss den Bewegungsempfehlungen in der Schweiz sollten Erwachsene mindestens 30 Minuten pro Tag mit mittlerer Intensität aktiv sein oder ein Ausdauertraining von mindestens 20 Minuten an drei oder mehr Tagen pro Woche absolvieren. Im Jahr 2007 erfüllten nur gerade 41.1% der erwachsenen Schweizer Bevölkerung wenigstens eine dieser Empfehlungen für gesundheitswirksame Bewegung.

Beispiele von traditionelleren Ansätzen in der Bewegungsförderung sind strukturierte Aktivitäten wie lokale Bewegungskurse, Setting-spezifische Ansätze wie schulbasierte Bewegungsförderungsprojekte, Events oder Kampagnen. In den letzten Jahren gewann zudem die Computer- und Internettechnologie in der Bewegungsförderung zunehmend an Popularität. Die Technik ermöglicht sogenannte computergestützte massgeschneiderte Interventionen, welche eine persönliche Beratungssituation simulieren, indem sie individuelle Motivationsfeedbacks liefern.

Zwei nationale Bewegungsförderungsprogramme in der Schweiz sind Allez Hop, ein eher traditioneller Ansatz mit wöchentlichen Bewegungskursen über drei Monate, und Active-online (www.active-online.ch) ein internetbasiertes massgeschneidertes Programm. Obwohl Evaluation in der Entwicklung und in der Implementierung von Gesundheitsförderungsprogrammen sehr wichtig ist, hat sie in der Schweiz im Bereich der Bewegungsförderung keine grosse Tradition. Zudem ist grundsätzlich (auch international) sehr wenig bekannt über die Wirksamkeit von computergestützten Interventionen, wenn sie unter realistischen Umsetzungsbedingungen über das Internet angeboten werden.

Ziel

Das Ziel dieser Dissertation war eine formative und summative Evaluation von Active-online, sowie eine Gegenüberstellung dieser wissenschaftlich fundierten Evaluationsansätze mit den eher pragmatischen Ansätzen, welche in der Evaluation von Allez Hop verwendet wurden.

Methoden

Active-online

Mit Hilfe eines Literaturreviews wurde die vorhandene Evidenz zur Wirksamkeit von computergestützen Interventionen gesammelt. Eine internetbasierte randomisierte kontrollierte Studie mit 1531 freiwilligen Studienteilnehmenden wurde durchgeführt, um im Rahmen der summativen Evaluation die Wirksamkeit von Active-online im Vergleich zu einer einfachen standardisierten Informationswebseite unter realistischen Umsetzungsbedingungen (internetbasierte Verabreichung der Intervention, online Datenerhebung, minimale Kontakte zu den Studienteilnehmenden) zu untersuchen. Neben einer Interventions- (N=681) und einer Kontrollgruppe (N=688) wurden spontane Benutzer (N=162) direkt von der Active-online Webseite rekrutiert und als separater Studienarm mitgeführt. Daten zum Bewegungsverhalten der Teilnehmenden wurden zu Studienbeginn sowie nach 6 Wochen, 6 Monaten und 13 Monaten erhoben. Es fanden Erhebungen mittels Online-Fragebogen statt sowie in einer Untergruppe (N=133) auch objektive Messungen mittels Akzelerometern.

Für die formative Evaluation wurden Daten zum Profil der Active-online Besucher sowie zur Nutzung der Intervention analysiert. Von Interesse war die "Adhärenz" (Ausmass der Nutzung von Active-online, z.B. Anzahl besuchter Seiten, Anteil der Besuche, bei welchen ein massgeschneidertes Modul gestartet wurde, Anzahl der Besuche, bei welchen ein massgeschneidertes Feedback erreicht wurde, sowie die Besuchsdauer), die "Attrition" (Ausmass des Verlusts von Benutzern, welche die Intervention besuchen, über die Zeit) sowie Faktoren, welche mit wiederholten Interventionsbesuchen zusammenhingen. Es wurden sowohl Vergleiche über die Zeit von 2003 bis 2009 als auch zwischen spontanen Benutzern und den Studienteilnehmenden gemacht.

Allez Hop

Die unterschiedlichen Evaluationsansätze, welche Allez Hop während der Implementierung von 1997 bis 2008 begleitet hatten, wurden in einem Artikel zusammengefasst. Als neuer Ansatz für eine routinemässige Evaluation von Allez Hop Kursen wurde eine halbautomatisierte internetbasierte Plattform entwickelt, welche den Kursleitenden ein direktes Feedback zu ihrem Kurs in Form eines Berichts erstellt. Die Machbarkeit dieses Systems wurde zuerst in einer Pilotstudie und dann in einer offenen Phase, bei der das System allen Allez Hop Kursleitenden in der Deutschschweiz zur Verfügung stand, untersucht. Der Frage nach der Wirksamkeit von Allez Hop wurde nachgegangen, indem Daten von wiederholten Befragungen bei Kursteilnehmenden im Jahr 2005 sowie aus wiederholten repräsentativen Querschnittsstudien auf Bevölkerungsebene (Schweizerische Gesundheitsbefragung 1997, 2002 und 2007 sowie zwei Sportstudien 1999 und 2007) analysiert wurden.

Resultate

Active-online

Es existiert erst wenig Literatur bezüglich der Evidenz zur Wirksamkeit von internetbasierten massgeschneiderten Interventionen. Die wenigen publizierten Studien wurden meist in einem kontrollierten Setting durchgeführt, indem die Wirksamkeit unter optimalen und nicht unter realistischen Bedingungen getestet wurde. Die Evidenz bezüglich der Wirksamkeit war gemischt. In unserer randomisierten Studie, welche im Rahmen der summativen Evaluation durchgeführt wurde, nahm zwar die körperliche Aktivität gemäss Angaben aus den Online-Befragungen in allen drei Gruppen zu, Active-online war jedoch nicht wirksamer als eine einfache Informationswebseite. Zudem wurde die Zunahme bei der körperlichen Aktivität gemäss Befragungen nicht bestätigt durch die Daten der Akzelerometer-Messungen.

Eine Auswertung der Benutzerdaten von Active-online im Rahmen der formativen Evaluation zeigte, dass die individuelle Nutzung der Intervention während der Studie tief war. Dies war nicht nur bei den Studienteilnehmenden der Fall, sondern auch bei spontanen Nutzern, welche die frei zugängliche Webseite zwischen 2003 und 2009 besuchten. Basierend auf den Erstbesuchen wurde festgestellt, dass die spontanen Besucher, die sich im Programm registrierten, Active-online am meisten nutzten (längste Besuchsdauer, sowie höchster Anteil an Personen, die in ein massgeschneidertes Modul einstiegen, die mindestens drei Minuten darin blieben, und die ein individuelles Feedback erhielten). Andererseits war die Chance, dass die Intervention wiederholt besucht wurde, bei den Studienteilnehmenden am höchsten. Der Anteil der Frauen, welche Active-online besuchte, stieg zwischen 2003 und 2009 von unter 50% auf über 60% an. Die individuelle Nutzung (Adhärenz) blieb über denselben Zeitraum relativ stabil.

Allez Hop

Während der Implementierung von Allez Hop zwischen 1997 und 2008 wurden mehrere Evaluationsschritte auf verschiedenen Ebenen (Kursteilnehmende, Leitende, Partner, Akteure, Bevölkerung) durchgeführt. Mit total über 18 000 angebotenen Kursen konnten etwa 200 000 Personen für eine Teilnahme motiviert werden. Rund 90% der Kursteilnehmenden waren Frauen, das Durchschnittsalter lag knapp unter 50 Jahren. Das Programm war erfolgreich in der Rekrutierung von ungenügend aktiven Personen (ca. 70% im Jahr 2005) und erreichte eine hohe Akzeptanz und positive Beurteilung sowohl bei den Kursteilnehmenden als auch in der allgemeinen Bevölkerung. Das internetbasierte halbautomatisierte System für routinemässige Kursevaluationen stellte sich als anwendbar heraus, und die Daten, welche in der offenen Phase gesammelt wurden, unterschieden sich nicht von jenen aus der Pilotphase. Allerdings nahmen in der offenen Phase nur sehr wenige Allez Hop Leitende mit ihren Kursen an der Evaluation teil, während die Teilnahme in der Pilotphase, welche aktiv propagiert wurde, viel höher war. Die Evidenz bezüglich der Wirksamkeit von Allez Hop, basierend auf wiederholten Datenerhebungen bei Kursteilnehmenden im Jahr 2005, war wegen methodischen Schwierigkeiten limitiert. Jedoch deuteten Änderungen im Bewegungsverhalten auf Bevölkerungsebene zwischen 1997 und 2007, vor allem in der

Hauptnutzergruppe von Allez Hop (Frauen im mittleren Alter), sowie ein relativ starker Anstieg von Walking (als eine der Hauptkursarten bei Allez Hop) auf einen möglichen "Allez Hop Effekt" hin.

Schlussfolgerungen

Active-online und Allez Hop gehören wohl zu den am besten evaluierten nationalen Bewegungsförderungsprogrammen in der Schweiz. Auch wenn sich sowohl die Programme als auch die gewählten Evaluationsansätze unterscheiden, haben doch die gesammelten Daten bei beiden Programmen wertvolle Informationen für deren Weiterentwicklung und Optimierung geliefert. Unsere randomisierte Studie war eine der ersten, welche die Wirksamkeit einer Intervention wie Active-online unter realistischen Bedingungen untersuchte, also mit minimalen Kontakten zu den Probanden, Verabreichung der Intervention über das Internet sowie internetbasierter Datenerhebung. Die Wirksamkeitsstudie von Active-online sowie die Analyse der Nutzerdaten haben wichtige Erkenntnisse für andere Forschende auf diesem Gebiet geliefert, und haben das Potential wie auch die Limitationen von internetbasierten Ansätzen in der Bewegungsförderung aufgezeigt.

Die Evaluationsansätze im Rahmen von Allez Hop, welches als Implementierungs- und nicht als Forschungsprojekt entwickelt wurde, können als pragmatisch beschrieben werden. Die Evaluation von bevölkerungsbezogenen Interventionen im Bereich Public Health ist mit spezifischen methodischen Herausforderungen verbunden, und wissenschaftlich fundierte Methoden wie randomisierte kontrollierte Studien sind meist nicht realisierbar. Deshalb werden auch andere Ansätze empfohlen, wie sie bei der Evaluation von Allez Hop zum Einsatz kamen. Trotz der hohen Akzeptanz und der positiven Beurteilung von Allez Hop sowie Hinweisen auf Verbesserungen im Bewegungsverhalten auf Bevölkerungsebene, welche wohl zumindest teilweise Programmen wie Allez Hop zuzuschreiben sind (auch wenn aufgrund dieser Daten keine kausalen Zusammenhänge nachgewiesen werden können), wird das Programm seit 2009 nicht mehr auf nationaler Ebene weitergeführt.

Es wird empfohlen, dass Evaluation einen integralen Teil von zukünftigen Bewegungsförderungsprojekten in der Schweiz bilden sollte, und zwar sowohl während der Entwicklung als auch während der Implementierung.

PART I

INTRODUCTION AND BACKGROUND

1 Introduction

1.1 Evaluation of Physical Activity Promotion Programmes in Switzerland - Where Are We Today?

Although the recognition that proper amounts of physical activity are necessary for healthy living dates back to the ancient Greeks [1], the science of physical activity and health as well as the promotion of physical activity are relatively young fields of research. The first systematic review of the cumulative evidence on the positive health effects of physical activity that has reached global attention was lead by the Centers for Disease Control and Prevention (CDC) in the United States (US) [1]. This comprehensive landmark review was published in 1996 as the first Surgeon General's report on physical activity and health [1]. The report is introduced as a "*work of real significance, on par with the Surgeon General's historic first report on smoking and health published in 1964*" (Message from Donna E. Shalala, Secretary of Health and Human Services) [1].

In Switzerland, although the national sport promotion programme "Youth and Sport" dates back to the 1970ies, the problem of physical inactivity has mainly started to get attention in the 1990ies. In 1995, evidence for the health effects of physical activity was systematically presented and discussed at the national symposium "Sport - Physical Activity - Health" in Magglingen. Four years later in 1999, the national network for health-enhancing physical activity HEPA Switzerland was founded, and in 2000 the Federal Government adopted the Concept for a National Sports Policy with "more physically active people" as its first main objective [2]. Several interventions to promote physical activity have been developed by different institutions in Switzerland until today. Traditional approaches include population-based structured activities such as local physical activity courses, events, or campaigns. More recently, computer and Internet technology has started to become popular for the delivery of so-called computer-tailored physical activity interventions that mimic a personal counselling situation by providing individualised motivational feedbacks.

As pointed out by Cavill et al [3], physical activity promotion should be evidence-based, including four key tasks: 1) to use existing evidence for the health benefits of physical activity to "make the case" and increase action by policy makers, 2) to collect evidence on the prevalence of physical activity based on surveillance, 3) to review evidence on "what works" in increasing physical activity and influencing practice, and 4) to evaluate practice [3].

Thus, evaluation should - together with planning and implementation - play an important role in physical activity promotion.

There are two main types of evaluation: outcome or summative evaluation and process or formative evaluation [4, 5]. Both types are relevant in physical activity promotion research. While outcome evaluation addresses the effectiveness of an intervention ("does it work?"), process evaluation focuses more on the development and implementation ("why does it (not) work?"). Evaluation results can give indications of acceptance, use and uptake of an intervention in the target population, they help to optimise the intervention, they give insight into the effectiveness of different approaches, they support the collection of evidence for future research, and they justify financial support and allocation of resources. Different models and frameworks have been developed in order to facilitate and systematise evaluations. For example, Glasgow and colleagues have proposed the RE-AIM framework for the evaluation of the impact of public health interventions [6]. RE-AIM stands for five dimensions which evaluations should address: reach, efficacy, adoption, implementation, and maintenance.

There is no standard data collection methodology in physical activity evaluation. Moreover, different methods may be associated with different limitations; some approaches may be more scientifically thorough while others are more pragmatic. The choice of the method mostly depends on the format and type of the intervention, the target group, the stakeholders and partners, and the available resources. For example, randomised controlled trials (RCTs) may not be feasible in a community-based physical activity intervention. Moreover, RCTs often only address the efficacy of an intervention but not the other dimensions proposed in the RE-AIM framework. As a result, pragmatic evaluation approaches are often applied in physical activity promotion research.

Evaluation of physical activity interventions does not have a great tradition in Switzerland and has only become an issue in recent years. Most traditional approaches have not been widely evaluated, and the even younger field of computer-tailored physical activity promotion has yet been less in the focus of evaluations. While in some countries like Belgium and the United States, single computer-tailored programmes have been evaluated and tested for their efficacy [7, 8], not much research has been underway in other countries. Furthermore, most efficacy studies have been carried out in controlled settings with small samples and not using new technologies such as the Internet to deliver the computer-tailored interventions. Therefore not much is known about the real-world effectiveness of Internet-based individually tailored physical activity interventions.

Two different national physical activity promotion programmes for adults will be the focus of this thesis: **Allez Hop**, a more traditional population-based approach offering local physical activity courses, was developed in 1996 by three Swiss health insurance companies and the Swiss Olympic Association. Even though the project started as an implementation rather than a research project, evaluation (mostly formative) has been part of the development and implementation of the programme [9-14]. The evaluation approaches used may be described as stepwise and pragmatic, and no formal outcome evaluation was conducted. On the other hand, the Web-based individually tailored intervention **Active-online** started as a research project at the Institute of Social and Preventive Medicine at the University of Zurich in 1999. The programme was evaluated several times during its development in a formative way by assessing acceptance and satisfaction of users [15-17]. Furthermore, the

development and the format of the intervention allowed an outcome evaluation using a scientifically thorough approach, and continuous objective collection of user data allowed a more in-depth process evaluation based on user characteristics and intervention use.

1.2 Goals and Objectives

The overall goal of this thesis was to evaluate the national physical activity promotion programme Active-online in a formative and summative way, and to contrast these scientifically thorough approaches with more pragmatic evaluation approaches used to evaluate Allez Hop.

The specific objectives were:

1. **To give an overview of Internet-based physical activity interventions including their strengths and limitations, and to review the evidence regarding their effectiveness.**

   → Chapter 3 addresses the potential of information technology in promoting physical activity. Chapter 4 focuses on Internet-based physical activity promotion, draws on the principles of individually tailored interventions in general, reviews their efficacy and dissemination, and presents two examples of Internet-based individually tailored interventions in Switzerland, Active-online and Feelok.

2. **To assess the effectiveness of Active-online compared to a nontailored website in a Web-based RCT as part of the summative evaluation.**

   → As one of the most important parts of the thesis, Chapter 5 reports on the results of a RCT assessing the effectiveness of Active-online in a real-life setting, comparing the effectiveness of the programme for trial participants and for spontaneous users, and assessing the impact of frequency and duration of intervention use on changes in physical activity behaviour. Results are reported both for self-reported and objective physical activity measures.

3. **To carry out an in-depth analysis of the user characteristics and patterns of individual use of Active-online as part of the formative evaluation.**

   → Chapter 6 addresses these issues in terms of adherence to Active-online (defined as the extent to which individuals experience the content of the intervention), nonusage attrition (referring to those individuals

stopping to use the intervention), and predictors of repeated intervention participation, using monitoring data obtained from the Active-online user database. Data are analysed over time from 2003 to 2009, and comparisons are made between open access users and participants of the randomised effectiveness trial.

4. **To summarise the stepwise approaches used in the evaluation of Allez Hop, to approach the question of a population impact of Allez Hop, and to present a new and innovative approach for the routine evaluation of Allez Hop courses using a semiautomated Web-based tool.**

   → Chapter 7 summarises the evaluation steps undertaken during the decade of Allez Hop between 1997 and 2008, the methods used, and the stakeholders that were involved in these evaluations. Chapter 8 focuses on evidence regarding the effectiveness of the programme in terms of changes in physical activity behaviour. These analyses are based on data from an evaluation in course participants in 2005 and data from two repeated cross-sectional population-based surveys. Chapter 9 reports on the feasibility of a semiautomated Web-based evaluation tool for routine Allez Hop course evaluations in a pilot phase and in an open setting.

During the realisation of the effectiveness study of Active-online, a new research question emerged, which could be approached in an analysis using longitudinal data from the Swiss Household Panel (SHP). For sample size calculations in effectiveness studies, it is necessary to make assumptions about the expected changes in physical activity behaviour due to the intervention. However, it is likely that spontaneous changes in physical activity behaviour occur in some individuals regardless of an intervention. Because no data were available in the literature regarding the size of such spontaneous changes, an additional goal was included in the thesis:

5. **To assess the size of spontaneous changes that occur in physical activity behaviour in individuals over time (without a specific intervention), with potential consequences for research addressing physical activity behaviour as an outcome.**

   → Chapter 10 addresses physical activity levels, changes in physical activity behaviour, as well as determinants of change in young Swiss men and women based on longitudinal data, which allows quantifying spontaneous changes in physical activity behaviour independently of a specific intervention.

Chapter 11, the discussion part of the thesis, summarises the main findings, discusses methodological issues in evaluating public health interventions, presents an outlook and some recommendations, and wraps up with concluding remarks.

2 Background

2.1 Physical Activity and Health

Physical activity is defined as any bodily movement produced by the skeletal muscles that results in a substantial increase over resting energy expenditure, including leisure-time physical activity, exercise, sport, transportation, occupational work, and chores [18]. Typically, energy expenditure associated with physical activity amounts to between 25% (in a sedentary person) and 50% (in endurance athletes or heavy labour workers) of total daily energy expenditure [18].

The importance of physical activity for health and health improvements is well documented in the literature. The first Surgeon's General report on physical activity and health, published in 1996, reported several important positive health outcomes: reduced overall mortality, reduced risks of cardiovascular disease, colon cancer, type 2 diabetes, falling, and obesity, and potential effects on mental health such as depression [1]. More than ten years later, the Physical Activity Guidelines Advisory Committee in the United States concluded similarly based on the up-dated evidence that, compared to less active persons, more active individuals have lower rates of all-cause mortality, coronary heart disease, high blood pressure, stroke, type 2 diabetes, metabolic syndrome, colon cancer, breast cancer, and depression [19]. Furthermore, there is strong evidence that active individuals have a healthier body mass and composition, and a biomarker profile that is more favourable for preventing chronic diseases and for enhancing bone health [19]. The UK Department of Health has summarised the level and strength of evidence for a relationship between physical activity and common chronic conditions regarding preventive and therapeutic effects in 2004 [20]. Strong preventive effects based on high level of evidence were reported for coronary heart disease, type 2 diabetes, osteoporosis, and colon cancer. Moderate effects based on high level of evidence were named for occlusive stroke and breast cancer (preventive effects) and for low back pain (therapeutic effects). Other relationships were described as moderate or weak based on medium or low levels of evidence, for example moderate effects based on medium level of evidence for overweight and obesity [20].

In a population-based cohort study including men aged 50 years and older, the total mortality rate after more than 10 years of follow-up was halved in men who had increased leisure-time physical activity from low to high

compared to those with unchanged low activity levels [21]. To show the size of the potential health benefits of physical activity, the authors compared the reduction in mortality associated with increased activity levels with the reduction in mortality associated with smoking cessation, and concluded that the size of the effect was very similar (40% lower mortality rate after more than 10 years of follow-up associated with smoking cessation compared to current smokers) [21]. This gives some indication of the size and importance of the problem of physical inactivity in chronic disease epidemiology. In summary, physical inactivity is one of the important modifiable risk factors in chronic disease epidemiology, and changes in physical activity behaviour can play a crucial role in the efforts to reduce the burden of chronic disease.

Cost of Physical Inactivity

Attempts have been made to estimate the economic costs of physical inactivity. Globally, the World Health Report 2002 estimated the amount of disease, disability and death in the world that can be attributed to a selected number of most important risk factors to human health [22]. Physical inactivity as one of these risks was estimated to cause 1.9 million premature deaths per year and 19 million disability-adjusted life years (DALY) lost (one DALY being equal to the loss of one healthy life year) [22]. Furthermore, physical inactivity was estimated to cause about 10-16% of cases each of breast cancer, colon and rectal cancers, and diabetes mellitus, and about 22% of ischaemic heart disease. The proportion of deaths attributable to physical inactivity was calculated to account for between 6%-7% of total deaths in developed countries. In a more recent report of the World Health Organisation (WHO) on global health risks published in 2009, physical inactivity was ranked fourth among the ten leading risk factor causes of death, accounting for 5.5% of total deaths globally and for 7.7% in high income countries, respectively [23, 24].

In the United States, the impact of physical inactivity and poor diet was assessed computing the annual deaths due to overweight. Overweight, which was assumed to account for the major impact of poor diet and physical inactivity on mortality, was estimated to cause between 5%-17% of total deaths in 2000 [25, 26]. However, it was also acknowledged that additional deaths due to inactivity and poor diet would be caused through other mechanisms [26]. Deaths specifically attributable to physical inactivity in the US have been estimated in a recent paper by Danaei et al [27]. Physical inactivity was calculated to account for 8%-9% (around 200 000) of total deaths per year in US adults, in addition to a similar number of deaths estimated to be attributable to overweight/obesity [27].

The total direct costs of physical inactivity-related disease in Switzerland, based on the proportion of disease estimated to be attributable to insufficient physical activity, have been reported to be 1.6 billion Swiss Francs (1.1 billion Euros) per year in a joint scientific position statement of the Swiss Federal Offices of Sport and Public Health, the Swiss Council for Accident Prevention, The Swiss National Accident Insurance Organisation (SUVA), The Department of Medical Economics of the Institute of Social and Preventive Medicine and the University Hospital of Zurich, and the Network HEPA Switzerland [28]. In addition, physical inactivity was calculated to be responsible for indirect costs of 0.8 billion Swiss Francs (0.5 billion Euros), for 1.4 million cases of disease, and for almost 2000 deaths per year [28]. These numbers were based on physical activity levels assessed in the

health-enhancing physical activity (HEPA) survey in 1999 [29], in which 37% of the interviewees reported no activity corresponding to the level of the minimum HEPA recommendations (see below). However, the items used to assess physical activity in that survey turned out to be too suggestive [30], and today monitoring of physical activity in Switzerland is mainly based on items regarding frequency and duration of moderate and vigorous intensity activities as assessed in the Swiss Health Survey [31]. Re-estimating the cost of physical inactivity based on activity levels from the 2002 Swiss Health Survey (see Table 2.1 later in this chapter), the estimates increase to at least 2900 premature deaths per year, 2.1 million cases of illness, and direct treatment costs of 2.4 billion Swiss Francs (1.6 billion Euros) [32]. Using the latest physical activity data from the Swiss Health Survey 2007 (see Table 2.1), estimates decrease slightly to 2800 premature deaths per year, 2 million cases of illness, and direct treatment costs of 2.2 billion Swiss Francs (1.5 billion Euros) (Brian Martin, personal communication, email 20.8.2009). It has to be noted, however, that these re-estimations are still based on 1999 data regarding prevalence and treatment costs and that they are thus likely to underestimate the real costs.

Physiological Mechanisms of Physical Activity

Several physiological and metabolic changes associated with physical activity which benefit health have been identified. These include acute responses after individual sessions of activity and chronic responses, adaptations that are acquired over weeks or months. However, some effects of regular physical activity may be due to the overlapping acute effects of regular individual physical activity sessions and may thus be independent of long-term adaptations [1]. Physiological responses include (based on [33, 34]):

- Changes in lipoprotein concentrations in the blood plasma with decreases in triglycerides and increases in high-density lipoprotein (HDL) cholesterol observed 24 hours after exercise. Such an improved blood lipid profile results in decreased systemic inflammation and in a reduced damage and atherosclerosis of blood vessels.
- Effects in whole-body insulin-glucose dynamics with enhanced insulin sensitivity after an exercise session, and contracting skeletal muscle that appears to have a synergistic effect with insulin in enhancing glucose uptake into the cells, fat tissue, muscles and the liver and thus allowing better glucose control.
- Effects on blood pressure with a decreased resting blood pressure for several hours following exercise through a reduction in total peripheral resistance, which is primarily mediated by changes in blood vessel diameter. Such a reduction in resting blood pressure has been termed "postexercise hypotension" and evidence suggests that hypotensive responses also occur for moderate-intensity activities.
- Haematological changes with increases in most markers of coagulation and thus increases in blood coagulability and, at the same time, antithrombotic effects by enhancing the enzymatic breakdown of blood clots (fibrinolysis) and by decreasing platelet adhesiveness and aggregation, which helps prevent clot formation.
- Changes in immune function with increased susceptibility after a session of vigorous exercise, but beneficial changes to the immune functions for moderate exercise that is frequent and regular.

- Appetite regulation in that a session of exercise usually stimulates an increase in energy intake but this increase only partially compensates for the additional energy expenditure during exercise, leading to an energy deficit.
- Increased catecholamine levels during exercise, resulting in increased adipose tissue lipolysis, with reduced lipase activation in muscle but elevated lipase activation in adipose tissue due to adaptations to regular physical activity.
- Enhanced fat oxidation for some hours after a moderate or vigorous exercise session.
- Reduction in total body fat or specifically in intra-abdominal fat.

Health-Enhancing Physical Activity Recommendations for Adults

The latest US national recommendations for physical activity and public health for adults, updated in 2008, advocate at least 150 minutes a week of moderate-intensity, or 75 minutes a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity activity [35]. Aerobic activity should be performed in episodes of at least 10 minutes, and preferably, it should be spread throughout the week. In addition, activities that maintain or increase muscular strength are recommended on at least two days a week. In Switzerland, national HEPA recommendations developed jointly by the Federal Office of Sport and Public Health and the Network HEPA Switzerland promote at least half an hour of moderate-intensity activity on most, preferably all days of the week, which can be achieved by adding up bouts of at least 10 minutes [32]. For already active individuals, three or more units of vigorous-intensity endurance training per week of 20 to 60 minutes each are recommended, in addition to a strength and flexibility training recommended twice a week. The Swiss HEPA recommendations for adults are illustrated in Figure 2.1 [32].

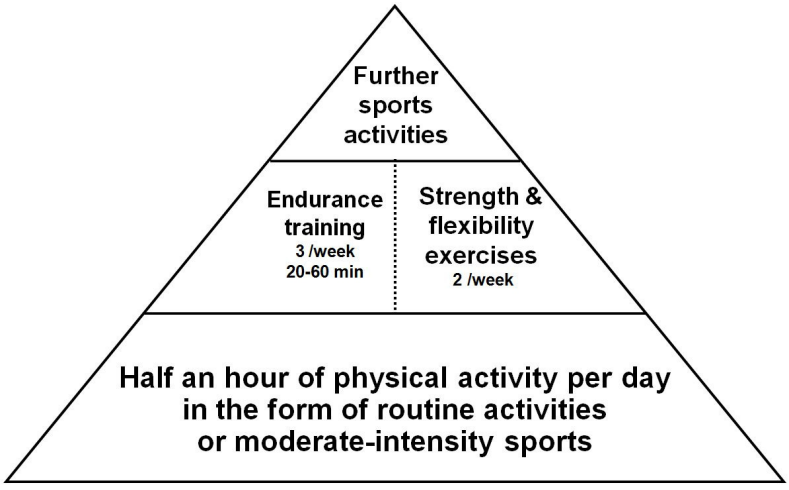

Figure 2.1 The activity pyramid: physical activity recommendations for adults (from [32])

Measurement of Physical Activity

Accurately measuring physical activity is a prerequisite for epidemiological research in this field. Several methods exist: self-report methods such as questionnaires, activity logs or diaries, interviewing techniques, and proxy report methods; and objective methods such as pedometers, accelerometers or heart rate monitors. Up to today, data on physical activity levels have mostly been assessed using questionnaires, especially in larger studies including hundreds of participants and in national physical activity surveillance. However, the application of activity monitors such as accelerometers has increased more recently [36]. In the context of this thesis, questionnaires as well as accelerometers were used to measure physical activity. These methods are described in more detail below. Before that, some terminology is introduced that is often used in relation with physical activity and its assessment.

Terminology Used in Relation with Physical Activity Measures

Physical activity may be expressed in terms of **energy expenditure**. Total daily energy expenditure can be divided into the **basal metabolic rate** (BMR), diet-induced thermogenesis (DIT), and physical activity. The BMR is the minimum amount of energy expended in complete physiological and mental rest, and is measured under standardised conditions: awake but at complete rest, fasted for at least 12 hours and in a thermoneutral environment. BMR typically accounts for about 65% of total daily energy expenditure in a sedentary person [18]. The thermic response to food (absorption, digestion, transport, and storage) accounts for about 10% of daily energy expenditure [18]. Physical activity is the most variable component of total daily energy expenditure in an individual, accounting for about 25% in a sedentary person. However, it may be as high as 50% in endurance athletes or in heavy labour workers [18].

Physical activity may also be expressed in terms of **metabolic equivalents** (METs). The MET concept expresses energy expenditure of any physical activity as a multiple of the **resting metabolic rate** (RMR). The RMR is used under less restrictive conditions than the BMR and is obtained during quiet sitting. One MET is defined as the ratio of work metabolic rate to a standard RMR of 1 $kcal \cdot kg^{-1} \cdot h^{-1}$ or 3.5 ml $O_2 \cdot kg^{-1} \cdot min^{-1}$ [37]. MET values range from 0.9 (sleeping) to 18 (running at a speed of 17.5 km h^{-1}) [37]. Moderate intensity physical activities typically range from 3 to 6 METs, while vigorous intensity activities are above 6 METs. The concept of **MET-minutes** (duration in specific activity times its MET value) is sometimes used to quantify total physical activity independent of frequency, duration and intensity of activities. For example, engaging in a moderate intensity activity of 3 METs for 60 minutes is assumed to be equal to engaging in a more vigorous intensity activity of 6 METs for 30 minutes, resulting both in 180 MET-minutes.

More generally, physical activity may be described in terms of **frequency, duration and intensity**. This can, for example, result in a number of days per week that an individual spent in moderate and/or vigorous intensity activities for a specific duration such as ≥30 minutes, or in a total number of minutes per week. Furthermore, information on frequency, duration and intensity of physical activities allows classifying individuals into different

physical activity categories. For example, sufficiently active, insufficiently active, and completely inactive individuals may be identified based on defined thresholds.

The outputs of accelerometer measurements are numerical values called activity **counts**, which represent accumulated vertical acceleration signals. These acceleration signals are filtered and digitised, before they are continuously integrated and summed over a user specific time interval, called **epoch time**. A common epoch time for the assessment of habitual physical activity in adults is 1 minute resulting in **counts per minute** as outputs. Accelerometers detect normal body motion but filter out high frequency movement such as vibrations. Accelerometer outputs can be downloaded and processed using specific software for the analysis. Using pre-specified cut-offs, the counts per minute can be classified as sedentary, light, moderate, or vigorous, and frequency and duration of different intensity activities can be assessed. Individuals can then also be classified into different physical activity categories.

Self-report Methods

A number of questionnaires exist to measure physical activity, the most commonly ones used internationally are the International Physical Activity Questionnaire (IPAQ, www.ipaq.ki.se/ipaq.htm), and the Global Physical Activity Questionnaire (GPAQ, www.who.int/chp/steps/GPAQ/en/index.html). However, many countries have developed their own questionnaires, which are often shorter, more applicable and serve the country-specific purposes. In Switzerland, a short questionnaire with four items on frequency and duration of moderate and vigorous physical activity during the last seven days is used in the official monitoring of physical activity on the population level [29]. Two efforts have been undertaken to validate this short questionnaire [30, 38]. In a smaller study with 35 individuals, a non-significant Spearman rank order correlation coefficient of 0.26 was found between energy expenditure measured from the questionnaire and accelerometer counts [30]. The second study was not a controlled validation study but used data from the HEPA Survey 2004 where a subgroup of responders (N=250) participated in subsequent accelerometer measurements in addition to the questionnaire. However, there was a time lag between responding to the questionnaire and accelerometer measures, which is a limitation of the study. The results are available in the form of a Master thesis [38], but they have not yet been published. A correlation of 0.21 (P = .001) was found for the categorisation into five distinctive physical activity categories according to questionnaire and accelerometer data [38]. A correlation of 0.27 (P < .001) was found for estimated energy expenditure (according to questionnaire) versus mean counts per minute (according to accelerometer) [38]. The intraclass correlation coefficient for reliability was 0.69 (P < .001) for MET-minutes·week^{-1} including moderate and vigorous activities (Urs Mäder, personal communication, email 3.2.2009). For comparison reasons and because it is short, this four-item questionnaire is often used in physical activity research in Switzerland, for example in intervention or evaluation studies, and has also been used in this thesis.

A more detailed questionnaire, the Physical Activity Frequency Questionnaire, has been developed at the University of Geneva [39]. This tool includes 70 items on different intensity activities (inactive to vigorous) performed during the last 7 days in a range of contexts such as work, transport, household, personal care, leisure time and sport, and allows the calculation of individual energy expenditure for the preceding week. The 70

items were developed using a 24h recall telephone interview in a random sample of 919 adult residents of Geneva to establish a list of activities that contributed to 95% of the energy expended. Energy expenditure was calculated for each of the 70 items separately using the following formula, which includes the individual BMR:

Energy Expenditure = duration of specific activity performance per day * BMR multiple for specific activity * BMR

The individual BMR was computed as a function of age, sex, weight (kg) and height (cm). Energy expenditure can be added up to total mean energy expenditure per day or separately to energy expended with light, moderate and/or vigorous activities. The PAFQ has been validated in 41 volunteers in free-living conditions using a heart rate monitor [39]. The Pearson correlation coefficient between the individuals' energy expenditure measured by heart rate monitor and by the PAFQ was 0.76 ($P < .001$) [39]. Even though this questionnaire allows more detailed analyses of physical activity behaviour and performs better in validity studies [39], it has not yet been used for monitoring at the national level and has only been used in a few physical activity research studies [40]. However, it is used for the regional monitoring in the Geneva area since 1997 as part of the "Bus santé" [41], an epidemiological surveillance system assessing different health determinants in a representative sample of the population in Geneva aged 35-74 years based on annual cross-sectional surveys.

Questionnaires are feasible and applicable in large samples at low costs, and it is possible to assess different dimensions of physical activity. Moreover, measures can be adapted to fit specific research questions or study specific populations. However, these advantages are somewhat countered by some inherent limitations and measurement errors [42]. Self-reporting physical activity through questionnaires is cognitively difficult for adults, but even more so for children, the elderly, and other subgroups [36]. Recall bias may be a problem, especially if physical activity is assessed for a longer period of time [42]. Responses may also depend on the context of questioning, and they may be influenced by social desirability which can produce over-reporting of total physical activity [42]. On the other hand, some activities such as everyday household tasks may not be remembered adequately resulting in underreporting of total physical activity. In fact, it seems that individuals tend to overestimate participation in vigorous intensity activities and underestimate participation in light to moderate activities [43]. For example, Chinapaw et al reported that time spent on sedentary activities was underestimated while time spent engaging in physical activities was overestimated based on a questionnaire when compared to accelerometer measures [44]. It has been argued that self-reports may not provide accurate estimates of the absolute amount of physical activity [42, 44]. Furthermore, differential over-reporting has been described with overweight adults reporting more vigorous intensity activities than normal weight adults, which was not confirmed by accelerometer measures [45].

Cross-sectional versus Longitudinal Self-report Data Assessment

Mostly, data on physical activity on a population level have been assessed cross-sectionally using self-report instruments, and country-level surveillance of physical activity is usually based on repeated cross-sectional

surveys [46]. For example, the Swiss Health Survey assesses data on different health and lifestyle issues every five years since 1992 using a cross-sectional design [31, 47]. These data allow analysing trends in physical activity behaviour and monitoring changes on the population level [31], however, behavioural changes in individuals or groups may cancel out each other and thus may go unnoticed in repeated cross-sectional studies. Longitudinal studies give the opportunity to describe physical activity behaviour and behavioural changes at the individual level. In Switzerland, the Swiss Household Panel (SHP) is a longitudinal nationwide survey collecting data on household and individual level every year since 1999 using computer-assisted telephone interviews [48]. The main aim of the panel is to monitor social changes and changing living conditions in the population of Switzerland. The survey covers a broad range of topics in social sciences. Few of the individual-level questions address physical activity. All household members aged 14 years and older of selected households are interviewed annually. Data from the Swiss Household Panel allow monitoring physical activity behaviour and especially behaviour changes on the individual level, estimating the proportion of spontaneous behavioural changes in individuals, and assessing potential determinants of physical activity behaviour and its changes. This dataset has been used in Chapter 10 to address objective 5 of this thesis.

Objective Methods

Objective methods for assessing physical activity include accelerometers, pedometers, and heart rate monitors. These methods may help to overcome some of the limitations of questionnaires described above. Accelerometers (Figure 2.2) are small devices that measure frequency and intensity of physical activity by collecting a series of counts that integrate vertical acceleration over a specified time period, the epoch time. A frequently used accelerometer is the Actigraph Model (e.g. models AM7164 and GT1M), formerly Computer Science and Applications, now Manufacturing Technology Inc, Fort Walton Beach, FL, USA (www.theactigraph.com). Accelerometers are usually carried on a belt on the right hip or lower back during waking hours for one week.

Limitations of accelerometers [49] are that they cannot be worn in the water (swimming is not assessed) and that they do not assess adequately some activities such as cycling (there is no vertical acceleration in the hip during cycling), upper body movements including activities involving the arms such as rowing or ironing, and carrying additional weight. High costs may also be an issue, and extensive data cleaning, reduction, and translation is required. Furthermore, different cut-offs to classify counts into light, moderate or vigorous-intensity activity have been defined in the literature, none of which seem to adequately represent all different activities. While some cut-offs have been developed based on walking and running activities only [50, 51], others have included different lifestyle activities [52, 53]. The latter ones are generally lower and overestimate time spent in moderate activities [53], while the former usually underestimate time spent in moderate lifestyle activities [54]. Technical problems and subjects not wearing the accelerometers as indicated result in a loss of data. Accelerometers do not provide information on the context of physical activity. Finally, wearing an accelerometer may influence physical activity behaviour.

Figure 2.2 Actigraph Accelerometer (left), worn on the right hip (right)

Self-reported Physical Activity Levels

Despite strong scientific evidence regarding the positive association between physical activity and health, physical activity levels are low in the general population in many developed countries. Sjöström et al compared physical activity levels in the Eurobarometer study in 2002 using the short IPAQ, including 15 member states of the European Union [55]. Sufficient activity was defined as either 5x30 minutes (moderate) or 3x20 minutes (vigorous) on top of a basal 60 minutes of moderate activity per day. This basal amount was included because the IPAQ measures activities of all domains and not just leisure-time activities. Thus the cut point for sufficient total activity was 3000 MET-minutes per week accumulated over seven days or 1500 MET-minutes of vigorous-intensity activity accumulated over three or more days. The prevalence of sufficient physical activity for health ranged from 44% in the Netherlands to 23% in Sweden and was 29% across all the 15 member countries [55]. The prevalence of inactivity (<600 MET-minutes per week) was between 19% in the Netherlands and 43% in France, the average over all member states was 31%. Similar patterns of physical activity across countries were reported by Rütten and Abu-Omar who reported on continuous outcomes of the same data [56].

In the International Prevalence Study conducted between 2002 and 2004, 20 countries participated representing all regions of the world, providing data on physical activity levels of the adult population based on the short version of the IPAQ [57]. The authors used similar definitions of activity (high: vigorous-intensity activity on >3 days per week and accumulating at least 1500 MET-minutes per week or >5 days of any combination of walking, moderate-intensity, or vigorous-intensity activities achieving at least 3000 MET-minutes per week; moderate: 3 days of vigorous-intensity activity of at least 20 minutes per day or 5 days of moderate-intensity activity or walking of >30 minutes per day for >10 minutes at a time or 5 days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving at least 600 MET-minutes per week; low: meeting neither "moderate" nor "high" criteria). The proportion of highly active individuals was reported to be between 21% in Japan and 63% in New Zealand [57]. The prevalence of low activity was between 7% in China and 43% in Japan [57].

In Switzerland, the most important data source on adult physical activity levels is the Swiss Health Survey, a cross-sectional survey carried out every five years [31]. Physical activity levels are generally reported according to a five-level indicator [31] which is displayed in Table 2.1 [58]. Even though the proportion meeting the HEPA recommendations increased from 35.9% in 2002 to 41.1% in 2007, still almost two thirds of the population do not achieve sufficient activity levels.

Table 2.1 Physical activity levels in Switzerland [58]

		in % of the Swiss population	
		2002	2007
N		18 760	17 907
Trained	≥20 minutes of vigorous intensity activities on ≥3 days a week	27.0	31.8
Regularly active	≥30 minutes of moderate intensity activities on ≥5 days a week	8.9	9.3
Irregularly active	≥150 minutes of moderate intensity activities per week or ≥20 minutes of vigorous intensity activities on ≥2 days a week	25.6	24.3
Partially active	≥30 minutes of moderate intensity activities per week or ≥20 minutes of vigorous intensity activities on 1 day per week	19.1	18.7
Inactive	less or no activities	19.4	15.9
Sufficiently active	trained or regularly active	35.9	41.1

Self-reported physical activity levels as assessed in the cross-sectional Swiss Health Survey [58] are higher in younger age groups compared to older ones and in men compared to women (Figure 2.3). The largest differences in activity levels are observed between the two youngest age groups (15-24 versus 25-34 years) and between the two oldest age groups (65-74 versus 75+ years).

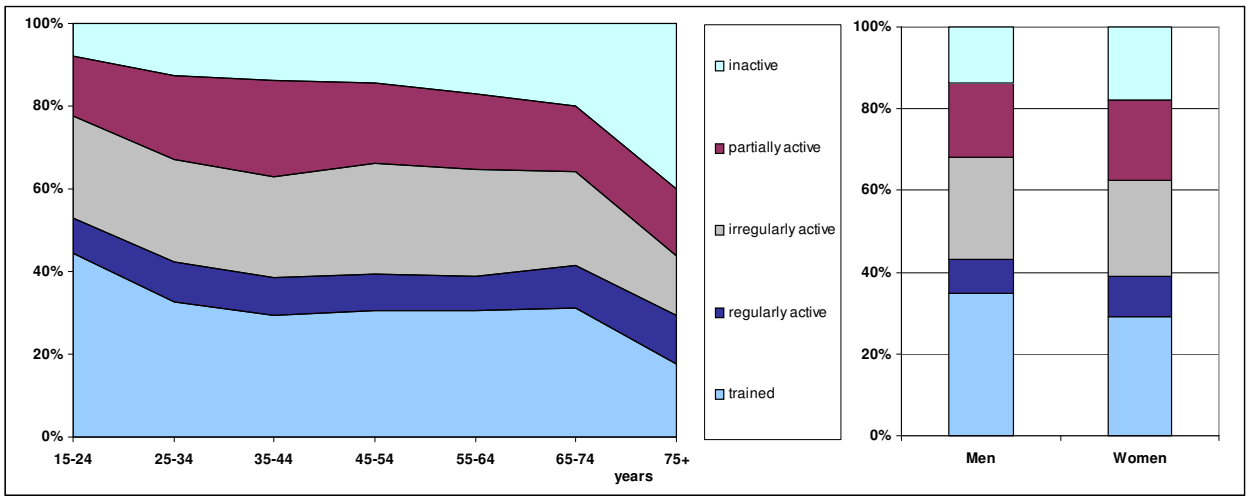

Figure 2.3 Physical activity levels in the general population in Switzerland in 2007 according to age group (left) and according to sex (right). Data source: Swiss Statistics: Swiss Health Survey 2007. Lamprecht & Stamm Sozialforschung und Beratung AG (www.sportobs.ch).

Physical Activity According to Accelerometer Assessments

Mostly, objective physical activity assessments are carried out in the context of small studies, in a defined setting, and in specific populations. Only few countries have started to collect objective physical activity data on the population level. The first population-based survey to use objectively measured physical activity was carried out in Sweden [59]. Hagströmer et al measured 1114 free-living adults (56% women, mean age 46 ±15 years) that were randomly recruited from the Swedish population in 2000/01. Participation rate was relatively low with 54%, however dropout analysis did not support any systematic selection bias. The age and gender profile of the final sample was similar to that of the general Swedish adult population. Freedson cut-offs were used to classify the accelerometer counts into light (<1952 counts per minute), moderate (1952-5724 counts per minute) and vigorous activities (≥5725 counts per minute) [50]. Based on these cut-offs, the Swedish adults were active in at least moderate intensity activity for a median of 31 minutes per day (interquartile range 18-47 minutes), and 52% accumulated ≥30 minutes of moderate-to-vigorous intensity physical activity per day, with men being more likely to do so (57% versus 48% of women, $P < .001$). When including only bouts of 10 minutes or more (as specified in the physical activity recommendations), only 1% of both men and women ($P = .59$) accumulated ≥30 minutes of at least moderate intensity physical activity per day [59]. The low proportion of adults meeting the physical activity recommendations according to these results are in sharp contrast to studies that have used self-reported data, for example in the European Union, where between 23% (Sweden) and 44% (Netherlands) have been reported to meet the recommendations [55].

In the US, the first objective measures of physical activity have taken place during the 2003-2004 National Health and Nutrition Examination Survey (NHANES) [60, 61]. Of the 9643 individuals included in the study, 7176 participated in the accelerometer measures. Two research groups used different methods to analyse the data and different criteria to include individuals in the analysis. While Hawkins et al analysed counts per minute in different activity levels and according to sex, age and ethnic group [61], Troiano et al also reported on the duration spent in different activity levels and adherence to physical activity recommendations [60]. Only the latter study is described here. Individuals of all ages that had valid accelerometer data (four or more days of at least 10 hours of monitor wear) were included in these analyses, resulting in 4867 individuals [60]. For individuals aged 18 years and older, intensity thresholds were calculated as a weighted average from four published sets of cut-offs, resulting in thresholds of <2020 counts per minute for light activities, 2020-5998 counts per minute for moderate intensity activities, and ≥5999 counts per minute for vigorous intensity activities. Individuals in the age category 20-29 years spent on average 39.7 minutes (men) and 23.6 minutes (women) in at least moderate intensity activities. This duration decreased with age and was 8.7 minutes in men and 5.4 minutes in women above 70 years [60]. Including only bouts of at least 10 minutes, the proportion meeting the physical activity recommendations was 3.5% in adults aged 20-59 years and 2.4% in adults aged 60 years and older, respectively [60]. While accelerometer data were qualitatively consistent with findings based on self-report for age and gender (higher activity levels in men and in younger age groups), the magnitude differed greatly: self-reported data from the Behavioural Risk Factor Surveillance System (BRFSS) survey 2003 (including leisure time and household activities) indicated that 46% of the US population met the recommended physical activity

levels [62]. According to the NHANES 2003-04 self-report instrument (including recreation, household and transport activities), 51% were estimated to adhere to the physical activity recommendations [60].

Finally, population-based objective physical activity measures using accelerometry were underway in Canada starting in 2007 in the Canadian Health Measures Survey with around 5000 individuals of all age groups [63]. In Switzerland, population-based monitoring of physical activity is generally based on self-reported data, although accelerometers have been included in a subsample of participants in the HEPA Survey 2004 [38]. The inclusion of objective measures has been recommended in Switzerland [30] and may play a more important role in future monitoring projects.

2.2. Interventions to Promote Physical Activity

To counteract physical inactivity and thus to contribute to reducing the burden of chronic disease, interventions to promote physical activity have taken place in many countries during the last years. There are different forms of physical activity promotion efforts, for example, structured interventions (courses or classes), campaigns (media, events), environmental interventions, or interventions offering personal counselling and support [32]. Interventions may address different target groups such as children, adolescents, adults, older adults, underserved populations, and women, among others. Furthermore, interventions may differ according to the setting in which they are applied (e.g. school, work place, health care, community, environment) and according to the delivery mode which is used to disseminate the intervention (e.g. face-to-face, mediated using print information, television, radio, Internet, newspaper, or telephone). Ideally, physical activity promotion incorporates and integrates different approaches that target various sub populations, use various delivery modes, and are applied in different settings [64].

Even though interventions may differ widely regarding the setting in which they are delivered, the target group, the intensity, frequency and duration of intervention delivery, the dissemination channel, the theoretical foundation, and other factors, several reviews have gathered and combined available evidence on their effectiveness and formulated conclusions. A review published by the Cochrane Collaboration in 2005 concluded that physical activity interventions have a positive moderate sized effect on increasing physical activity in the short- to mid-term [65]. However, there was large heterogeneity in the observed effects between studies, and many questions remained unsolved. A review of reviews on the effectiveness of public health interventions for increasing physical activity among adults summarised, in addition, that interventions based on theories of behaviour change and tailored to the individual, as well as interventions promoting activities that are not facility-dependent, particularly walking, are associated with longer-term changes in behaviour [66]. A review focusing on longer-term effectiveness of interventions promoting physical activity (>12 months) also found evidence for positive intervention effects over 12 to 24 months compared to no-intervention controls or minimal interventions [67]. However, evidence was not conclusive regarding superior effects of individually tailored interventions compared to standard approaches with regard to maintaining physical activity behaviour in the long-term [67]. It

has to be noted that the conclusions of these reviews are mainly based on self-reported data because most included studies used self-reported measures to assess physical activity.

More recently, computer-tailored interventions have become popular tools to promote healthy lifestyles, targeting different behaviours such as smoking [68], nutrition [69], physical activity [70, 71], or multiple health behaviours [72]. The core of these tailored so-called "expert systems", which mimic a personal counselling situation, are a) instruments to assess specific characteristics of the participants based on theories of behaviour change, b) a library with short feedback segments, and c) rules and algorithms for selecting and compiling tailored feedback segments individually for each participant. Delivery modes of computer-tailored interventions include print materials, CD-ROMs and the Internet. When delivered online, these interventions may be a promising tool and have several advantages: Interactive designs may be used to tailor intervention content individually and to make interventions more attractive to users. Using the Internet to deliver an intervention opens new dimensions for reaching large target groups at low extra costs per additional user. Furthermore, users are free to access the intervention from any place and at any time. High flexibility, no face-to-face contacts and (ideally) no cost for users can make such interventions attractive and minimise the threshold for individuals to get involved.

In Switzerland, a number of projects and interventions exist to promote physical activity [32]. Examples of campaigns and events in Switzerland are "bike to work" (www.biketowork.ch) [73], a project which motivates teams of four employees in companies to cycle to work on at least half of the working days during a one-month period, and "slowUp" events (www.slowup.ch), car-free days organised in different regions of Switzerland allowing the population to use the roads for human-powered mobility activities. Switzerland has a favourable environment for physical activity, with open access to forest and mountain trails, side walks and cycling lanes. Furthermore, a dense network of hiking trails (www.wanderland.ch), national and regional cycling routes (www.veloland.ch), and around 500 Vita Parcours (www.vitaparcours.ch) [74] exist. "SwitzerlandMobility" (www.schweizmobil.ch), launched in 2008, is the national network for human-powered mobility including hiking, cycling, mountain biking, skating and canoeing [75]. "SwitzerlandMobility" manages an official and standard signalised route network for the different activities and coordinates the cooperation between public and private sector service providers.

Individual counselling and support is another approach to promote physical activity in Switzerland. For example, the Swiss College of Primary Care Medicine, the Swiss Federal Office of Sport, and other partners have developed models for physical activity counselling that is suitable and feasible for routine use in primary care [76-78]. The Web-based physical activity intervention Active-online (www.active-online.ch) has been developed between 1999 and 2003 as a joint project of the Institute of Social and Preventive Medicine at the University of Zurich and the Federal Office of Sport, supported by Health Promotion Switzerland, SUVA, Allez Hop, and Qualitop [79]. It offers individually tailored motivational feedbacks based on the Transtheoretical Model of Behaviour Change (TTM) [80]. The TTM is intended to explain changes in individuals' behaviour based on five stages: The first and the second stage are intentional stages (**Precontemplation**: no intention to change; **Contemplation**: intention to change), the third stage is both intentional and behavioural (**Preparation**: intention to change in the near future (usually within next month), starting to adopt new behaviour to some extent), and the

forth and fifth stages are defined using behavioural and temporal criteria (**Action**: adoption of new behaviour for less than a specified time period, usually six months; **Maintenance**: adoption of new behaviour for more than a specified time period, usually six months) [81]. Active-online is freely available on the Internet since 2003 in German, French and Italian. The target group are insufficiently active adults. The programme is described in more detail in Chapter 4, and its evaluation is the focus of Part III (Chapters 5 and 6). Another Internet-based programme (www.feelok.ch) targeting adolescents aged 12 to 18 years addresses several health issues including physical activity, nutrition, smoking, and alcohol, among others [82]. The development of Feelok was coordinated at the Institute of Social and Preventive Medicine at the University of Zurich, however, the different modules are managed by other institutions that have expertise in the respective fields. The module on physical activity was launched in 2005. Feelok is designed for use in schools, however, adolescents may also visit the Internet-based programme at home.

The best known structured activities in physical activity promotion in Switzerland include "Youth and Sport" (www.jugendundsport.ch), "Allez Hop", and "Sport for Seniors" ("Seniorensport Schweiz"), the latter two having been combined into the new concept "Sport for Adults" ("Erwachsenensport Schweiz") in 2009. "Youth and Sport", a federal programme that is in place since the 1970ies, aims to promote sport activities among children and adolescents aged between 10 and 20 years, reaching more than 500 000 participants every year. Furthermore, "Youth and Sport Kids" as an extension of "Youth and Sport" targeting children aged 5 to 10 years takes place in schools, offering one or two lessons per week of diverse physical activities and active play. The aims are to increase physical activity in children at school and to provide high quality sport and physical activity offers.

Organised on a national level but limited to the training of instructors, "Sport for adults" promotes structured activities such as walking, Nordic walking or water gymnastic. Allez Hop as a large population-based physical activity promotion programme was developed in 1996 by three Swiss health insurance companies and the Swiss Olympic Association. The core of the programme were inexpensive local physical activity courses offered by trained Allez Hop instructors once a week for about 12 weeks. The aim was to motivate participants to continue exercising after the course has finished, either individually or by joining a sport club. The organisation of the programme and the training of the course instructors were centralised, while courses were offered on a local level in many regions of Switzerland. An inventory of all ongoing and upcoming course offers was provided on the Allez Hop website and could be searched by region. In 2003, the Federal Office of Sport, Health Promotion Switzerland, the Swiss Olympic Association, and Santéswiss as the governing body of the Swiss health insurance companies took over the sponsorship of Allez Hop. By the end of 2008, the programme was incorporated into the new concept "Sport for adults". Several different evaluation approaches on different levels (course participants, instructors, project partners, population) have contributed to the development and optimisation of the programme. Part IV (Chapter 7, 8, and 9) addresses Allez Hop and the different evaluation approaches.

2.3 Evaluation of Physical Activity Interventions

The WHO Europe Working Group on Health Promotion Evaluation has defined evaluation as "the systematic examination and assessment of the features of an initiative and its effects, in order to produce information that can be used by those who have an interest in its improvement or effectiveness" [83]. The core features of approaches appropriate for the evaluation of initiatives are: **participation** of those who have an interest in the initiative (e.g. policy makers, professionals, communities, participants), the use of **multiple methods** based on a **variety of disciplines** to gather information, **capacity building** for individuals, communities and organisations to address important health issues, and **appropriateness** to accommodate the complex nature of interventions and their long-term impacts [83].

Like in other health promotion research, evaluation plays an important role in the development and dissemination of physical activity interventions. When developing an intervention, it is important to be able to answer a series of questions regarding the success of the intervention on different levels. For stakeholders, sponsors and researchers likewise it is important to learn, for example, whether the implementation of a programme works, whether the target group can be reached, whether the programme is accepted, whether it is used sufficiently by the target group, and whether the objectives of the programme can be attained.

There are two main types of evaluation: **outcome or summative evaluation** and **process or formative evaluation** [4, 5]. Outcome evaluation addresses primarily questions regarding the effectiveness of an intervention, while process evaluation focuses more on the successful development and implementation of the intervention and on why an intervention does or does not work, and allows to optimise the intervention and its implementation. Ideally, both types of evaluation will take place during different stages of development and implementation of a programme.

Several models and frameworks have been developed to help researchers plan, organise and conduct evaluations in a systematic way. The RE-AIM framework, proposed by Glasgow et al for the evaluation of the impact of public health interventions, conceptualises the impact as a function of five factors: reach, efficacy, adoption, implementation, and maintenance [6]. The impact is assumed to be a multiplicative combination of the five component dimensions. The authors suggest evaluating each of these dimensions and combining them to determine the overall public health impact [6].

Different approaches and designs for the collection of data may be used in evaluations of physical activity interventions. The Physical Activity Evaluation Handbook published by the CDC in 2002 lists the following designs as commonly used: randomised trial as the most rigorous design (but which is mostly not feasible or appropriate for a community-based programme), one sample pretest posttest design, quasi-experimental pretest posttest design with two samples, time series design, and cross-sectional design [84]. The quasi-experimental design mimics a randomised trial by including a control group, but without the key element of randomisation. However, this is often the preferred design when randomisation is not feasible. The one sample pretest posttest design uses baseline information to be compared with follow-up information without a control group. Time series are related to monitoring and data is assessed several times during a predefined time period to monitor changes,

a comparison group may be included but is not imperative. Cross-sectional designs cannot be used for outcome evaluation, however they may be used for posttest-only data collection after an intervention occurred to describe what happened, or to compare two groups after an intervention has occurred in one of them only, or to gather data regarding the awareness of a campaign in the population [84].

Internal and external validity are important constructs in outcome evaluations. **Internal validity** refers to inferences regarding cause-effect or causal relationships. The key issue is whether observed changes in the outcome of interest can be correctly attributed to the intervention under investigation [85]. Two main errors can threaten the internal validity, bias (or systematic error) and random error (or chance error) [85]. Systematic error includes selection bias (systematic difference in any characteristics between groups which may lead to confounding), performance bias (systematic difference in the care provided to the participants other than the intervention), detection bias (systematic difference between groups in outcome assessment), and attrition bias (systematic difference between groups in the loss of study participants) [85]. Random error is due to the variability in the measured data that arises purely by chance [85]. **External validity** refers to the extent to which the results of a RCT can be generalised to the real world with regard to setting, population, and context. Internal validity is a prerequisite of external validity, however, results of an internally valid trial may be clinically limited if it lacks external validity [85].

To assess the effectiveness of an intervention in an outcome evaluation, RCTs are the most rigorous design. Although it is the design that in most situations helps to maximally control for potential confounders due to randomisation and thus to enhance internal validity, RCTs often cut back on external validity due to the controlled setting [86]. For example, results can be generalised only to those participants who are willing to accept randomisation [86]. Furthermore, interventions are often applied in a controlled setting and efforts are made to reach a high compliance. Therefore, research may investigate the **efficacy** of an intervention (highly controlled, under ideal intervention conditions) or the **effectiveness** of an intervention (less controlled, under real intervention conditions) [87, 88].

A major challenge when conducting RCTs is to make them contextually relevant, that they include outcomes of concern to decision makers, answer real-world questions, and include representative participants [86]. If a RCT design is not feasible or not considered the appropriate study design, other designs will be useful to collect data that give some indication of programme success, even though no causal relationship can be established and the question of effectiveness regarding the primary outcome cannot be answered ultimately. Limitations for using RCTs may include financial aspects (they are very time-consuming and expensive), ethical issues (it may ethically not be justified to withdraw an intervention from one group), or feasibility (it may not be possible to randomise, for example in community-based intervention approaches).

In Switzerland, evaluation of physical activity promotion programmes is still in its infancy. There is no common consent whether and how physical activity interventions should be evaluated. Only a small number of the physical activity promotion programmes in Switzerland described above have included some kind of evaluation [9, 73, 74, 77, 78]. In general, it is possible to get financial support for intervention projects without having an

evaluation concept. However, during the last years more weight has been put on evaluation. Allez Hop and Active-online are probably among the best evaluated national physical activity promotion programmes in Switzerland. However, the designs and approaches used were very different. Active-online started as a scientific research project and was developed in a team of experts in public health, sport sciences, psychology, design, and computer sciences. Data collection and both process and outcome evaluation played an important role from the beginning: Version 1 of the programme (in German) was tested regarding acceptance and satisfaction using an online questionnaire among intervention visitors recruited via a consumer's magazine [15, 17]. The results showed that visitors were generally satisfied with the programme and that insufficiently active individuals could be reached. However, the evaluation also revealed that some adaptations were necessary. For example, the feedback text needed to be more reader-friendly, print options had to be simplified, and it had to be made clearer that Active-online is a motivational programme and does not "prescribe" specific exercise sessions or generate individual training programmes [15]. An important adaptation was also the registration process. While visitors had to register in version 1 choosing a personal password, registration became optional in version 2. The reason was that a number of visitors did not want to register or were not able to (probably due to insufficient computer skills) and thus a number of visitors were lost. Other adaptations were made concerning the design and the structure, for example, the new modular structure of the expert system on HEPA and endurance training, and the introduction of a new module on strength and flexibility training.

The revised version 2 of the programme was the focus of a subsequent process evaluation [16]. Compared to the evaluation of version 1, participants were slightly older in this second evaluation, and a higher proportion of insufficiently active individuals could be reached [16]. Again, the general acceptance of the website was good. The optional registration turned out to be an advantage with more individuals entering the expert system, however, not all of them did start the tailoring questionnaires to get a personal feedback. Following this second evaluation, the programme was extended to include three language versions (French and Italian in addition to German), email reminders to encourage follow-up visits for registered users, and tailored follow-up feedback [89]. The translation and cultural adaptation of the programme was based on a survey assessing cultural differences in physical activity behaviour, motivation, and attitudes in the Swiss population [90]. The new version went online in 2003. Another step in the process evaluation of Active-online was the continuous collection of data in the Active-online user database which allowed characterising the participants and their patterns of intervention use over time and in different contexts in which the intervention was applied (see Chapter 6). These analyses were not only of interest regarding the evaluation of Active-online, but also for other researchers in the field, because only very little has been published on patterns of Web-based tailored intervention use, especially in an open access context.

Because not much is known about the effectiveness of Web-based tailored physical activity interventions like Active-online, especially when disseminated under real-life conditions in the population, a randomised effectiveness study was planned in order to start collecting evidence in that field of research. In a pilot study, the feasibility of an Internet-based RCT was tested [79]. Finally, an important part of this thesis was to assess the

effectiveness of Active-online in a large-scale RCT carried out over the Internet in a real-life setting (see Chapter 5).

Unlike Active-online, Allez Hop started as an implementation rather than a research project. Furthermore, some study designs such as RCTs are mostly not feasible for evaluation purposes in population-based programmes. Nevertheless, evaluation plays an important role in large population-based programmes in order to provide information about the success and the feasibility of the programme to stakeholders and partners. In the programme Allez Hop, some funding was available for evaluations, and different approaches were used to collect data on the acceptance of Allez Hop in stakeholders, partners, instructors, and participants [10, 11], to assess the characteristics and physical activity behaviour of participants [9-13], to evaluate the training of Allez Hop instructors [14], and to collect population-level data on the awareness of Allez Hop [91] and on changes in physical activity behaviour in Switzerland over time [31, 58]. Part IV will address the evaluation approaches regarding Allez Hop in more depth, review and summarise the different evaluation steps (Chapter 7), approach the question of a population impact of Allez Hop after more than a decade of implementation (Chapter 8), and present a semiautomated Web-based approach for routine course evaluations (Chapter 9).

PART II

USING INFORMATION TECHNOLOGY TO PROMOTE PHYSICAL ACTIVITY

3 Information Technology and Its Role in Promoting Physical Activity and Sport for All

This chapter has been published as an invited article in a conference proceeding:

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Abstract

There is growing concern about the worldwide extent of physical inactivity. Technological changes, also in the field of information, are named as some of the driving forces. However, in these changes there are not only dangers, but there is also great potential for promoting physical activity and sport for all.

Information technology plays an important role in scientific research in general and has many implications for sports and for physical activity. In the development of sport equipment, in technical training, in membership management for clubs, in promoting events and in providing access to results, computer-based applications are well established. This review focuses on some less well known areas that have a particular potential for the promotion of physical activity and sport for all:

- Support for sport and physical activity providers and professionals
- Facilitated access to offers and facilities
- Individual motivation and support for becoming and remaining physically active
- Exercise-generating video games

A great number of tools exist to support sport for all instructors in their activities with training groups. Increasingly, these tools are available not only in printed versions as books or manuals, but also in electronic format. Interactive tools up to full e-learning programmes are available also for physical activity counsellors. For professionals in sport for all promotion and in physical activity promotion, exchange platforms are becoming more and more important. They usually include information technology elements as well as opportunities to meet in person.

Electronic databases for training offers in clubs, fitness centres or also through individuals are technically feasible. However, keeping the information in them updated is a major challenge and usually only works if financial incentives can be applied. Databases focussing on infrastructure alone are less prone to be outdated and might be an intermediate solution. Only few integrated systems including facilities for sport and physical activity, transport infrastructure and accommodation have been realised so far.

Motivation and support for becoming physically active can be provided through counselling systems with different degrees of complexity and automation. Reminders are often used to support behavioural change, pedometers have shown potential as feedback devices. Training diaries can be used for remote feedback. Ideally information technology based systems provide links to specific offers in sport for all and physical activity.

Exercise-generating video games are a rather new development with great commercial potential. While conventional e-games induce only activities of low intensity in players, more recently developed exercise-generating video games can be used for moderate or maybe even vigorous exercise. In addition to individual use, social forms like group competitions are being developed.

In many instances traditional tools such as magazines, instruction courses and oral arrangements are partially or entirely replaced by faster and - once the necessary infrastructure is generally available - cheaper IT elements. These allow for better exchange and - potentially - wider dissemination. In automated counselling and feedback systems as well as in exercise-generating video games, genuinely new developments are possible. For some of these interventions, evidence on effectiveness in behavioural change is available. Long-term maintenance of positive behaviour in physical activity and sport remains the main challenge.

3.1 Introduction

There is growing concern about the worldwide extent of physical inactivity [22]. Technological changes, also in the field of information technology, are named as some of the driving forces behind this development. However, these changes are not only potentially detrimental for physical activity behaviour, but there is also great potential for promoting physical activity and sport for all.

According to the Compact Oxford English Dictionary, Information Technology (abbreviated as IT) is “the study or use of systems such as computers and telecommunications for storing, retrieving, and sending information”. It is penetrating today's life and has many implications for scientific research in general, such as data retrieval and data analysis [92]. In sports and physical activity, the use of information technology has been well established for a number of dimensions (Table 3.1).

Table 3.1 Established use and new fields for information technology in physical activity and sport for all. In addition to the general use of IT in scientific research, established areas in physical activity and sport as well as fields with specific potential for development can be identified

Established use of IT in physical activity and sport for all	New fields for IT in promoting physical activity
• development of sport equipment • technical training • membership management for clubs • promotion of events • access to results	• Support for sport and physical activity providers and professionals • Facilitated access to offers and facilities • Individual motivation and support for becoming and remaining physically active • Exercise-generating video games

In the development of sport equipment, mechanical and bio-mechanical research (both heavily depending on IT) have become an important success factor for sports such as competition sailing and yachting, paragliding or cross-country skiing. However, not only sports with an obvious technological component, but also the development of widely used equipment such as running shoes depends on IT [93]. Video technology has been used for some time to register and optimise motion sequences as well as tactical processes in team sports, more

and more it is now coupled with analytical tools to support the coaches' interpretation of the data [94]. Address lists for email and SMS or text messaging can substantially facilitate interaction with sport club members, either in an isolated way or combined with databases, websites and content management systems.

Communication trough the Internet has become an important element in promoting sport events, often providing not only the essential information that could also be found in a flyer, but also links to related offers and the opportunity to register online or to book transport and accommodation. Often through the same websites, access to results is provided including several search options or additional information such as split times. Many such websites exist, the New York City Marathon (www.nycmarathon.org) is one of them. Some sports such as orienteering to a large extent take place away from spectators, for example in the forest. Here IT has made it possible to reconstruct the details of competitions and even to make direct comparisons between participants that did not compete simultaneously. The website of the Swedish O-Ringen 5 Day orienteering event (www.oringen.org) gives such an example with most of the information available in English as well (Figure 3.1).

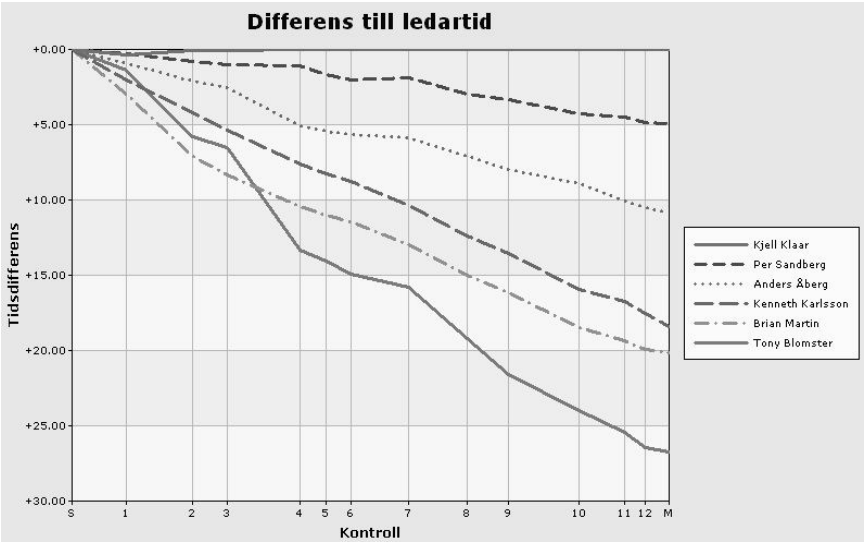

Figure 3.1 Graphical representation of runners' split times from the Swedish O-Ringen orienteering event website (www.oringen.org). Many sporting events nowadays provide competition results through the Internet. The sophisticated presentation of results allows for example the direct comparison of participants who had not been competing simultaneously

The purpose of this publication is not to focus on these established uses of IT, but to give an overview of some emerging areas that have a particular potential for the promotion of physical activity and sport for all (Table 3.1). Where possible, scientific publications will be cited, but due to the rapid development of the field sometimes only references to ongoing projects and websites can be provided.

3.2 Support for Sport and Physical Activity Providers and Professionals

Traditionally a great number of tools have existed to support sport for all instructors in their activities with training groups, for example coaches' manuals, visual aids and training programmes. Instead of providing these tools only in printed format, more and more they are available now also in electronic format. The Swiss programme Youth and Sport is such an example, with a website that includes openly available information as well as some password restricted areas open to registered coaches only (www.jeunesseetsport.ch, Illustration 3.1).

Illustration 3.1 Screenshot of the website of the Swiss national programme Youth and Sport (www.jeunesseetsport.ch). The website provides general information to an interested public and specific information in a closed user group only to certified coaches

A new development is the use of e-learning, where a part of the training of instructors is not done in class, but independently using electronic teaching tools. The Swiss physical activity counsellors' curriculum "Active upon advice" (www.ratzurtat.ch, Illustration 3.2) is such an example. In this project, the IT-based teaching elements were developed based on a formative evaluation focussing on the preferences and acceptance in the intended target audience. In order to develop and verify the necessary inter-personal skills, the curriculum also includes traditional teaching and testing elements [95].

Illustration 3.2 Physical activity professionals during formative evaluation of the Swiss physical activity counsellors' curriculum (www.ratzurtat.ch). The curriculum contains both e-learning elements and traditional teaching and testing elements

Websites such as the ones mentioned above often link up to related offers and information. In addition, specific exchange platforms for professionals in the promotion of sport for all and physical activity are becoming more and more important (Table 3.2). The World Health Organisation WHO has a number of resources on physical activity and health, both at the global level and at the level of its regional offices. With Agita Mundo and the Global Alliance on Physical Activity GAPA two global organisations exist that are specifically dedicated to this field, the new International Society on Physical Activity and Health ISPAH is likely to become an important player in the near future.

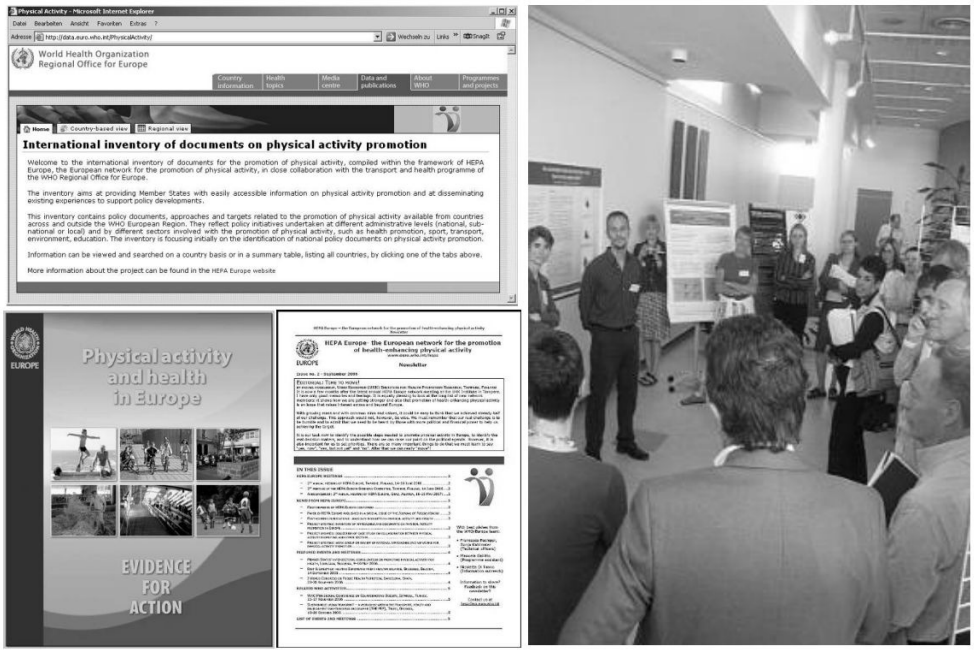

Illustration 3.3 Examples for IT and in-person elements of HEPA Europe, the European network for the promotion of health-enhancing physical activity. International document inventory database, electronic version of WHO publication and HEPA Europe newsletter, all from the www.euro.who.int/hepa website, and discussion during the 2006 annual network meeting in Tampere, Finland

Currently, there are three organisations covering continents or world regions on physical activity and health, namely the Red de Actividad Fisica de las Americas – Physical Activity Network of the Americas RAFA-PANA, HEPA Europe, the European network for the promotion of health-enhancing physical activity, and the Asia Pacific Physical Activity Network. In addition to a website, these organisations usually have newsletters that can be subscribed to, publications that can be downloaded or ordered and other tools such as inventories. However, with respect to the fact that IT can enhance but not replace direct human interaction, most of them also have opportunities to meet in person with the other members at regular meetings or workshops (Illustration 3.3).

Table 3.2 Important international exchange platforms for physical activity and health professionals. In addition to WHO, there are currently three global institutions dealing specifically with the issue and so far three networks covering continents or world regions

World Health Organisation WHO	www.who.int
Agita Mundo	www.agitamundo.org
Global Alliance on Physical Activity GAPA	www.globalpa.org.uk
International Society on Physical Activity and Health ISPAH	www.ispah.org
Physical Activity Network of the Americas	www.rafapana.org
HEPA Europe	www.euro.who.int/hepa
Asia Pacific Physical Activity Network	www.ap-pan.org

No comprehensive picture, but only examples can be given of the situation within countries [96]. Structures similar to the international networks exist at the national or local level, such as the Network HEPA Switzerland (www.hepa.ch) or Agita São Paolo (www.agitasp.org.br). In addition there are platforms for specific issues such as best practice (www.cbpp-pcpe.phac-aspc.gc.ca), community interventions (www.thecommunityguide.org/pa) or interventions in children (www.children-on-the-move.ch).

3.3 Facilitating Access to Offers and Facilities

Knowing about specific possibilities to exercise and to do sports is an essential issue both for individuals wanting to become more active and for counselling professionals. Using IT to provide this knowledge is an intriguing idea. Conceptually it relies on the existence of centralised knowledge about offers, on the possibility to make queries and to receive replies. In a very localised context, this information is often available from individuals or groups in institutions and they can be approached directly. In the context of larger communities or even at a national level, the information becomes so complex that it is kept and managed in a database and queries can be made by telephone for example. If the database is an electronic one, communication can also happen through IT, for example through text messaging or SMS, through email or through websites.

Such a system can be used to establish contacts between individuals who look for others to exercise with, as in the Swiss Meet2Move project (www.meet2move.com). Several schemes have already existed also for institutionalised or group offers, but few have been able to keep the database up to date and complete.

Technically this issue can be solved, for example by giving institutions the possibility to edit the database concerning their own offers. However, motivating them to actually do so is the far greater challenge. It seems that financing an institution for doing this at the local level is a solution, such as the regional agency of the Ligues vaudoises de la santé in the context of a primary care physical activity promotion scheme [76], and that providing financial incentives in form of subsidies to sports organisations [82] is another one. Direct financial interests can also be instrumental for keeping databases up to date, such as subsidies for membership fees through health insurance companies only in certified and registered fitness centres (www.qualitop.org, Illustration 3.4) or the perspective of participation fees for qualified organisers of walking courses in the former Allez Hop project [97]. Another possibility is to focus only on existing infrastructure such as gymnasiums or sport grounds, as it has been done in the Active Scotland initiative (www.activescotland.org.uk) which started in 2008 [98]. Such an approach can achieve a good geographical coverage and faces less danger of being outdated. However, it leaves it to the individuals to find out about the actual offers and there might be a danger to miss offers that are geographically independent such as walking courses.

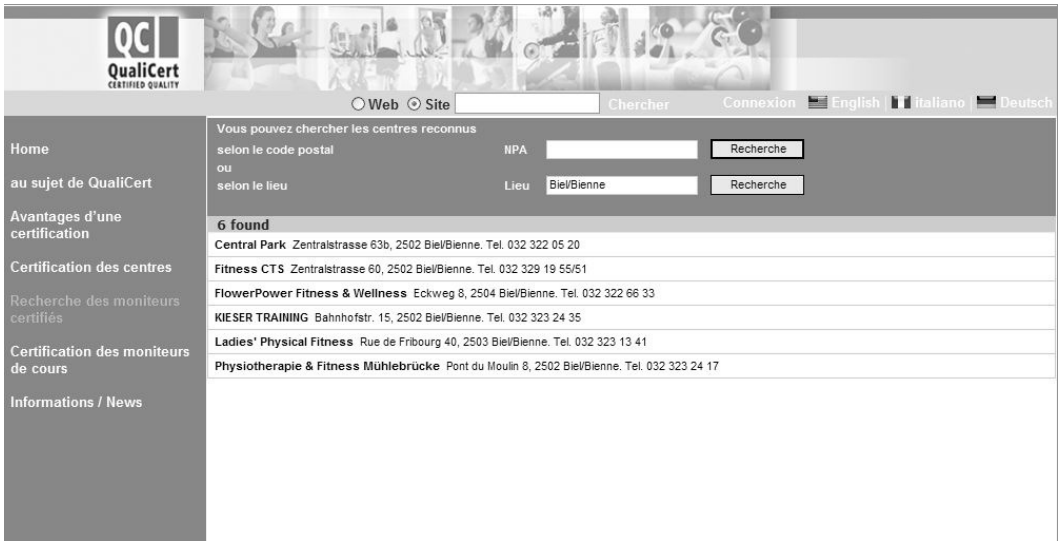

Illustration 3.4 Screenshot of the Qualitop website (www.qualitop.org) as an example for a physical activity offer search engine by name or postal code of the town. As the certified fitness centres listed in the database qualify for membership fee subsidies through many health insurance companies, this is an incentive to keep the information complete and up to date

Ideally, integrated information systems cover geographical information, infrastructure, rental possibilities for equipment, transport, and accommodation. For the health and the sport sector in most countries, such an endeavour would probably be beyond its possibilities. However, through collaboration with the public administration, sports associations, sponsors and commercial partners, the tourist experts from SwitzerlandMobility (www.switzerlandmobility.ch, Illustration 3.5) have created such a platform covering national offers in hiking, cycling, mountain biking, skating and canoeing [75].

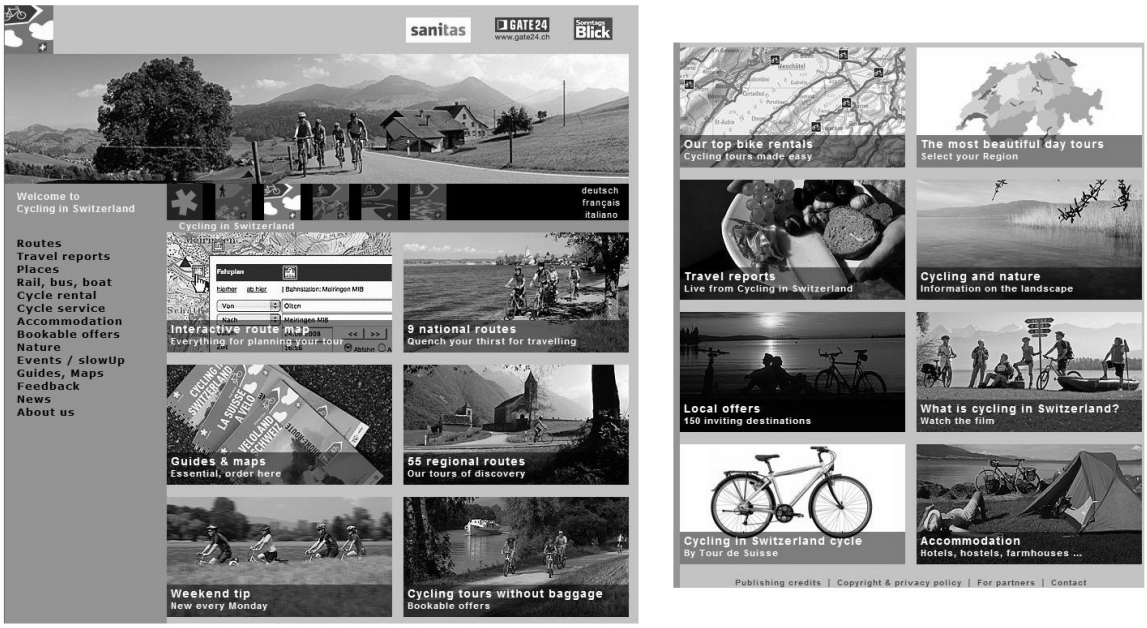

Illustration 3.5 Screenshots of the cycling module of the Switzerland Mobility website (www.switzerlandmobility.ch). The development and maintenance of integrated information systems for physical activity offers is very demanding, but can be realised in collaborative efforts

3.4 Individual Motivation and Support for Becoming and Remaining Physically Active

Traditionally, motivation and support for becoming and remaining physically active have been delivered through individuals and groups of people, be it family, friends, sport instructors and other athletes or counselling professionals. Nowadays, they can also be provided through IT-based counselling systems with different degrees of complexity and automation, often including tools to follow one's behavioural changes when revisiting the system. Such interventions are often Internet-based and have the potential to reach large numbers of individuals at relatively low cost. Other advantages are interactivity, immediate display of individual, personally-relevant feedback and information based on behaviour, attitudes and motivation of the user, as well as time- and place-independent availability. Such an example is the Swiss programme Active-online (www.active-online.ch) that is available free of charge in German, French and Italian (Illustration 3.6) [81].

Two reviews have investigated the effectiveness of website delivered physical activity interventions. Vandelanotte and colleagues summarised that a little more than half of the controlled trials included in their review reported positive behavioural outcomes [70]. Studies with shorter follow-up periods and a higher number of contacts were more likely to find positive outcomes. There was limited evidence of maintenance of physical activity when follow-up was longer than three months. Van den Berg and colleagues found evidence in their review that interventions were more effective than a waiting list control strategy [71]. However, they were not able to establish key components of interventions that may increase effectiveness.

Feedback on physical activity behaviour can support behaviour change. A simple IT-based tool often used in this context is the pedometer or step-counter. A recent Canadian study has found indications of its effectiveness at the population level [99].

Illustration 3.6 Screenshot of the Internet counselling system Active-online (www.active.online.ch). The expert system provides tailored feedback and advice in German, French and Italian and is available free of charge

Training diaries are a traditional tool of sport training, they are now also available in electronic format. Commercial offers for personal coaching integrate these tools and provide individual feedback from experts, for example from the Swiss world class marathon runner Victor Röthlin (www.vicsystem.ch). While a vast range of such offers exist, it is left to the user to judge their quality and appropriateness of fees.

Ideally, IT-based motivation and support systems provide not only general information and advice, but also links to specific offers in sport for all and physical activity. One such example is the Feelok website, a Swiss prevention programme for adolescents (Illustration 3.7). It covers a whole range of topics including physical activity and sport [82]. The website not only provides feedback on adolescents' physical activity behaviour, tips for changing or maintaining it and tools to identify individually appropriate activities, but it also contains a module presenting different sport disciplines in text and video sequences. In a further step, the programme allows to search for local and regional clubs offering this specific sport in the context of the national Youth and Sport programme and it provides the respective place, time and contact details.

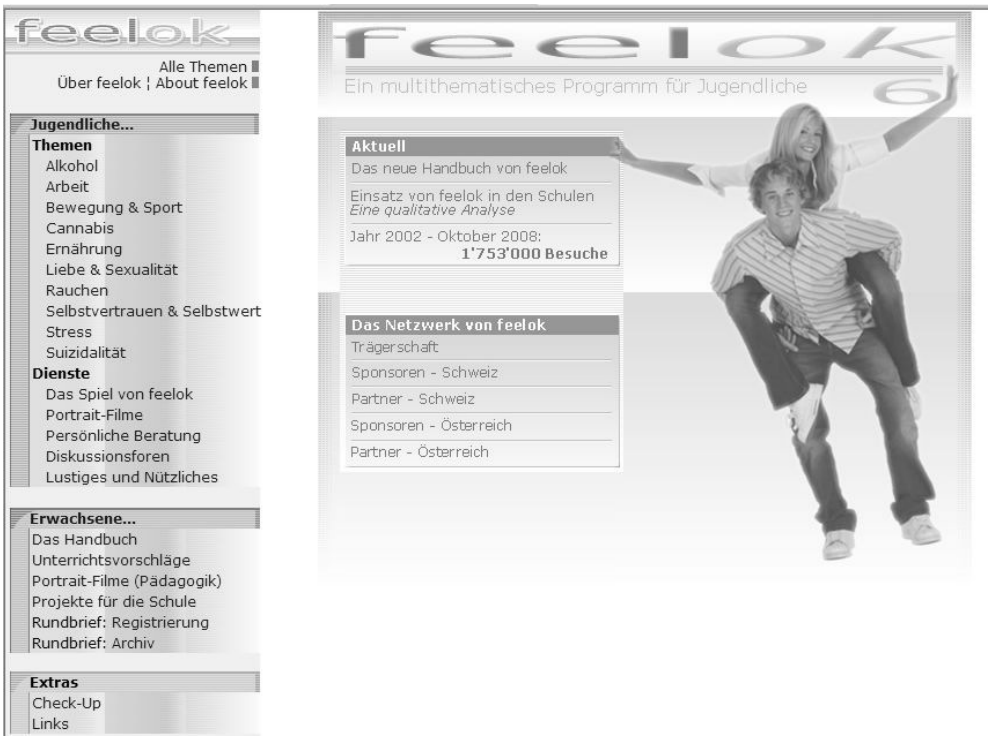

Illustration 3.7 Screenshot of the Feelok youth prevention programme (www.feelok.ch). Physical activity and sport is only one out of a range of topics covered on the website. Adolescents can access information and motivational tools, but also details about specific sports and opportunities for training

3.5 The Potential of Exercise-Generating Video Games

Video games have been on the market for several years and since early on there have been concerns that they might contribute to the problem of physical inactivity. Advances in technology have made it possible to include feedback on bodily movements of the users, through cameras, pads reacting to body weight and pressure or other devices. Thus a whole range of exercise-generating video games is now available and promoted commercially (Illustration 3.8).

Studies have shown that playing active games is using significantly more energy than playing sedentary video games, but not as much as real sports [100]. Preliminary study results indicate that playing exercise-generating video games on a regular basis may positively influence children's overall physical activity levels [101]. The development in this field is rapid and there are specific websites such as "GamerSize Science - Quest for the perfect ExerGame" (www.gamersizescience.org) informing about the latest news.

Physiologically, there is sufficient evidence that exercise-generating video games can induce physical activity relevant for health, and in customised physical activity programmes for people with disabilities the potential of IT is actively explored [102]. There are some indications that forms of exercise gaming using group interaction and support can improve exercise adherence compared to solitary use [103]. At the current point in time it seems likely that exercise-generating video games can make a contribution to physical activity promotion, maybe comparable to the one of exercise equipment such as home trainers. However, whether they will have an impact

at the population level will depend on their ability to reach large audiences and to induce long-time exercise adherence.

Illustration 3.8 Examples of commercially available exercise-generating video games. Technical devices such as cameras or sensor mats allow interaction between the activities of the player and the situation on the screen

3.6 Discussion

Information technology is already well established in research in general and in a number of specific implementations in physical activity and sport, such as development of equipment, technical training, membership management for clubs, promoting events and providing access to results. This review describes the potential of IT in four new fields:

- In the support for sport and physical activity providers and professionals, traditional tools can be partially or entirely replaced by faster and potentially cheaper IT elements.
- IT can be used in facilitating access to offers and facilities, but integrated solutions require considerable resources and keeping the information up to date is a huge challenge regardless of technical aspects.
- Individual motivation and support for becoming and remaining physically active can profit from using IT, and feedback providing systems offer new perspectives.
- In exercise-generating video games the technological potential seems to be there, long-term participation or combination with other forms of activity will be the key issue.

In many of these developments, traditional tools are replaced by new ones that allow physical activity and sport professionals to do faster and more efficiently many of the things they already have been doing. In some fields such as automated counselling, feedback systems and exercise-generating video games, genuinely new

developments are possible. However, as IT cannot replace personal interaction, approaches usually include IT elements as well as opportunities to meet in person.

There is a wealth of offers competing for visitors, especially on the Internet, of varying quality regarding content, readability and usability. Furthermore, some commercial websites may be more interested in selling a product than in helping individuals to change behaviour. An evaluation of physical activity websites reported that only few websites used the advantages of the Internet, such as interactivity, and most did not provide personal information and individually tailored feedback [104]. A study carried out on nutrition websites found large differences in quality of content between the different offers, with ".gov" and ".org" websites being of generally better quality than ".com" ones [105]. At the same time, better readability did not correspond with better quality of content [105]. Also in physical activity websites, better appeal is no guarantee for better content, which can make judging and selecting offers very difficult. The best general recommendation currently to be given is to rely less on design and more on the trustworthiness of the institution behind the offer.

The use and availability of IT varies widely between countries and population groups. It also changes over time, sometimes rapidly. In order for it to reach its full potential – and to justify the costs for development and implementation - the necessary infrastructure must be generally available and socially acceptable in the target group. While most of this review deals with Internet-based technology, telephones, text messaging, smart phones, game consoles or other tools still to be developed might be more relevant in specific contexts.

Only for some of the interventions in this review, evidence on effectiveness in behavioural change is available. Therefore expectations have to be realistic, particular if an approach focuses only on the individual and not also on the social and physical environment. Long-term maintenance of positive behaviour in physical activity and sport remains the main challenge. IT can support physical activity and sport for all promotion, but it cannot replace human interaction and personal experiences.

4 Internet-Based Physical Activity Promotion

This chapter has been published as a book section:

Martin-Diener E, Wanner M, Padlina O. Internetgestützte Bewegungsförderung (Internet-based physical activity promotion). In: Fuchs R, Göhner W, Seelig H, editor. Aufbau eines körperlich-aktiven Lebensstils. Theorie, Empirie und Praxis. Göttingen: Hogrefe Verlag GmbH & Co; 2007. p. 294-313.

An update of the literature review for 2007-2009 has been added at the end of the book section (Chapter 4.6).

In jüngerer Zeit wurde das Potential des Einsatzes von neuen Technologien und von Massenkommunikation (Computer, Telefon, Internet) in verschiedenen Bereichen des Gesundheitswesens erkannt. In Gesundheitsförderung und Prävention wurden seit Anfang der 1990er Jahre Möglichkeiten des Einsatzes der Computertechnologie für die Förderung eines gesunden Lebensstils entwickelt und erprobt [106, 107]. Die Entwicklung der neuen Technologien ermöglichte erstmals eine automatisierte Beratung auf individueller Ebene; in der Regel werden solche computergestützten Beratungsprogramme als „maßgeschneiderte Interventionen" bezeichnet. Gemäß dem heutigen Verständnis berücksichtigt eine qualitativ gute internetbasierte Intervention in der Gesundheitsförderung die Prinzipien der maßgeschneiderten Interventionen, deshalb folgt an dieser Stelle zuerst ein kurzer Exkurs zu diesem Thema.

4.1 Die Prinzipien von maßgeschneiderten Interventionen

Computergestützte maßgeschneiderte Interventionen simulieren eine persönliche Beratungssituation, in der auf Verhalten, Motivation und Einstellung der Teilnehmer eingegangen wird. Die Antworten auf spezifische Fragen werden genutzt, um den Verlauf der Intervention zu steuern. Einen Überblick über die Entwicklung von maßgeschneiderten Interventionen geben Kreuter, Farrell, Olevitch und Brennan (2000) [108] sowie Dijkstra und De Vries (1999) [109].

Maßgeschneiderte Interventionen basieren auf Theorien der gesundheitsbezogenen Verhaltensänderung wie z.B. dem Transtheoretischen Modell (TTM) der Verhaltensänderung [80]. Bei den einfachsten Interventionen wird z.B. nur eine Einteilung in die fünf Stadien des TTMs vorgenommen und es werden fünf verschiedene Feedback-Materialien für die einzelnen Stadien entwickelt (stufenspezifische Intervention). Der Ansatz der computergestützten maßgeschneiderten Interventionen ermöglicht jedoch einen viel höheren Individualisierungsgrad, indem auf Basis der erhobenen individuellen Merkmale einzelne Teile der Beratung individuell zusammengestellt werden. Kernstücke von computergestützten maßgeschneiderten Interventionen bilden (a) Befragungsinstrumente zur Erhebung von für die Beratung relevanten Merkmalen der Teilnehmer, (b) eine Feedback-Bibliothek mit kurzen Feedback-Bausteinen sowie (c) Regeln, welche die Auswahl und Zusammensetzung der auf den jeweiligen Teilnehmer zugeschnittenen Feedback-Segmente zu einem Beratungstext erlauben.

Bei der ersten Generation der computergestützten maßgeschneiderten Interventionen [110, 111] wurde das Feedback-Material in Form von gedruckten Materialien erstellt und per Post verschickt. Mit den technologischen

Fortschritten der letzten Jahre hat sich eine zukunftsweisende zweite Generation von Systemen mit Dissemination von Feedbacks über das Internet entwickelt [110]. Die Vorteile von interaktiven, internetbasierten maßgeschneiderten Interventionen sind ein sofortiges Feedback, eine große Reichweite bei relativ geringen Kosten sowie eine flexible Anpassung und Aktualisierung der Interventionen an die neuesten wissenschaftlichen Erkenntnisse [110]. Internetbasierte maßgeschneiderte Interventionen bringen jedoch auch Herausforderungen mit sich. So können nur Personen mit Internetzugang und solche mit Kenntnissen im Umgang mit Computern erreicht werden. Weiter bietet das Internet eine Fülle von Informationen, und oft ist es für die Benutzer schwierig, die Qualität der Informationen zu beurteilen. Zudem kann die Flut von Informationen und Angeboten die Aufmerksamkeit der Benutzer leicht ab- oder auf andere Angebote umlenken. Wegen der Anonymität des Internets muss im Vergleich zur persönlichen Beratungssituation auch von einer geringeren Befolgung (Compliance) ausgegangen werden.

Die Argumentation für den Einsatz von computergestützten (internetbasierten) maßgeschneiderte Interventionen aus Public Health-Sicht stützt sich auf zwei Faktoren: (a) Die Computertechnologie ermöglicht es, Beratungsmaterialien einzusetzen, die auf Charakteristika und Bedürfnisse des Klienten zugeschnitten sind und deshalb wirksamer sein sollten als standardisiertes Einheitsmaterial, und (b) dank des Einsatzes der Internet-Technologie kann eine solche individualisierte Beratung einem großen Kreis von Nutzern zu relativ geringen Kosten zugänglich gemacht werden. Entscheidend für den Impact eines Gesundheitsförderungs- oder Präventionsprogramms auf Public Health-Ebene sind beide Faktoren – sowohl dessen Wirksamkeit (Abschnitt 4.2) als auch der Grad der Dissemination (Abschnitt 4.3) des Programms.

4.2 Die Wirksamkeit von maßgeschneiderten Interventionen

Die in der wissenschaftlichen Literatur dokumentierten maßgeschneiderten Interventionen sind sehr verschieden (Tabelle 4.1). Die Programme unterscheiden sich bezüglich Zielgruppe, Setting der Beratung, thematisierter Verhaltensweisen, dem eingesetzten Medium und dem Grad der Individualisierung der Beratung; sie basieren auf verschiedenen Theorien der Verhaltensänderung; die meisten Programme waren nur für einen engen Kreis von Studienteilnehmern zugänglich und ganz wenige Programme waren öffentlich. Das Bild von der Wirksamkeit solcher Interventionen ist sehr komplex, kommen doch zur Vielfalt der Programme noch die verschiedensten Designs für Wirksamkeitsstudien dazu, mit unterschiedlicher Wahl der Studienpopulationen und Kontrollinterventionen, Follow-up-Dauer und Outcome-Größen.

Tabelle 4.1 Maßgeschneiderte Interventionen: Charakteristika von Programmen

Zielgruppe	▪ Altersgruppe (z.B. Jugendliche) ▪ Gruppe mit spezifischen Risikofaktoren (z.B. Diabetes Typ II)
Gesundheitsverhalten	▪ Bewegung ▪ andere Verhaltensweisen (z.B. Rauchen, Ernährung) ▪ kombinierte Ansätze (z.B. Bewegung und Ernährung)
Theoretischer Hintergrund	▪ Transtheoretisches Modell ▪ Andere Theorien aus den Verhaltenswissenschaften
Individualisierungsgrad	▪ Standardisiert: für alle das Gleiche (z.B. Broschüre, Buch) ▪ Stufenspezifisch: meist entsprechend den Stufen des TTM ▪ Personifiziert: mit persönlicher Note, z.B. namentlicher Anrede ▪ Individualisiert: zugeschnitten auf individuelle Merkmale
Medium	▪ „Paper/Pencil“ (schriftlich, per Post) ▪ CD-Rom ▪ Telefon ▪ Internet
Zugang	▪ Nur für Studienteilnehmer ▪ Öffentlicher Zugang, gegen Bezahlung ▪ Öffentlicher Zugang, gratis
Setting	▪ Arbeitsplatz ▪ Schule ▪ medizinisches Umfeld ▪ Freizeit

Im Bereich der internetbasierten Interventionen zur Bewegungsförderung, dem eigentlichen Kernthema dieses Beitrags, sind die wissenschaftlichen Quellen bis heute sehr spärlich. Aus diesem Grund wird das Thema in einem umfassenderen Rahmen aufgearbeitet. Die Leserschaft soll einen Eindruck vom Potenzial des Ansatzes generell, aber auch von den Wissens- und Forschungslücken im Bereich der Bewegungsförderung erhalten: Einerseits werden Studien berücksichtigt, die die Wirksamkeit von maßgeschneiderten Interventionen im Bewegungsbereich untersuchen, aber noch nicht via Internet implementiert wurden (Programme der ersten Generation); anderseits werden Studien zu internetbasierten Programmen (zweite Generation) aus anderen Verhaltensbereichen kurz vorgestellt.

Wirksamkeit von maßgeschneiderten Interventionen der ersten Generation

Die ersten Veröffentlichungen zur Wirksamkeit von maßgeschneiderten Interventionen im Bewegungsbereich erschienen um das Jahr 2000. In einem Review zur Wirksamkeit von computergestützten maßgeschneiderten Interventionen im Bereich Bewegung und Ernährung wurden zwischen 1965 und 2004 publizierte randomisierte kontrollierte Studien zusammengefasst [112]. Darin wurden elf Studien zum Thema Bewegung berücksichtigt, wovon neun zur ersten Generation zu zählen sind. Von den drei Studien, welche kurzzeitige Effekte (< 3 Monate) untersuchten, fand eine Studie signifikante Effekte der maßgeschneiderten Intervention [113]. Fünf Studien untersuchten mittelfristige Auswirkungen (3–6 Monate); zwei davon fanden signifikante Unterschiede zugunsten der maßgeschneiderten Intervention für diejenigen Teilnehmer, welche bei Studienbeginn inaktiv waren [8, 114]. In zwei Studien wurden jedoch auch Effekte zugunsten der Kontrollgruppe gefunden. Von den sechs Langzeitstudien (> 6 Monate) fand eine Studie signifikante Unterschiede zwischen Interventions- und

Kontrollgruppe [115]. Die Autoren des Review folgerten, dass, basierend auf der kleinen Anzahl vorhandener Studien im Bereich Bewegung, keine definitiv positiven Schlüsse zugunsten der maßgeschneiderten Interventionen gezogen werden können.

Weitere Studien untersuchten den Ansatz der maßgeschneiderten Interventionen im Rahmen von persönlichen Beratungen – meist zusammen mit gedruckten Materialien – im medizinischen Umfeld [78, 116, 117] sowie am Arbeitsplatz [114, 118]. Auch die Ergebnisse dieser Wirksamkeitsstudien ergeben kein einheitliches Bild. Van Sluijs et al (2005) fanden positive Effekte der Intervention auf die Selbstwirksamkeit nach acht Wochen und nach sechs Monaten, nicht jedoch nach zwölf Monaten (N = 358) [116]. Gegenüber der Baseline hatte sich die körperliche Aktivität (Anzahl der Minuten pro Woche) nach zwölf Monaten sowohl in der Interventions- als auch in der Kontrollgruppe erhöht [117]. Auch Jimmy und Martin (2005) fanden 14 Monate nach Studienbeginn eine Zunahme des Anteils genügend aktiver Personen sowohl in der Interventions- als auch in der Kontrollgruppe (N = 161) [78]. Bei Campbell et al (2002) zeigte die Interventionsgruppe eine Erhöhung im kombinierten Kraft- und Beweglichkeitstraining (Häufigkeit pro Woche) nach sechs Monaten sowie im Beweglichkeitstraining nach 18 Monaten; keine signifikanten Unterschiede wurden für Ausdaueraktivitäten gefunden (N = 859) [118]. Die Studie von Marcus et al (1998) zeigte auf, dass in der Interventionsgruppe mehr Personen einen Fortschritt in der Stadienzugehörigkeit erzielten als in der Kontrollgruppe; dagegen konnten keine Auswirkungen auf die gesamte Dauer der körperlichen Aktivität nachgewiesen werden (N = 1559) [114]. Marshall et al (2003) fanden eine Erhöhung der körperlichen Aktivität durch eine stadienspezifische Intervention gegenüber keiner Intervention (N = 462) [119].

Wirksamkeit von maßgeschneiderten Interventionen der zweiten Generation

Trotz zahlreicher Webseiten im Bereich der Gesundheitsförderung sind qualitativ hoch stehende Interventionen selten [104, 120]: Doshi et al (2003) beurteilten 24 englischsprachige Webseiten im Bereich Bewegungsförderung und folgerten, dass die meisten Webseiten die Stadienzugehörigkeit nicht ermittelten, keine Rückmeldungen gaben und keine maßgeschneiderte Unterstützung anboten [104]. Sogar bei Webseiten, bei denen die Stadienzugehörigkeit ermittelt wurde, wurde es versäumt, diese für maßgeschneiderte Unterstützung und Rückmeldungen einzusetzen. Bock et al (2004) geben einen Überblick über Inhalt, Qualität und Benutzerfreundlichkeit von Rauchentwöhnungsprogrammen im Internet und kommen zum Schluss, dass nur wenige Webseiten die Vorteile des Internets (Interaktivität, sofortige und individuelle maßgeschneiderte Feedbacks, Möglichkeit zum Follow-up) nutzen und eine umfassende, verständliche und nachhaltige Beratung und Behandlung anbieten [120]. In einem Review über Ernährungswebseiten wurde gefunden, dass Webseiten mit höherer inhaltlicher Qualität schlecht lesbar und bedienbar waren und umgekehrt [105].

Untersuchungen zur Wirksamkeit von internetbasierten maßgeschneiderten Interventionen gibt es bis heute relativ wenige. Im Bereich der Rauchentwöhnung gibt Etter (2006) einen Überblick über die Wirksamkeit von internetbasierten Interventionen [121]: Die Originalversion eines auf Gesundheitsrisiken und Bewältigungsstrategien fokussierenden internetbasierten Entwöhnungsprogramms (www.stop-tabac.ch) war wirksamer als eine gekürzte und mehr auf Nikotinersatz fokussierende Version [122]. In einer randomisierten

kontrollierten Studie erreichte eine internetbasierte maßgeschneiderte Intervention (Committed Quitters Stop Smoking Plan, CQ Plan) als Zusatz zu einer Nikotinersatztherapie nach zwölf Wochen signifikant höhere Abstinenzraten als eine standardisierte Intervention [123]. In einer nicht-randomisierten Studie erhöhten automatische E-Mail-Nachrichten und eine erweiterte Webseite die Rauchstopraten im Vergleich zu einer einmaligen Intervention mit einer einfachen Informations-Webseite [124]. In einer laufenden randomisierten kontrollierten Studie der American Cancer Society mit 6000 Rauchern wird zur Zeit die Wirksamkeit von sechs verschiedenen Online-Rauchentwöhnungsprogrammen untersucht [125].

Im Bereich der Ernährung sind ebenfalls erst wenige Studien zur Wirksamkeit von internetbasierten maßgeschneiderten Interventionen veröffentlicht worden. Die unmittelbare Wirkung einer Webseite wurde in einer randomisierten, kontrollierten Studie im Vergleich zu einem standardisierten Brief mit Informationen zu Ernährung untersucht. Die Webseite wurde mehr geschätzt, als persönlich relevanter eingestuft und hatte einen größeren Einfluss auf den Vorsatz zur Umstellung der Essgewohnheiten [110]. In einer anderen Studie wurden die kurzfristigen Effekte einer internetbasierten maßgeschneiderten Intervention verglichen mit allgemeinen Ernährungsinformationen sowie damit, dass keine Informationen vorlagen. Die maßgeschneiderten Interventionen wurden besser bewertet als die allgemeinen Informationen, und der selbst eingeschätzte Gemüseverzehr war nach drei Wochen in der Interventionsgruppe leicht höher; keine Effekte wurden für den Fett- und Früchteverzehr gefunden [69].

Im Bereich der Bewegungsförderung sind in den letzten Jahren mehrere Studien und Pilotstudien mit meist kleiner Teilnehmerzahl zur Wirksamkeit von internetbasierten maßgeschneiderten Interventionen erschienen [7, 126-129]. Sie werden im Folgenden etwas detaillierter vorgestellt.

In einer randomisierten kontrollierten Studie (N = 655) wurde eine achtwöchige Intervention mit stufenspezifischem (nach TTM) gedruckten Material („Active Living“ Broschüre und zweiwöchige Motivationsbriefe) mit einer auf demselben Inhalt basierenden stufenspezifischen Webseite („Active Living“ Webseite plus zweiwöchige Motivations-E-Mails) verglichen [128]. Die gesamte Dauer körperlicher Aktivität erhöhte sich in beiden Gruppen leicht, es wurden jedoch keine signifikanten Unterschiede zwischen den Gruppen gefunden.

Napolitano et al (2003) untersuchten in einer kleinen Gruppe von Probanden (N = 65) über drei Monate die Wirksamkeit einer stufenspezifischen (nach TTM) internetbasierten Intervention [130] plus zwölf wöchentlichen E-Mail-Tipps im Vergleich zu keiner Intervention (Warteliste-Kontrollgruppe) [7]. Nach einem Monat hatte die Anzahl von Minuten körperlicher Aktivität mittlerer Intensität in der Interventionsgruppe relativ zur Kontrollgruppe signifikant zugenommen, nach drei Monaten konnte jedoch kein signifikanter Unterschied mehr nachgewiesen werden. Die Anzahl der Minuten für „Gehen“ (pro Woche) nahm in der Interventionsgruppe sowohl nach einem als auch nach drei Monaten signifikant zu.

In einer Pilotstudie von Hageman et al (2005) wurden 31 ungenügend aktive Frauen zwischen 50 und 69 Jahren zufällig in eine Interventions- und eine Kontrollgruppe eingeteilt [126]. Beide Gruppen erhielten drei über Internet

verschickte, monatliche Newsletter entweder in Form einer maßgeschneiderten Intervention oder als Standardtext. Die körperliche Aktivität erhöhte sich in keiner der beiden Gruppen.

Die Wirksamkeit eines vierwöchigen, internetbasierten, auf dem TTM basierenden Motivationsprogramms für Bewegung in der Freizeit bei Erwachsenen mit körperlichen Behinderungen wurde in einer randomisierten Pilotstudie mit 150 Probanden untersucht [131]. Die Kontrollgruppe erhielt wöchentliche E-Mails mit Motivationstexten zu Themen, die nichts mit Bewegung zu tun hatten. Die Nachbefragung am Ende der Intervention zeigte keine signifikanten Unterschiede in Bezug auf das Ausmaß an körperlicher Aktivität zwischen Interventions- und Kontrollgruppe.

Im Rahmen einer achtwöchigen Bewegungsförderungs-Intervention für Diabetes Typ 2 Patienten wurde die Wirksamkeit eines individualisierten internetbasierten Bewegungsprogramms im Vergleich zu einer Informationswebseite mit diabetesspezifischen Beiträgen untersucht [129]. Es wurden keine signifikanten Effekte für die gesamte körperliche Aktivität (Minuten pro Woche) zwischen der Interventions- (n = 38) und der Kontrollgruppe (n = 40) gefunden; das Programm war jedoch bei denjenigen Patienten wirksam, welche das Programm mehr als dreimal benutzt hatten (Interventionsgruppe n = 20, Kontrollgruppe n = 12).

King et al (2006) untersuchten bei 301 Diabetes Typ 2 Patienten die Effekte einer Intervention bestehend aus maßgeschneiderter Intervention auf CD-ROM, zwei persönlichen Beratungen innerhalb von zwei Monaten sowie telefonischem Follow-up-Support im Vergleich zu Kontrollbedingungen bestehend aus einer interaktiven computerbasierten Einschätzung von Gesundheitsrisiken mit Rückmeldungen plus zwei verkürzten Beratungen ohne Follow-up [127]. Das Ausmaß der moderaten körperlichen Aktivität, die Häufigkeit des Krafttrainings sowie der wöchentliche Energieverbrauch waren in der Interventionsgruppe nach zwei Monaten signifikant erhöht.

Die Wirksamkeit von internetbasierten maßgeschneiderten Interventionen, welche verschiedene Verhaltensweisen anvisieren, wurden ebenfalls untersucht [8, 132, 133]. Vandelanotte et al (2003, 2005) fanden eine signifikante Abnahme des Fettverzehrs sowie des Anteils von Fett an der gesamten Energieaufnahme in den Interventionsgruppen verglichen mit der Warteliste-Kontrollgruppe sechs Monate nach einer computergestützten interaktiven maßgeschneiderten Intervention zu Fettverzehr und Bewegung [8, 133]. Der Umfang an körperlicher Aktivität pro Woche erhöhte sich bei den Teilnehmern der Interventionsgruppen signifikant im Vergleich zur Warteliste-Kontrollgruppe. Der Anteil Teilnehmer, welche die Bewegungsempfehlungen erfüllten, erhöhte sich um 14% in den Interventionsgruppen und um 7% in der Kontrollgruppe.

Eine auf dem TTM basierende Internet-/Video-Intervention bewirkte bei Schulkindern der 7. Klasse, welche während eines Monats mindestens die Hälfte der acht Interventionsmodule besucht hatten, dass sie sich nach der Intervention im Erhebungszeitraum von drei Tagen insgesamt 22 Minuten mehr bewegten als vor der Intervention (die Kontrollgruppe bewegte sich 46 Minuten weniger). Im gleichen Zeitraum verringerte sich bei der Interventionsgruppe der Anteil des Fettkonsums an der Gesamtenergieaufnahme signifikant von 30.7% auf 29.9%, während er bei der Kontrollgruppe konstant blieb [132].

Zusammenfassend kann festgehalten werden, dass noch keine klaren Aussagen über die Wirksamkeit von maßgeschneiderten Interventionen im Bereich der Bewegung gemacht werden können. Zwar konnten teilweise positive Effekte nachgewiesen werden, in vielen Studien ist jedoch die Anzahl der Studienteilnehmer/innen zu klein, um möglicherweise vorhandene Effekte signifikant aufzeigen zu können. Da die Interventionen jeweils als Ganzes untersucht werden, die maßgeschneiderten Rückmeldungen jedoch häufig nur einen Teil der Intervention ausmachen, ist es zudem schwierig, die Gründe für fehlende positive Effekte zu ermitteln. Neben der maßgeschneiderten Intervention können z.B. auch das Design der Webseite sowie andere Teile der Intervention einen Einfluss haben. Fehlende Kenntnis darüber, ob und wie häufig die Intervention benutzt wurde, kann die Studienresultate ebenfalls beeinflussen. Dies zeigt sich z.B., wenn ein Teil der Interventionsgruppe die Intervention nicht nutzt und dadurch allfällige Effekte verdünnt werden. Die Untersuchung von Doshi et al (2003) zeigt zudem auf, dass im Bereich der internetbasierten Bewegungsförderung zum Teil noch Defizite bezüglich der Qualität und dem adäquaten Einsatz der technischen Möglichkeiten bestehen, die ebenfalls für fehlende Effekte verantwortlich sein könnten [104].

4.3 Dissemination von maßgeschneiderten Interventionen

Für den Public Health Impact eines Interventionsprogramms ist nicht nur die Wirksamkeit des Programms entscheidend, sondern auch die Anzahl der Personen, die durch das Programm beeinflusst werden. Für Programme, die frei im Internet zugänglich sind, sind der Erreichungsgrad der eigentlichen Zielgruppe sowie die Intensität, mit der sich die Besucher mit dem Programm auseinandersetzen, von Bedeutung.

In der wissenschaftlichen Literatur finden sich zu diesen Fragen praktisch keine Veröffentlichungen. Leslie et al (2005) stellten fest, dass zwar oft vom Potenzial des Internets in Prävention und Gesundheitsförderung gesprochen wird, aber noch keine Daten zu Ausmaß und Qualität der tatsächlichen Nutzung vorliegen [134]. In ihrer Studie wurde das Userverhalten der 327 Freiwilligen der Interventionsgruppe einer randomisierten kontrollierten Studie zur Bewegungsförderung, die im Setting Arbeitsplatz durchgeführt wurde, untersucht. 46% der Mitglieder der Interventionsgruppe besuchten die Website des Programms während der Studiendauer von acht Wochen. Ein Besuch dauerte durchschnittlich neun Minuten, dabei wurden durchschnittlich 18 Seiten herunter geladen. 77% dieser Besuche erfolgte nach der ersten von total vier Einladungen per E-Mail.

In einer einzigen Studie [135] wurden für ein frei zugängliches Rauchentwöhnungsprogramm Anzahl, Charakteristika und Nutzerverhalten der Besucher untersucht. Das Programm wurde in Französisch entwickelt und später ins Englische übersetzt. In 34 Monaten schrieben sich 18 361 Personen aus 112 Ländern ins Programm ein. 20% dieser Besucher kehrten unter der gleichen Identifikation nach durchschnittlich (Median) 132 Tagen ins Programm zurück. Personen auf der Stufe der Handlung gemäss TTM waren übervertreten, während Personen auf der Stufe der Präkontemplation untervertreten waren. Für Personen auf der Handlungsstufe war die Wahrscheinlichkeit, ins Programm zurückzukehren, am größten (28%), während sie für Personen auf der Stufe der Präkontemplation nur halb so groß war.

Es gibt also allererste Hinweise auf das Verhalten von Besuchern einer internetbasierten maßgeschneiderten Intervention. Hingegen ist bis heute weitgehend unbekannt, welche Anteile der Bevölkerung und welche Bevölkerungsgruppen durch frei zugängliche, maßgeschneiderte Interventionen im Bewegungsbereich oder in anderen Bereichen des Gesundheitsverhaltens erreicht werden können.

4.4 Zwei Beispiele von internetbasierten individualisierten Programmen zur Bewegungsförderung

Aus den obigen Ausführungen wird ersichtlich, dass sowohl auf der Ebene der Wirksamkeit internetbasierter Interventionen, als auch bezüglich deren Implementation noch beträchtliche Wissenslücken bestehen. Am Beispiel der zwei im Folgenden vorgestellten Programme sollen deshalb die Aspekte der Zielgruppenerreichung und Dissemination näher beleuchtet werden.

Active-online

Beschreibung des Programms

Das Programm Active-online ist primär für ungenügend aktive Personen im Alter von etwa 30–60 Jahren konzipiert [81]. Es bietet zwei Module an: Im Hauptmodul „Bewegung“ werden die Besucher unterstützt, körperlich aktiver zu werden, sei es mit Aktivitäten von mäßiger Intensität (wie Alltagsbewegung) oder mit Aktivitäten von hoher Intensität vom Typ Ausdauertraining. Das zweite Modul soll zu regelmäßigem Krafttraining und Stretching motivieren. Active-online basiert auf dem Transtheoretischen Modell der Verhaltensänderung; das Modul für „Bewegung“ ist individualisiert. Die Prinzipien der maßgeschneiderten Intervention orientieren sich stark an den Konzepten der ersten computergestützten maßgeschneiderten Interventionen [107]: Das Programm bietet einerseits individuelle Vergleiche mit dem Durchschnitt der anderen Nutzer auf der gleichen Stufe der Verhaltensänderung (normative Vergleiche). Andererseits bietet das Programm für Personen, die die Website wiederholt besuchen, Vergleiche mit früheren Besuchen und damit eine Kommentierung des Fortschritts oder Rückschritts (ipsative Vergleiche). Die Beratung im Modul für Krafttraining und Stretching ist stufenspezifisch. Active-online wird ausschließlich über das Internet angeboten. Der Zugang ist öffentlich und gratis. Besuche sind anonym möglich; wer aber ein Feedback zum Verlauf des Änderungsprozesses möchte, muss sich registrieren und erhält ein persönliches Login. Das Programm wurde in Deutsch entwickelt und dann ins Französische und Italienische übersetzt.

Entwicklung und Akzeptanz

Active-online wurde schrittweise entwickelt, eine erste noch unvollständige deutsche Version (Version 1) des Programms wurde im Dezember 2000 evaluiert. Dazu wurde in einem redaktionellen Beitrag in der Wochenzeitschrift "Der Beobachter" auf das Programm hingewiesen, und die Leserschaft wurde eingeladen, die Website zu besuchen und in einem Online-Fragebogen ihre Eindrücke festzuhalten. Während der zweiwöchigen

Evaluationsperiode stiegen 1777 Personen ins Programm ein, indem Sie mindestens die Antwort auf die erste Frage abschickten. 71% dieser Besucher beantworteten zudem die Evaluationsfragen. Sowohl von den genügend wie von den ungenügend aktiven Personen beurteilten rund 90% das Programm als gut oder sehr gut. Im Vergleich zu anderen Charakteristika des Programms wurde der empathische, nicht belehrende Tonfall am besten bewertet. Am meisten geschätzt wurden das Design und die einfache Struktur der Website, am meisten kritisiert der benötigte Zeitaufwand für den Download von Seiten und das Lesen der Texte.

Zielgruppenerreichung

Die vollständige Version 2 des Programms (deutsch) wurde auf analoge Art im April 2002 nochmals evaluiert. Tabelle 4.2 zeigt das Profil der Besucher in den beiden Evaluationsphasen; die entsprechenden Daten wurden aus der Datenbank des Programms herunter geladen. Männer und Frauen wurden mit dem Programm gleichermaßen erreicht; gut 70% der Besucher gehörten zur anvisierten Altersgruppe der 30- bis 60-Jährigen, wobei der Altersdurchschnitt im Jahr 2002 höher war als im Jahr 2000. Der Anteil ungenügend aktiver Besucher war überproportional vertreten; 2001 betrug der Anteil ungenügend aktiver Personen in der deutschsprachigen Schweiz 25% [29].

Tabelle 4.2 Geschlecht, Alter und Aktivitätsniveau der Besucher von Active-online

	Version 1 [a] N (%)	Version 2 [b] N (%)
Geschlecht		
männlich	890 (49.5)	891 (47.5)
weiblich	919 (50.5)	986 (52.5)
Alter		
–29	389 (21.6)	343 (18.3)
30–39	528 (29.3)	477 (25.5)
40–49	487 (27.0)	458 (24.5)
50–59	264 (14.7)	384 (20.5)
60+	134 (7.4)	211 (11.3)
Aktivitätsniveau		
ungenügend aktiv	830 (50.4)	844 (60.4)
genügend aktiv [c]	817 (49.6)	554 (40.6)

[a] unvollständige Version, Evaluation während zwei Wochen im Dezember 2000

[b] vollständige Version, Evaluation während zwei Wochen im April 2002

[c] eine halbe Stunde aktiv mit mindestens mäßiger Intensität an allen oder fast allen Tagen der Woche, *oder* mindestens dreimal wöchentlich für mindestens 20 Minuten aktiv mit hoher Intensität

Nutzung

Während der ersten Evaluationsphase (Registrierung obligatorisch) stiegen 27.0% aller Besucher der Website von Active-online ins Programm ein, indem sie die Antwort auf die erste Frage abschickten. 58.0% dieser

Personen absolvierten das ganze Programm. Während der zweiten Evaluationsphase (Registrierung freiwillig) stiegen 45.5% der Besucher ins Programm ein und 60.3% von ihnen beendeten es. Die mittlere Besuchsdauer im eigentlichen Beratungsteil betrug 11.5 Minuten für Version 1 und 11.9 Minuten für Version 2.

Dissemination

Active-online wurde im April 2003 mit einem Medien-Event offiziell lanciert. Ab Juli 2003 war dank einer Kooperation mit dem größten Schweizer Internet-Portal Bluewin der Zugang auf Active-online via dieses Portal möglich. In der Rubrik „Gesundheit" auf der zweiten Hierarchieebene des Portals gelangten die Besucher über einen Link direkt ins Programm Active-online. Bluewin engagierte sich während eines guten Jahres intensiv, indem periodisch zusätzlich auf der Homepage Werbebanner für das Programm platziert wurden. In der Folge fehlten jedoch die personellen und finanziellen Ressourcen, um das Programm aktiv bewerben zu können; die Dissemination erfolgte primär durch Dritte via verschiedene Medienkanäle (Hinweise in Printmedien, Links auf Websites). Einen Eindruck davon, welche Reichweite ein solches Internetangebot unter den beschriebenen Möglichkeiten der Bewerbung haben kann, vermittelt Abbildung 4.1 (die Schweiz zählt rund sieben Millionen Einwohner; rund 80% der Besucher in der dargestellten Zeitperiode stammten aus der Schweiz). Nach dem Abflauen des Effekts der Lancierung pendelte sich die Anzahl der Besuche, die über eine direkte Eingabe der URL erfolgten, bei rund 4000 pro Monat ein. Im besten Monat gelangten annähernd 9000 Personen via Bluewin-Portal ins Programm Active-online. Im weiteren zeitlichen Verlauf stabilisierten sich die Besucherzahlen auf dem Niveau des ersten Quartals 2005.

Nicht jeder Besuch auf der Website führt automatisch zu einer Nutzung des interaktiven Programms. Abbildung 4.2 zeigt, wie viele Personen pro Monat ins Programm einstiegen, indem sie die Antwort zur ersten Frage abschickten. Die Spitzen zwischen April 2003 und August 2004 sind der Lancierung und dem Engagement von Bluewin zuzuschreiben. Ab September 2004 nutzten rund 500 bis 1000 Personen pro Monat das Programm in der beschriebenen Art und Weise.

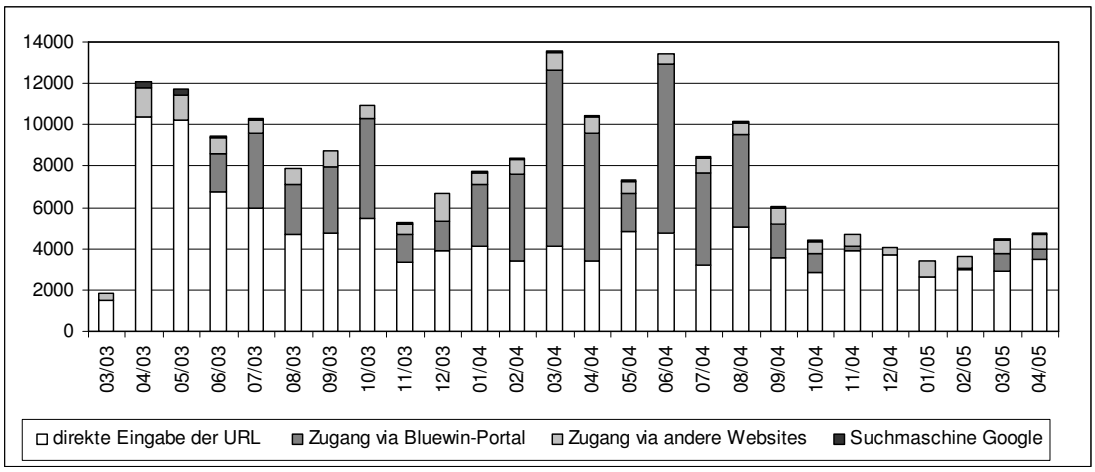

Abbildung 4.1 Monatliche Besucherzahlen auf der Website Active-online von März 2003 bis April 2005

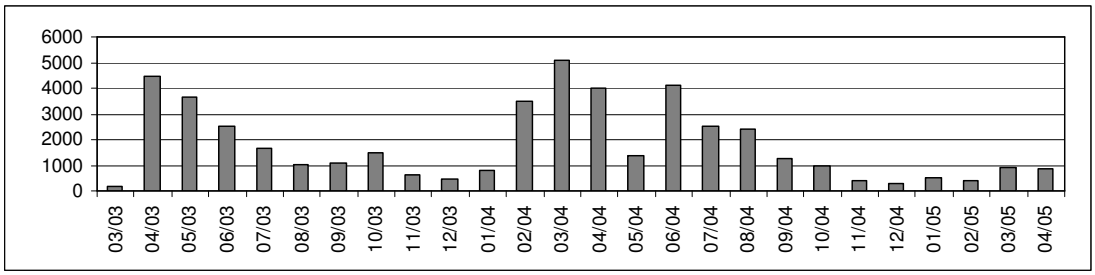

Abbildung 4.2 Anzahl Einstiege pro Monat in den interaktiven Teil des Programms Active-online von März 2003 bis April 2005

Wirksamkeitsstudie: Stand der Arbeiten

Die Untersuchung der Wirksamkeit des Programms Active-online ist noch nicht abgeschlossen. Es wurde entschieden, keine Laborstudie durchzuführen, sondern eine Studie im natürlichen Kontext des Internetgebrauchs. In einer Machbarkeitsstudie wurde getestet, ob sich eine randomisierte kontrollierte Studie ganz im Rahmen des Internets durchführen lässt [136]. Die Studienteilnehmer wurden mit Hinweisen in Printmedien und auf Websites rekrutiert. Die Teilnehmenden füllten den Studienfragebogen im Internet aus und wurden nach der Randomisierung entweder zu Active-online weitergeleitet oder zu einer Website mit einem anderen Gesundheitsthema (Sonnenschutz). Die Einladungen zu den Nachbefragungen erfolgten mit automatischem E-Mail-Versand, die Datenerhebungen wiederum online. Dieser Ablauf erwies sich als gangbar. Die Datenerhebung für die Hauptstudie wurde im Mai 2006 lanciert, Nachbefragungen erfolgten nach sechs Wochen, nach weiteren sechs Monaten und einem Jahr sind weitere Nachbefragungen geplant. Die Resultate sind 2008 zu erwarten.

Ein Programm wie Active-online zeigt auf, dass die Zielgruppe der ungenügend aktiven Personen mit einer internetbasierten maßgeschneiderten Intervention erreicht werden kann. Nach einer einmaligen Lancierungskampagne war die Anzahl der Nutzer auch nach Monaten oder Jahren beachtlich. Ohne zusätzliche intensive Bewerbung, idealerweise in Zusammenarbeit mit großen Internet-Portalen, wird das Potenzial eines solchen Programms jedoch bei weitem nicht ausgeschöpft. Die Frage der Wirksamkeit des Programms zur Verbesserung des Bewegungsverhaltens ist zurzeit noch unbeantwortet.

Feelok

Active-online ist eine klassische monothematische maßgeschneiderte Intervention. Das Programm Feelok (www.feelok.ch) hingegen stützt sich auf neue inhaltliche, technische und theoretische Konzepte: (a) die Webanwendung ist multidimensional (mehrere Verhaltensdimensionen werden behandelt); (b) die modernsten technischen Möglichkeiten werden gezielt eingesetzt (Spiele, Videomodule, zeitgesteuerte E-Mail-Funktionen usw.); (c) es wird viel Wert auf spezifische Disseminationsmaßnahmen gelegt, damit die Zielgruppe im schulischen Umfeld in Kontakt mit Feelok kommt; (d) zudem wurden komplexe Statistiktools und innovative Evaluationsdesigns entwickelt, um Erkenntnisse bezüglich der Nutzung des Programms zu gewinnen. Das

Beispiel Feelok zeigt exemplarisch, wie das Internet als Medium eingesetzt werden kann, um mit gesundheitsfördernden und präventiven Inhalten eine bestimmte Zielgruppe anzusprechen. Das Programm wurde am Institut für Sozial- und Präventivmedizin der Universität Zürich entwickelt; für die Inhalte sind verschiedene Experten und Fachinstitutionen zuständig.

Beschreibung des Programms

Feelok ist ein internetbasiertes Präventions- und Gesundheitsförderungsprogramm für Jugendliche zwischen 12 und 18 Jahren, das acht gesundheitsrelevante Dimensionen thematisiert: Cannabis, Rauchen, Stress, Bewegung, Alkohol, Selbstvertrauen und Selbstwert, Liebe und Sexualität sowie Ernährung. Bei den ersten fünf Dimensionen wird neben den allgemeinen Informationen auch eine stufenspezifische Intervention angeboten, die vorwiegend auf dem Transtheoretischen Modell basiert. Feelok wird vor allem im schulischen Setting angewendet.

Um die Qualität und Aktualität der Inhalte zu gewährleisten, werden die einzelnen thematischen Feelok-Programme von fachlich kompetenten, renommierten Institutionen verwaltet (multiinstitutionelles Konzept). Das multiinstitutionelle multidimensionale Konzept ist für die Schulen vorteilhaft, da sie mit ihm eine einzige internetbasierte Anwendung erhalten, in welcher verschiedene, für Jugendliche relevante Themen aktuell und in vertrauter Form dargestellt sind. Ein weiterer Vorteil des Netzwerkes ist, dass die beteiligten Institutionen die von ihnen selber erstellten oder verwalteten Programme bekannt machen. Von dieser Implementierungsarbeit profitieren synergetisch alle Programme von Feelok.

Ende 2005 wurde das Bewegungs- und Ernährungsprogramm lanciert. Dieses neueste Tool von Feelok ist das anspruchsvollste Projekt. Es ist das Resultat zahlreicher Studien und der interdisziplinären Zusammenarbeit verschiedener Fachleute aus Wissenschaft und Praxis aus den Bereichen Pädagogik, Sport, Bewegungsförderung und Ernährung. Auch die zahlreichen Anregungen, die von Seiten der Userinnen und User spontan über das Internet eingegangen sind, sowie die Rückmeldungen von Jugendlichen und Lehrpersonen, die im Rahmen von Workshops gezielt eingefordert wurden, haben die Ausgestaltung des neuen Programms mit beeinflusst.

In seiner ersten Version beinhaltet das Bewegungsprogramm zwei Module: das erste Modul spricht körperlich inaktive und wenig aktive Jugendliche an, mit dem Ziel, sie für mehr Bewegung (und Sport) zu motivieren. Das zweite Modul richtet sich an Lehrpersonen. Kurze Videosequenzen, verbunden mit didaktischen Anregungen, ermutigen diese, im Unterricht kurze, aktive Bewegungsspiele einzuplanen und durchzuführen. Eine Erweiterung des Bewegungsprogramms mit einem neuen Modul für körperlich aktive Jugendliche ist geplant.

Das Bewegungs- und Ernährungsprogramm bietet innovative Instrumente an, die die Auseinandersetzung mit diesen zwei Themen interessant machen: Spiele, Tests, Interviews mit Jugendlichen, Videomodule, interaktive Tools wie „Assistenten“, erweiterte zeitgesteuerte E-Mail-Funktionen usw. Lehrpersonen können Arbeitsblätter herunterladen, die den Schülerinnen und Schülern Anregungen und Gelegenheiten zum selbstständigen Lernen geben.

Die folgenden Abschnitte beziehen sich auf die ganze Feelok-Anwendung und nicht nur auf das Bewegungs- und Ernährungsprogramm.

Dissemination und Zielgruppenerreichung

Zahlreiche Implementierungsmaßnahmen haben die Verbreitung von Feelok ab 2002 bis heute unterstützt: 1) Weiterbildung von Lehrpersonen und Multiplikatoren, 2) gezielte Verteilung von Werbungsmaterialien (Flyer, Poster, WC-Aufkleber – siehe www.pisspoint.ch), 3) Zusammenarbeit mit Netzwerken wie dem Netzwerk bildung+gesundheit Schweiz sowie mit verwandten Projekten, 4) Medienarbeit (Verlinkung mit anderen Websites, Veröffentlichung von Artikeln in Zeitschriften, Integrierung von Feelok in schulischen Medien wie CDs und Büchern), 5) Vorträge und Präsentationen bzw. Events und 6) andere Maßnahmen.

Bis Ende 2004 war nicht bekannt, zu welchem Userprofil diese Maßnahmen führten. Mit einem innovativen Untersuchungsdesign („gestapelte Umfrage", mehr Details unter www.feelok.ch) konnte das Profil der User, die die Startseite von Feelok besuchten, erfasst werden. In der Erhebungszeit wurde die Startseite von Feelok von rund 80 600 Personen besucht, 11 846 Personen (14.7%) beteiligten sich an der Umfrage: 85% der antwortenden Besucher von Feelok waren junge Menschen zwischen 10 und 19 Jahren, wobei die 14–15-Jährigen deutlich überwogen. 54% waren Mädchen, 76% kamen aus der Schweiz (N = 1854, Beteiligung 28.8%) und rund 60% hatten Feelok kennen gelernt, weil sie einen entsprechenden Hinweis von einer Lehrperson erhalten hatten oder weil das Programm in der Schule eingesetzt wurde (N = 1106, Beteiligung 23.2%). Die anvisierte Zielgruppe wird somit erreicht.

Eine andere Evaluationsstudie zeigte, dass vor allem die Weiterbildung und Zusammenarbeit mit Lehrpersonen und mit anderen Multiplikatoren (z.B. Fachpersonen für Gesundheitsförderung und Prävention) sowie die WC-Aufkleber die Nutzung von Feelok fördern. Zudem weisen die neusten Erfahrungen darauf hin, dass auch das multiinstitutionelle Konzept einen positiven Einfluss auf die Dissemination von Feelok hat.

Nutzung

Feelok wird täglich rund 1200 Mal besucht (Stand: März 2006), dreimal mehr als vor 2 ½ Jahren. Dies ist eine erfreuliche, aber globale und nicht sehr präzise Information. Ein vom Projektteam entwickeltes Statistiktool liefert für die einzelnen Feelok-Programme mehr Details, wie das Beispiel in Tabelle 4.3 zeigt.

Wenn man davon ausgeht, dass Feelok täglich rund 1200 Mal besucht wird und das Bewegungs- und Ernährungsprogramm in 3 ½ Monaten insgesamt 1497 Mal während mindestens drei Minuten in Anspruch genommen wurde, dann bedeutet dies, dass sich 1.2% aller Feelok-Besucher mit den Bewegungs- und Ernährungsinhalten auseinandergesetzt haben. Dies wiederum führt zu zwei Schlussfolgerungen: 1) ein multidimensionales Internetprogramm wie Feelok muss sehr viele jungen Menschen erreichen, nur so wird ein einzelnes Teilprogramm von einer relevanten Besucherzahl genutzt. 2) Zusätzliche Strategien müssen die Verbreitung des neuen Bewegungs- und Ernährungsprogramms unterstützen, um mehr junge Menschen und Lehrpersonen dazu zu bringen, sich mit dessen Inhalten zu beschäftigen.

Tabelle 4.3 Die Besuche des Bewegungsprogramms (BP) und des Ernährungsprogramms (EP) von Feelok, für die Periode vom 1.12.2005–14.3.2006

	Anzahl Besuche, die länger als 3 Min. dauern (N)	Anteil Besuche, die länger als 3 Min. dauern (%)	Dauer eines Besuchs: Mittelwert (SD) (Min.)
BP – Gemütliche [a]	356	35	15 (20)
BP – Lehrpersonen	292	47	20 (31)
EP – Grundlagen	849	62	23 (27)

[a] körperlich ungenügend aktive junge Menschen, nämlich jene, die weniger als 1500 Kilokalorien pro Woche mit körperlichen Aktivitäten von mindestens mittlerer Intensität verbrauchen.

Wirksamkeitsstudien zu Feelok generell: Stand der Arbeiten

Die Wirksamkeit des Cannabisprogramms wurde mit einem quasi-experimentellen Design (N = 636, Setting: Berufsschule) im Kanton Zürich untersucht. Methodologische Probleme – die Einteilung in Interventions- und Kontrollgruppe hat keine vergleichbaren Gruppen ergeben, ein Teil der Kontrollgruppe kam ebenso in Kontakt mit dem Interventionsprogramm – erlaubten keine klare Schlussfolgerung über die kurzfristige Wirkung der Intervention. Die nachhaltige Wirkung wurde nicht untersucht.

Eine weitere internetbasierte kontrollierte Wirksamkeitsstudie zum Rauchprogramm mit innovativem Design wurde im September 2005 gestartet. Studienteilnehmende sind spontane Besucher/innen des Programms, die nach vorgegebenen Kriterien einer Interventions- resp. einer Kontrollgruppe zugewiesen werden. Die Datenerhebung (Follow-up-Befragungen nach einem, sechs und zwölf Monaten) wird bis Mitte 2007 abgeschlossen sein. Ein erster Bericht wird voraussichtlich im Jahr 2008 veröffentlicht. Mehr Informationen unter anderem über das Design der Studie findet man unter www.feelok.ch/berichte/bericht_2005_TPF4.doc.

Im Rahmen von Feelok wurden fünf verschiedene Ziele verfolgt: 1) ein Programm bedürfnisgerecht zu gestalten, um die Diffusion der Intervention zu fördern, 2) die Schule als Setting für nicht immer einfache präventive und gesundheitsfördernde Themen aufzubauen, 3) die Komplexität der Aufgaben mit einem multiinstitutionellen Ansatz zu bewältigen, 4) die Anwendung benutzerfreundlich zu gestalten, und 5) die Entwicklung der Intervention auf wissenschaftlichen Prinzipien und Erkenntnissen abzustützen. Der Fokus auf diese Ziele hat sich weitgehend bewährt. Allerdings können die erwähnten Ziele auch in Konflikt miteinander treten. Es kann zum Beispiel schwierig sein, die Anforderung von Seiten der Schule, ein unkompliziertes und benutzerfreundliches Tool zu erhalten, mit den wissenschaftlichen Anforderungen an eine Evaluation in Einklang zu bringen. Aus diesen Gründen ist ein gewisses Maß an Pragmatismus und Freude an originellen Lösungen unabdingbar im Umgang mit einer Vielfalt von Vorgaben und Erwartungen.

4.5 Diskussion und Fazit

Das Potenzial internetbasierter Interventionen spezifisch für die Bewegungsförderung, aber auch für andere Bereiche der Gesundheitsförderung, ist anerkannt. Allerdings sind solche Programme ein noch sehr junges Phänomen. Aus diesem Grund ist die Evidenz ihrer Bedeutung für den Bereich Public Health noch limitiert.

Zunächst ist die Zahl der Studien zur Wirksamkeit von internetbasierten Programmen zur Bewegungsförderung noch klein; die zu Grunde liegenden Programme sind sehr verschieden; die Untersuchungsdesigns sind selten vergleichbar; entsprechend uneinheitlich sind die Erkenntnisse bezüglich der Wirksamkeit zur Veränderung des Bewegungsverhaltens. Je nach Outcome-Maß waren einige Programme wirksam gegenüber der jeweiligen Kontrollintervention, andere nicht. Es scheint, dass die Wirksamkeit der Programme auf die Verhaltensänderung bislang eher über kurze und weniger über längere Zeit nachgewiesen werden konnte. Aus diesen Gründen ist es noch nicht möglich, sich ein differenziertes Bild von der Wirksamkeit verschiedenster internetbasierter Programme zu machen.

Auffallend ist, dass an einigen Untersuchungen nur sehr wenige Probanden teilnahmen; dies könnte mit ein Grund dafür sein, dass keine signifikanten Effekte gezeigt werden konnten. Des Weiteren fehlen Studien mit längerer Follow-up-Dauer. Außerdem gibt es noch keine Wirksamkeitsstudien, die nicht in einem laborartigen Kontext oder in speziell ausgewählten Populationen, sondern in der realen Welt des Internetgebrauchs im täglichen Leben durchgeführt wurden; solche Studien sind sehr aufwändig. Schließlich ist festzuhalten, dass eine internetbasierte Intervention ein äußerst komplexes, aus verschiedensten Elementen aufgebautes System ist. Die bis heute vorliegenden Studien untersuchten die Wirksamkeit eines solchen Programms als „Blackbox“. Es besteht keine Möglichkeit, Aussagen darüber zu machen, welche Elemente für die beobachtete Wirksamkeit wichtig waren und welche nicht. Es wird noch lange dauern, bis diesbezüglich differenziertere Erkenntnisse vorliegen werden.

Für den Impact auf Public Health-Ebene sind neben der Wirksamkeit eines Programms die Zielgruppenerreichung und der Verbreitungsgrad des Programms in der Bevölkerung entscheidend. Trotz noch limitierter Erfahrungen mit öffentlich zugänglichen Programmen lässt sich sagen, dass es im Bereich der Bewegungsförderung möglich scheint, die anvisierten Zielgruppen – wie ungenügend aktive Personen oder spezifische Altersgruppen – bei entsprechender Gestaltung der Website und adäquaten Kommunikationsmaßnahmen zu erreichen.

Es gibt aber noch kaum Daten dazu, wie hoch ein realistischer Erreichungsgrad – unter Einsatz welcher Ressourcen – ist. Vor wenigen Jahren waren die Erwartungen, ausgehend von den Beteiligungen an einer wissenschaftlichen Studie mit äußerst proaktiver Rekrutierungsstrategie – 80% der Raucher einer Bevölkerungsstichprobe nahmen freiwillig an einer Studie zur Rauchentwöhnung teil – noch sehr optimistisch [137]. Inzwischen haben diese zu hohen Erwartungen der Erkenntnis Platz gemacht, dass es auch mit internetbasierten Interventionen eine Herausforderung bleiben wird, relevante Anteile der Bevölkerung dazu zu motivieren, sich auf freiwilliger Basis mit einem Programm zur Verhaltensänderung auseinanderzusetzen [138].

Internetbasierte Interventionen haben das Potenzial, zielgruppenspezifisch viele Menschen zu erreichen. Die Programme können mit relativ geringem Aufwand an inhaltliche und technische Entwicklungen angepasst werden. Zudem eröffnen sich für die Forschung in methodischer Hinsicht kreative und innovative Möglichkeiten. Die Entwicklung steht allerdings erst in der Anfangsphase und auf die Forschung warten noch zahlreiche große Herausforderungen.

4.6 Update of the Literature on the Effectiveness of Computer-Tailored Second Generation Physical Activity Interventions Published between 2007-2009

A number of new studies on the effectiveness of Web-based tailored physical activity interventions were published between 2007 and 2009. However, only few of them have been carried out in a real-life setting [139, 140], assessing medium-term effects in relatively large samples. Many studies were based on small sample sizes [141, 142], short-term follow-up data [72], or were carried out in a controlled setting [143]. Two reviews published in 2007 have addressed Web-based (but not specifically computer-tailored) physical activity interventions and have summarised the evidence that was available up to July 2006 [70, 71]. Vandelanotte et al found that eight of fifteen studies reported positive changes in physical activity behaviour [70]. However, effect sizes were generally small and mostly short lived. Studies with shorter follow-up periods and a higher number of contacts were more likely to find positive outcomes. Only four studies were explicitly based on computer-tailored interventions, while others were based for example on stage-targeted materials. Two of these four studies showed positive outcomes. Studies using objective data on website usage all reported low exposure to intervention materials, indicating that engagement and retention of participants is challenging [70]. Van den Berg et al included ten studies in their review on Internet-based physical activity interventions, the majority of which were personalised or tailored to the characteristics of the participants [71]. Two of three studies in which Internet-based interventions were compared with a waiting list control group reported significant differences between intervention and control group. However, effect sizes were generally low. One of four studies in which the intensity of contact in two types of Internet-based interventions varied reported positive physical activity outcomes in the intervention group compared to the control group. None of three studies in which the applied treatment procedures varied (e.g. individually tailored versus standard Web-based intervention, Web-based intervention versus printed intervention) reported significant positive effects in favour of the intervention group. The authors concluded that there is indicative evidence that Internet-based interventions are more effective when compared to a waiting list strategy [71].

Another review published in 2007 provides a descriptive evaluation of second generation interactive computerised interventions for physical activity, dietary behaviours, and combined interventions for weight loss [144]. Thirteen physical activity interventions were included with most studies comprising primarily female participants. The majority of interventions were theory-based. Intervention duration ranged from one to six months. The final posttest was usually immediately following the intervention. Three studies reported positive physical activity outcomes in favour of the intervention, six studies reported indeterminate results, and one study found a between-group difference in favour of the control group at posttest. Twenty interventions were included

that addressed both physical activity and dietary behaviours for weight loss. Of those, 17 studies measured physical activity, and six of them reported results in favour of the intervention. The authors concluded that research in this field is still in its infancy and that the findings related to the effectiveness of the interventions were mixed [144].

In 2009, a review was published that up-dated the evidence available up to January 2008 based on second generation computer-tailored physical activity interventions targeting adults [145]. Seventeen studies describing the evaluation of 16 interventions were included. Of these, 13 studies reported short- to medium-term and one reported long-term positive effects on physical activity, respectively. However, only seven of these studies reported significant positive effects in favour of the tailored intervention over a control group, while seven studies reported a significant positive effect over time for both intervention and control groups with no significant effect between groups, for one of which the effect was only found for individuals inactive at baseline [145]. The majority of interventions were delivered using the Internet and/or email. The generalisability of findings was highlighted as an important limitation of all studies. Reasons for the lack of external validity and thus generalisability include small or unrepresentative samples, an unrepresentative target population, or the controlled setting within which the studies were conducted [145]. Less than half of the included studies used objective measures of physical activity, with only one third of them finding positive between group effects. This emphasises the importance of using objective measures to assess physical activity. Furthermore, there was a lack of long-term follow-up, with only one study demonstrating intervention effects that were maintained two years after baseline [143]. The authors of the review concluded that the evidence on the effectiveness of second generation tailored physical activity interventions was inconclusive given the inconsistent results of the included studies [145].

As this is a fast moving field of research, a few more studies have been published after January 2008 that were not included in the review described above. In a small trial, the effectiveness of an Internet-delivered behaviour change programme was compared with the same intervention delivered in a classroom, with a traditional exercise prescription approach, and with a no intervention control group in sedentary adults (N=17) [141]. Physical activity measured as step counts increased significantly in all three intervention groups after the 16-week experimental period and was significantly higher compared to the control group at posttest. Applying the Internet-delivered intervention in a population of sedentary overweight/obese adults (N=32) resulted in a significant increase in average steps per day of 1382 in the intervention group (P = .03) and a non-significant increase of 816 in the control group (P = .14), with no significant differences between groups post-intervention [141].

The efficacy of an individually tailored, Internet-plus-email physical activity intervention was tested in 156 ethnically-diverse adult females in California compared to a waiting list control group [146]. Participants randomised to the intervention group received ten weekly emails containing links to the intervention website. The last follow-up took place three months after baseline. Significant group differences in walking and moderate-to-vigorous intensity physical activity were observed after three months: Walking increased by 69 and 32 minutes per week in the intervention and control group, respectively; moderate-to-vigorous intensity physical activity increased by 23 minutes per week in the intervention group and decreased by 25 minutes in the control group [146]. However, these results should be interpreted with caution because the control group did not receive

comparable contact with the research staff and therefore the observed effects could also be due to non-specific factors [146].

In a large-scale trial, the one month short-term efficacy of an Internet-delivered computer-tailored lifestyle intervention targeting different behaviours (saturated fat intake, physical activity, and smoking cessation) was assessed [72]. In the 966 participants with lower than recommended physical activity levels at baseline who responded at posttest, a borderline significant intervention effect was found for the likelihood of meeting the physical activity recommendations based on self-reported data (OR=1.34, 95% CI 1.001-1.80) [72]. However, observed effects were no longer significant when using an intention-to-treat approach in the analysis or when including the whole study population (including those meeting the physical activity recommendations at baseline, N=1717).

Finally, the effectiveness of a three month intervention, including a personal activity monitor in combination with a Web-based tailored physical activity advice, was assessed in a randomised trial with follow-up assessments three and eight months after baseline in 102 Dutch office workers [147]. The personal activity monitor was a uniaxial accelerometer which accumulates a single index score as a proxy of total daily physical activity shown continuously on the display. The intervention did neither result in increased self-reported physical activity levels nor in changes in determinants of physical activity, aerobic fitness and body composition [147]. The authors speculated that these results may be due to the fact that only 74% of the participants read their tailored advice, and 39% of those did not find it appealing; 73% had worn the personal activity monitor "regularly" to "often". Moreover, 67% of the study population already met the physical activity recommendations at baseline, thus a ceiling effect may have occurred. A higher adherence to the intervention programme did not result in increased levels of physical activity.

Conclusions

Updated evidence on the effectiveness of individually tailored Internet-delivered physical activity interventions is still inconclusive, with some studies showing small but significant effects in favour of the intervention group compared to a control group, some studies reporting significant increases in physical activity levels over time in both intervention and control groups with no between-group differences, and some studies producing no significant effects at all. One reason for these different findings may be the large heterogeneity of interventions and studies [145]. Effectiveness may depend on many factors such as the quality of the intervention, exposure to intervention materials (duration, frequency, number of contacts, individual use), levels of interactivity, the use of theories for developing the intervention, and the mode of delivery, among others. Furthermore, there are usually numerous elements within tailored interventions, as well as factors associated with the study setting, which could be responsible for any of the observed effects. Studies disentangling different aspects of an intervention and looking at separate intervention effects of particular elements are required [70]. Moreover, studies including large representative samples from the general population, using objective measures to assess physical activity levels, including long-term follow-up assessments, and delivering the intervention in an uncontrolled, real-life setting over the Internet could provide important new information in this field of research.

PART III

EVALUATION OF THE PHYSICAL ACTIVITY PROMOTION PROGRAMME ACTIVE-ONLINE

5 Effectiveness of Active-Online, an Individually Tailored Physical Activity Intervention, in a Real-Life Setting: Randomised Controlled Trial

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Available at: www.jmir.org/2009/3/e21/HTML

Abstract

Background: Effective interventions are needed to reduce the chronic disease epidemic. The Internet has the potential to provide large populations with individual advice at relatively low cost.

Objective: The focus of the study was the Web-based tailored physical activity intervention Active-online. The main research questions were (1) How effective is Active-online, compared to a nontailored website, in increasing self-reported and objectively measured physical activity levels in the general population when delivered in a real-life setting? (2) Do respondents recruited for the randomised study differ from spontaneous users of Active-online, and how does effectiveness differ between these groups? (3) What is the impact of frequency and duration of use of Active-online on changes in physical activity behaviour?

Methods: Volunteers recruited via different media channels completed a Web-based baseline survey and were randomised to Active-online (intervention group) or a nontailored website (control group). In addition, spontaneous users were recruited directly from the Active-online website. In a subgroup of participants, physical activity was measured objectively using accelerometers. Follow-up assessments took place 6 weeks (FU1), 6 months (FU2), and 13 months (FU3) after baseline.

Results: A total of 1531 respondents completed the baseline questionnaire (intervention group n = 681, control group n = 688, spontaneous users n = 162); 133 individuals had valid accelerometer data at baseline. Mean age of the total sample was 43.7 years, and 1146 (74.9%) were women. Mixed linear models (adjusted for sex, age, BMI category, and stage of change) showed a significant increase in self-reported mean minutes spent in moderate- and vigorous-intensity activity from baseline to FU1 (coefficient = 0.14, P = .001) and to FU3 (coefficient = 0.19, P < .001) in all participants with no significant differences between groups. A significant increase in the proportion of individuals meeting the HEPA recommendations (self-reported) was observed in all participants between baseline and FU3 (OR = 1.47, P = .03), with a higher increase in spontaneous users compared to the randomised groups (interaction between FU3 and spontaneous users, OR = 2.95, P = .02). There were no increases in physical activity over time in any group for objectively measured physical activity. A significant relation was found between time spent on the tailored intervention and changes in self-reported physical activity between baseline and FU3 (coefficient = 1.13, P = .03, intervention group and spontaneous users combined). However, this association was no longer significant when adjusting for stage of change.

Conclusions: In a real-life setting, Active-online was not more effective than a nontailored website in increasing physical activity levels in volunteers from the general population. Further research may investigate ways of

integrating Web-based physical activity interventions in a wider context, for example, primary care or workplace health promotion.

5.1 Introduction

To reduce the burden of chronic disease and premature death due to an inactive lifestyle [1, 20], interventions are needed that are effective in enhancing physical activity levels in the general population. In Switzerland, the health-enhancing physical activity (HEPA) recommendations advocate at least 30 minutes of moderate activity on most, preferably all, days of the week or at least 20 minutes of vigorous activity on three or more days of the week [32]. However, only 36% of the adult population in Switzerland meets either of these recommendations [148]. Thus, effective interventions reaching large numbers are required.

Computer-tailored interventions simulate a personal counselling situation by providing individual feedback based on the behaviour, motivation, and attitudes of the user [108]. Tailored interventions of the first generation (using print materials for assessment and dissemination) have been effective in inducing behaviour changes for smoking [68, 111], nutrition [112, 149], and physical activity [113, 118, 150-152]. Second generation interventions use the advantages of the Internet - interactivity, availability at any time from any place, and immediate display of feedback - to potentially reach large populations at relatively low cost.

To date, studies investigating the effectiveness of second generation Web-based tailored physical activity interventions have either been carried out in small confined populations [126, 129, 142], have not used truly tailored information but materials targeted to the stages of change [7, 128], have looked at only short-term effects [72], or have been carried out in optimised and controlled settings such as computer labs [143]. Results from these studies were mixed [70, 71]. Interventions shown to be effective in controlled settings may still be ineffective if delivered in an uncontrolled, real-life setting. The potential public health impact of Web-based computer-tailored interventions can only be estimated if their effectiveness is tested under real-life conditions. Thus, studies evaluating online physical activity interventions in real-life settings are now needed. To our knowledge, there is only one individually tailored Internet-based intervention targeting physical activity that has been evaluated in two samples of the general population in a real-life setting, showing mixed results [139, 140].

Intensity of intervention use may be associated with induced physical activity changes [65]. However, little is known about the impact of frequency and duration of intervention use on the effectiveness of a Web-based tailored physical activity intervention. This may be an important issue for the interpretation of results from real-life effectiveness studies.

The focus of the present study was a Web-based tailored physical activity intervention that is freely accessible on the Internet (www.active-online.ch). Active-online was tested for its acceptability and feasibility before the final version went online in 2003 [17]. The main research questions were (1) How effective is Active-online, compared to a nontailored website with general information on physical activity and health, in increasing self-reported and objectively measured physical activity levels in the general population when delivered in a real-life setting? (2) Do

respondents recruited for the randomised study differ from spontaneous users of Active-online, and how does effectiveness differ between these groups? (3) What is the impact of frequency and duration of use of Active-online on changes in physical activity behaviour?

5.2 Methods

Study Design, Setting, and Participants

Participants for this Web-based study were recruited by advertisements in newspapers, in magazines, and on the Internet. They were invited to take part in a physical activity study and were given the link to the study website (with a domain name different from the one of the intervention). At the same time, spontaneous users were recruited directly from the Active-online website by redirecting them to the study website if they chose to participate in the study. The study was carried out in German, and recruitment lasted from May 1 to August 2, 2006. Based on sample size calculations assuming an increase in meeting the HEPA recommendations of 30% in the intervention group and 20% in the control group (alpha = .05, power = 0.8), 250 participants were required per group. Assuming a realistic loss to follow-up in a Web-based survey without face-to-face contact of about 50% over 1 year [153], this number doubled to 500 participants per group.

Interested individuals could access the study website from any computer with Internet access. Information regarding the study and all study questionnaires were provided there. Individuals completing the baseline questionnaire and leaving their email address were registered. Media-recruited participants were randomly allocated to either the intervention group (IG) or the control group (CG) and were forwarded to Active-online or the nontailored website, respectively. Spontaneous users (SU) were included as a separate study group but followed the same study protocol as the IG.

Respondents could volunteer to take part in accelerometer measurements via an additional Web page that they were routed to after the baseline questionnaire, depending on the availability of accelerometers. Volunteers were not forwarded directly to the intervention websites but were sent an accelerometer to obtain baseline measurements and had to return a separate written consent form. Only after the accelerometer was returned was an email sent out with a link to Active-online or the nontailored website.

Randomisation was carried out using random numbers provided by the University of Geneva's online service (www.randomnumbers.info) based on a physical quantum random number generator. Participants were not aware of the group they were randomised to. The study website with all the study questionnaires was kept strictly separate from Active-online, using two different domains, in order to minimise the chance of controls getting involved with Active-online.

Email addresses were used to identify and contact participants at follow-up. All participants were followed up 6 weeks (FU1), 6 months (FU2), and 13 months (FU3) after the baseline assessment, receiving a maximum of three email invitations each time with a personal link referring them back to the study website. Those volunteers having participated in the accelerometer measures at baseline were asked to repeat accelerometer measures at

each follow-up in addition to the online questionnaires. Individuals in the IG and SU additionally received three reminder emails with a personal link to Active-online between FU2 and FU3 at 9, 10, and 11 months after the baseline assessment, encouraging them to revisit Active-online. The study procedure is depicted in Figure 5.1 according to group. The study used an automated design with emails automatically timed to each participant's starting date. There were no face-to-face contacts. The study design had been tested in a feasibility study [79]. As incentives, two city bikes were being raffled among the participants who completed the study. The study was approved by the ethics commission of the canton of Berne, Switzerland. The trial was not registered as the funding agency (Swiss Federal Council of Sports ESK) did not request a trial registration and we were not aware when the study started in 2006 that Web-based trials should be registered. In lieu of trial registration, we append the original application for funding, containing the protocol (Multimedia Appendix 1).

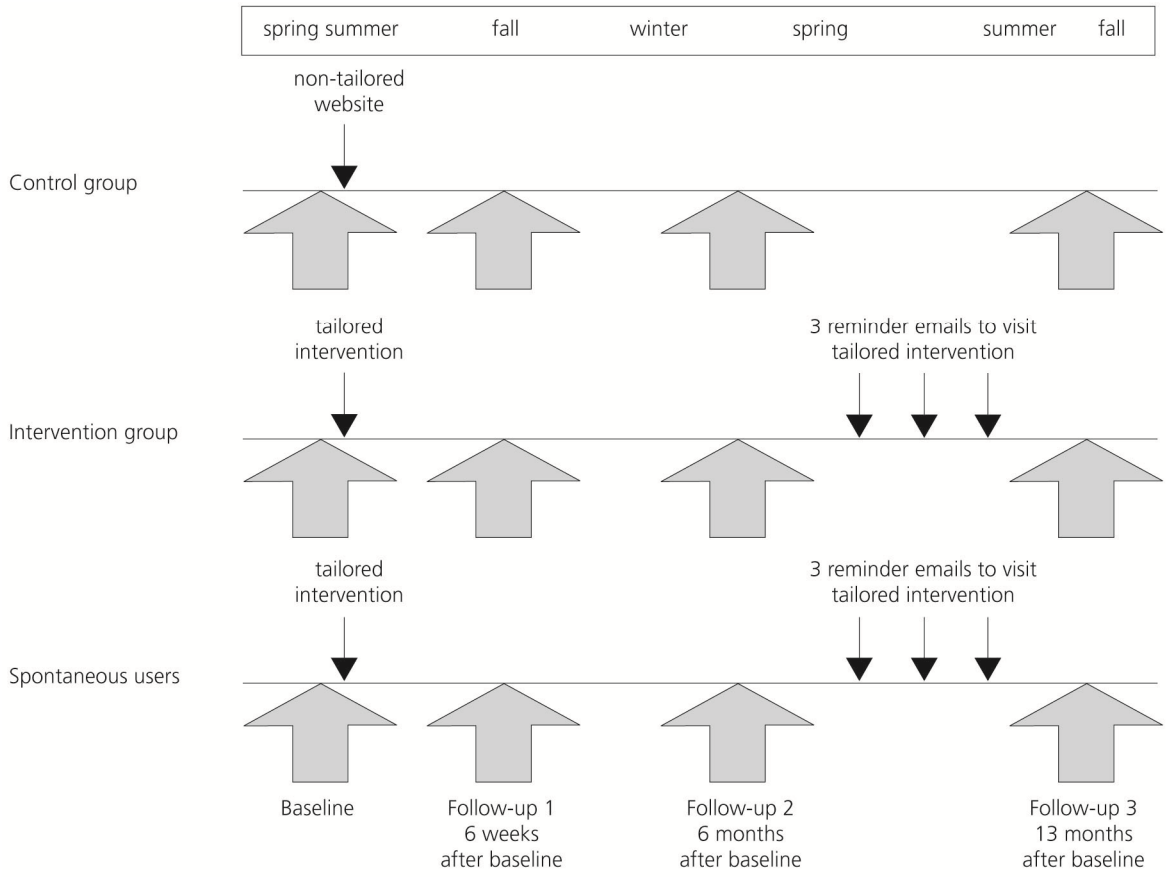

Figure 5.1 Study procedure for each group

Tailored Intervention and Standard Website

Active-online is an interactive, individually tailored physical activity programme targeting individuals aged 30 to 60 years. It has been freely available on the Internet since 2003. The aim of the programme is to increase physical activity levels in users by offering individually tailored counselling and motivational feedback. The programme was developed in German by an interdisciplinary team of experts in public health, sport sciences, psychology, design, and computer science, and then translated and culturally adapted for French and Italian audiences. The theoretical framework of the programme is the transtheoretical model of behaviour change [80]. Visitors may choose one of two tailored modules, either on everyday activities and endurance training or on strength and flexibility training. Figure 5.2 shows a screenshot of the Active-online page where one of the two modules can be selected. The first module offers a maximum of four tailored feedbacks using questionnaires on stages of change, decisional balance, processes of change, and self-efficacy. Stages of change are assessed according to a seven-stage concept focusing on current behaviour (moderate- and vigorous-intensity activity) as well as on intention to change [81]. The decisional balance and self-efficacy scales are based on instruments of Basler et al [154], and the processes of change scale on instruments of Marcus et al [155], and Nigg and Riebe [156]. Depending on their current stage of change, visitors are guided through one, three, or four sections of the module. More information is available in Martin-Diener et al [81]. The module on strength and flexibility training offers a maximum of two tailored feedbacks based on questionnaires assessing five stages of change as well as attitudes and knowledge regarding strength training. The feedback for flexibility training is based on current behaviour. Based on answers to these “diagnostic” questionnaires, short text segments are selected from the feedback library, compiled into unique individual feedback, and displayed immediately on screen. Feedback reports are available in a printer-friendly format. Additional support tools, such as strength and stretching exercise sheets, and organisational and motivational download forms, are provided.

Users may visit Active-online without registering, or they may register with their email address to obtain a password. Registered users have the possibility of following changes in their physical activity behaviour when revisiting the website. They also receive reminder emails encouraging them to revisit Active-online.

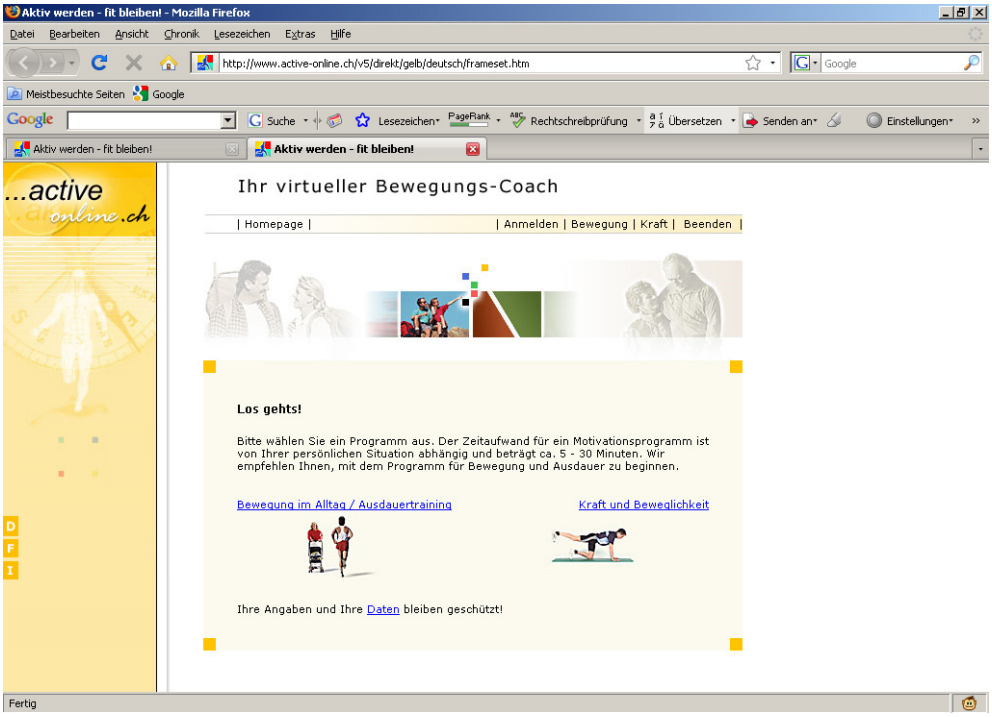

Figure 5.2 Screenshot of the tailored intervention

Participants in the CG were forwarded to a nontailored website with general information on physical activity and health with no additional reminder emails. This was a static website with some tips on how to include more physical activity in daily life and some information regarding positive health effects of physical activity. Figure 5.3 shows a screenshot of the nontailored website.

Figure 5.3 Screenshot of the standard website for the CG

Measures

The online baseline questionnaire included questions on demographics, physical activity behaviour, stage of change, self-efficacy, and general and mental health. Data are only presented for physical activity. Physical activity was assessed using a short questionnaire with four items on frequency and duration of moderate- and vigorous-intensity activity that is used in the official monitoring of physical activity in the Swiss population [29]. These questions allow the calculation of total minutes of moderate- and vigorous-intensity activity per week (total reported activity time) and the classification of participants according to the HEPA recommendations as outcome measures. Reported times exceeding 8 hours per day or 40 hours per week of moderate-intensity activity and 5 hours per day or 17.5 hours per week of vigorous-intensity activity were set to missing. Truncating these high values instead of setting them to missing did not change the results. Demographic variables included age, gender, living situation, highest education, nationality, smoking status, height, and weight. Body mass index (BMI) was calculated as weight (in kg) divided by height (in meters squared) and categorised as < 18.5, 18.5 to < 25, 25 to < 30, and ≥ 30 kg/m^2. The same questionnaire (except demographic variables) was used in the follow-up assessments.

Accelerometers (Actigraph models AM7164 and GT1M, formerly Computer Science and Applications, now Manufacturing Technology Inc, Fort Walton Beach, FL, USA) were used for objective physical activity assessment. The accelerometers have been validated in earlier studies [50, 157]. Participants were asked to wear the accelerometer on their right hip during waking hours for a 7-day period at baseline and each follow-up. A minimum of 4 days with at least 10 hours per day of data recording, including one weekend day, were required to be included in the analysis. The data collected by the accelerometers are a series of counts integrating vertical acceleration over a specified time interval (epoch time). Epoch time was set to 1 minute. Cut-off points developed by Swartz et al were used to classify light (≤ 573 counts/minute), moderate (574-4944 counts/minute), and vigorous activities (≥ 4945 counts/minute) [52]. These cut-offs were chosen because they were derived using a wide range of lifestyle activities and may prove applicable for predicting time spent in different intensity categories during free-living activities [54]. Mean counts per minute over the recording period and minutes of moderate and vigorous activity per week according to accelerometer data (total accelerometry activity time, only bouts of at least 10 minutes) were calculated.

Data regarding the use of Active-online for the IG and SU were obtained from the Active-online user database. Each visit to the website was recorded, including start date and time, end date and time, number of pages viewed, etc. Participants were provided with a password to re-enter Active-online in order to track their repeated visits. Use of the nontailored website in the CG was not measured.

Statistical Analyses

Minutes of physical activity were positively skewed and were log-transformed for analysis. Chi-square tests for categorical variables and t-tests for continuous variables were used to compare responders and nonresponders and to compare differences between IG and CG and between IG and SU at baseline. In a preliminary analysis, paired t-tests and McNemar tests were applied, respectively, to compare changes in total activity time and

changes in the proportion meeting the HEPA recommendations between baseline and each FU and for each group separately. Mixed logistic and mixed linear models were used to simultaneously analyse the effects of time and group allocation on the proportion meeting the HEPA recommendations and on total activity time, respectively, including gender, age, BMI category, and stage of change at baseline as covariates in the adjusted model. Stage of change was included to account for baseline motivation to change. The inclusion of time-group interaction terms in mixed models allows identification of potential differences in changes between groups at any time point. Changes in total reported activity time were analysed for all participants and separately for participants meeting and not meeting the HEPA recommendations at baseline, because the latter are those most in need of effective interventions to increase their physical activity behaviour. Participants were analysed as randomised.

The impact of the use of Active-online on changes in physical activity behaviour in the IG and SU was analysed with a linear regression model including the difference in total reported activity time between baseline and FU3 as the dependent variable and the minutes spent in the tailored intervention as the independent variable, including gender, age, BMI category, and stage of change at baseline as covariates in the adjusted model. STATA 9.2 (STATACorp LP, College Station, TX, USA) was used for all analyses.

5.3 Results

Participants

In total, 1919 respondents recruited via different media channels and 220 respondents recruited via the Active-online website started the baseline survey on our study website; 1401 and 168, respectively, finished the survey and were registered as participants (Figure 5.4). We excluded 38 respondents due to technical problems; 1369 were randomised into the IG (n = 681) or the CG (n = 688), and 162 were registered as SU (7.4% of all visits recorded in the Active-online user database during the recruitment period). The response is shown in Figure 5.4 according to group allocation and follow-up. No difference in response was seen at FU1. At FU2, response was significantly lower in the IG compared to CG, and in SU compared to IG. At FU3, response was significantly lower in both the IG and SU compared to CG, with no significant difference between IG and SU. Depending on availability of accelerometers, 326 participants (21.3%) had the choice to wear an accelerometer. Of those, 144 (44.2%) agreed to take part in the objective measures, corresponding to 9.4% of the total sample.

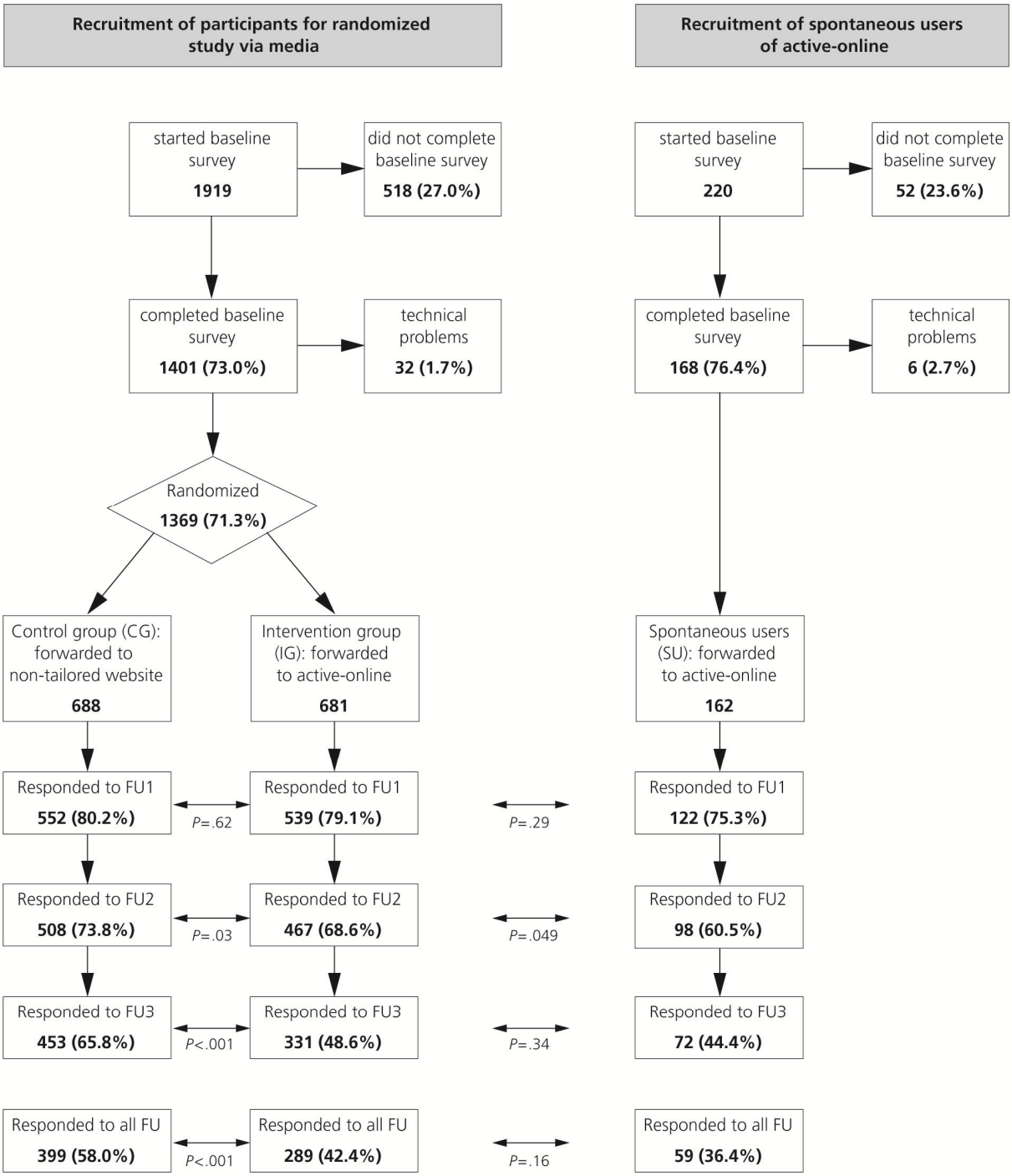

Figure 5.4 Participant flow: recruitment channels, randomisation, baseline, and follow-up assessments

Table 5.1 displays the baseline characteristics of the total sample and of each group separately. There were no significant differences in demographic variables between the randomised groups (IG and CG). However, compared to the IG, SU were significantly younger (38.8 versus 44.2 years, P < .001), more likely to be smokers (23.5% versus 12.8%, P < .001), and less likely to be living with children (38.9% versus 53.5%, P < .001).

Table 5.1 Characteristics of participants at baseline according to group [a]

Self-Reported Measures	Total (n = 1531)	CG (n = 688)	IG (n = 681)	*P* (IG-CG)	SU (n = 162)	*P* (IG-SU)
Demographic variables						
Female (%)	74.9	75.9	74.7	.63	71.0	.33
Age, years	43.7 ± 13.1	44.2 ± 12.8	44.2 ± 13.3	.99	38.8 ± 13.0	< .001
Age groups (%)				.32		< .001
< 30 years	16.2	13.8	15.3		30.3	
30-60 years	72.9	75.6	72.1		64.8	
> 60 years	10.9	10.6	12.6		4.9	
Living with a partner (%)	70.0	70.4	70.8	.86	65.4	.18
Living with children (%)	53.2	56.3	53.5	.30	38.9	.001
Swiss nationality (%)	87.3	86.2	88.6	.19	86.4	.45
University degree (%)	24.9	25.2	24.1	.65	27.2	.41
Health-related variables						
Smokers (%)	13.1	10.9	12.8	.28	23.5	.001
BMI, kg/m^2	24.6 ± 4.6	24.5 ± 4.5	24.8 ± 4.6	.38	24.5 ± 4.6	.57
Overweight and obese (%)	39.3	38.3	41.1	.30	36.4	.28
Physical activity-related variables						
Meeting HEPA recommendations (%)	40.8	40.4	40.9	.84	42.2	.75
Total reported activity time, minutes/week	277 ± 253	276 ± 256	276 ± 258	.99	283 ± 222	.76
Objective Measures	Total (n = 133)	CG (n = 52)	IG (n = 62)	*P* (IG-CG)	SU (n = 19)	*P* (IG-SU)
Objective physical activity						
Mean counts per minute	451 ± 186	450 ± 176	457 ± 196	.85	436 ± 193	.69
Total accelerometry activity time, minutes/week	377 ± 214	383 ± 211	383 ± 227	.99	341 ± 183	.47

[a] Values are mean ± SD unless otherwise noted.

There were significant differences in some variables between participants who responded to each follow-up (responders) and those who did not respond to at least one follow-up (nonresponders). Nonresponders were slightly younger, less likely to be Swiss, more likely to be smokers at baseline, more likely to be overweight or obese, and less likely to meet the HEPA recommendations at baseline. The subgroup of participants with accelerometers (n = 144) were slightly older, more likely to live with children, and more likely to be overweight or obese than those not participating in the accelerometer part of the study.

Self-Reported Physical Activity

When including those participants with complete data for all four time points (n = 736), significant increases in the proportion of participants meeting the HEPA recommendations were observed in SU between baseline and FU1 (*P* = .045) and FU3 (*P* = .002). Nonsignificant increases between baseline and FU3 were seen in the IG and CG. Changes in total reported activity time per week between baseline and FU3 are depicted in Figure 5.5 according to group, for all participants with complete data (n = 736) and separately for those individuals meeting (n = 336) and not meeting (n = 400) the HEPA recommendations at baseline. When including only those participants who did not meet the HEPA recommendations at baseline, total reported activity time increased significantly in all groups. The increases observed in these insufficiently active individuals exceeded the increase observed in all

participants; thus, a decrease in total reported activity time was found in those individuals meeting the HEPA recommendations at baseline. The decrease was significant in the CG.

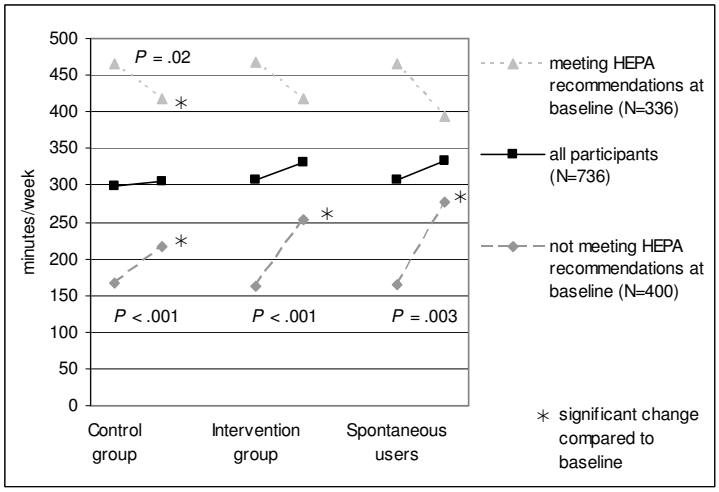

Figure 5.5 Changes in total reported activity time (minutes/week) between baseline and FU3 according to group, for all participants with complete data (n = 736) and separately for those meeting (n = 336) and not meeting (n = 400) the HEPA recommendations at baseline

Table 5.2 shows the percent changes in the proportion meeting the HEPA recommendations and changes in total reported activity time between baseline and each follow-up according to group, including those participants who responded to the specific follow-up. A significant increase in individuals meeting the HEPA recommendations was observed in SU between baseline and FU3. Total reported activity time was generally lower at FU2; however, there were no significant changes at any follow-up or in any group.

Table 5.2 Percent changes in self-reported physical activity between baseline and each follow-up according to group [a]

	Baseline to FU1	*P*	Baseline to FU2	*P*	Baseline to FU3	*P*
Meeting HEPA recommendations						
CG	+2.2%	.27	−0.8%	.71	+3.8%	.12
IG	+2.3%	.27	−1.7%	.45	+4.0%	.21
SU	+7.4%	.11	−2.0%	.69	+18.3%	.005
Total reported activity time (minutes/week)						
CG	+4.8%	.13	−3.7%	.27	+4.5%	.25
IG	+4.7%	.14	−2.6%	.52	+3.4%	.51
SU	+9.6%	.11	+4.9%	.48	+15.4%	.19

[a] Results are based on participants with complete data at two time points (see Figure 5.4 for number of participants).

Table 5.3 shows the results from mixed logistic and mixed linear models for all participants, evaluating simultaneously the effect of time and group allocation. There were no differences between groups regarding the HEPA recommendations; however, a borderline significant increase in total reported activity time was found for SU compared to the CG. Irrespective of group allocation, participants were significantly more likely to meet the HEPA recommendations at FU3 compared to baseline, and a significant increase in total reported activity time was observed between baseline and FU1 as well as between baseline and FU3. There was a significant interaction between FU3 and SU in both the unadjusted (OR = 2.83, *P* = .03) and adjusted logistic model (OR = 2.95, *P* = .02), indicating that the proportion meeting the HEPA recommendations was significantly higher in SU compared to the randomised groups at FU3. There were no interactions between time of follow-up and group allocation in the mixed linear model, indicating that there were no differences in total reported activity time between groups at any follow-up.

Table 5.3 Time and group parameters for changes in physical activity, based on mixed logistic and mixed linear models [a]

	Meeting HEPA Recommendations				Total Reported Activity Time (minutes/week)			
	Unadjusted		Adjusted		Unadjusted		Adjusted	
	OR	95% CI	OR	95% CI	Coeff	95% CI	Coeff	95% CI
Group								
IG	1.04	0.68-1.57	1.02	0.72-1.45	0.02	–0.10, 0.15	0.02	–0.08, 0.13
SU	1.15	0.59-2.24	1.08	0.62-1.89	0.16	–0.04, 0.35	0.17	0.000-0.35
Time								
FU1 (6 weeks)	1.34	0.96-1.85	1.30	0.93-1.82	0.15	0.06-0.23	0.14	0.05-0.22
FU2 (6 months)	1.04	0.75-1.46	1.01	0.71-1.42	0.02	–0.06, 0.11	0.02	–0.07, 0.10
FU3 (13 months)	1.49	1.05-2.11	1.47	1.03-2.09	0.19	0.10-0.28	0.19	0.10-0.28

[a] Basic unit is the CG at baseline. Adjusted models include gender, age, BMI category, and stage of change at baseline.

Objectively Measured Physical Activity

At baseline, 144 individuals (56 in CG, 68 in IG, and 20 in SU) wore an accelerometer, resulting in valid data for 133 individuals (92.4%). Valid accelerometer data were available for 117 individuals (88.0% of those with valid data at baseline) at FU1, for 114 individuals (85.7%) at FU2, and for 105 individuals (78.9%) at FU3; 93 participants (69.9%) had complete accelerometer data. There were no differences between groups.

Table 5.4 shows the percent changes in counts per minute and in total accelerometry activity time between baseline and each follow-up for each group separately. There were no significant changes observed in the IG. In the CG, activity levels decreased significantly between baseline and FU2 as well as between baseline and FU3. In SU, activity levels decreased significantly between baseline and FU2. Mixed linear models did not show any significant effects for time and group and no interaction effects.

Table 5.4 Percent changes in objective physical activity between baseline and each follow-up according to group [a]

	Baseline to FU1	*P*	Baseline to FU2	*P*	Baseline to FU3	*P*
Counts per minute						
CG	−4.8%	.19	−11.6%	.004	−8.1%	.03
IG	+2.5%	.52	−8.0%	.06	−1.2%	.83
SU	+1.5%	.83	−16.2%	.04	−2.1%	.81
Total accelerometry activity time (minutes/week)						
CG	−6.2%	.29	−17.5%	< .001	−10.3%	.03
IG	−1.5%	.82	−5.4%	.29	−1.2%	.87
SU	−5.1%	.72	−29.1%	.045	−16.0%	.16

[a] Results are based on participants with complete data at two time points.

Frequency and Duration of Use of Active-Online

In total, 2112 visits of IG and SU study participants (n = 843) were counted on Active-online, with a mean number of 2.5 (± 1.6) visits per person. The number of visits was described by a positively skewed distribution representing 50% with two or less visits on Active-online during the study period between baseline and FU3. On average, 46 pages were viewed per person, with a median of 31 pages.

In 1226 of all visits (58.0%), one of the two tailored modules was started. These 1226 visits can be attributed to 628 individuals (74.5% of all participants in IG and SU). The mean number of visits within a tailored module for these individuals was 1.9 (± 1.2). The mean and median time spent in the modules for participants who started a tailored module was 12 minutes and 9 minutes per visit, respectively, and 23 minutes and 15 minutes during the whole study period, respectively.

In 962 of all visits (45.5%), at least one tailored feedback was obtained in the module on everyday activities and endurance training, and in 460 of all visits (21.8%), at least one tailored feedback was obtained in the module on strength and flexibility training. There was no difference in the use of Active-online between the IG and SU.

In the CG, 62 of 453 participants responding to FU3 (13.7%) stated that they had heard about Active-online and had used it at least once during the preceding year.

Linear regression showed a weak but significant relation between total minutes spent within one of the tailored modules (IG participants and SU combined) and changes in total reported activity time between baseline and FU3 in the unadjusted model (coefficient = 1.13, 95% CI 0.09 - 2.17, *P* = .03), and a borderline significant relation in the model adjusted for age, gender, and BMI category (coefficient = 1.07, 95% CI 0.004 - 2.13, *P* = .049). When adding stage of change to the model, the relation was attenuated and no longer significant (coefficient = 0.58, 95% CI −0.43 to 1.59, *P* = .26), indicating that stage of change was associated with both changes in total reported activity time as well as time spent in the tailored modules. There was no interaction between stage of change and time spent in the tailored modules.

5.4 Discussion

Principle Results and Comparison with Prior Work

In the present study, there were significant increases in self-reported physical activity levels between baseline and the last follow-up after 13 months in all participants, but there were no significant differences between the randomised groups. More pronounced increases were found in SU of Active-online. However, these individuals were not randomised and thus cannot be directly compared with the randomised groups. Furthermore, SU willing to participate in the study may not be representative of all Active-online users since they were a self-selected sample and only represented 7.4% of all visits on Active-online during the recruitment period.

Self-reported changes in physical activity levels were not confirmed by objective measures. Differences between self-reported and objective measures may be due to the possibility that study participation influenced the perception of physical activity behaviour and thus reporting of physical activity levels. A seasonal pattern [158], with lower activity levels in winter (FU2), was observed in both self-reported and objective physical activity data.

Results of other computer-tailored [112] and Web-based tailored [70, 71] physical activity intervention studies have been mixed. The results in the present study are comparable with other studies investigating Web-based physical activity interventions. While some studies produced effective results in the short term [7, 72] or when compared to a waiting list control group [140], others showed improvements in physical activity levels in both intervention and control conditions [129], like we did with regard to self-reported physical activity. A tailored intervention that has been effective when delivered on CD-ROM in a controlled setting after 6 months [8] and after 2 years [143] was not effective when delivered online in a real-life setting compared with online standard advice [139]. Similar to our study, Spittaels et al also found increases in self-reported physical activity levels in both intervention and control groups, and increases in physical activity levels were not confirmed by accelerometer data [139]. The present study adds evidence to the point that effectiveness of a Web-based physical activity intervention may be difficult to demonstrate when delivered in an uncontrolled setting.

As per the real-life setting, study participants were free to start and stop the intervention. In addition, the anonymous nature of the Internet and the wealth of available information may make it difficult to achieve sufficient levels of intervention use. On average, individuals in the IG and SU started a tailored module less than twice during the study period, accumulating a mean of 23 minutes in the tailored modules in total (12 minutes per visit). In a study assessing user attitudes toward a physical activity website, an average time of 7.1 minutes spent on the tailored intervention per visit and a total average of 356 minutes over 1 year was reported [159]. While the duration per visit was higher in our study sample, the total accumulated time spent on the intervention was 15 times higher in the other study. Leslie et al reported that participants who entered a tailored Web-based physical activity intervention spent, on average, 9 minutes per visit [134]. However, 152 participants produced 4114 visits on the website over 8 weeks, indicating that the accumulated exposure was clearly higher in that study than in our sample. Low exposure to intervention materials has been reported in other studies using objective data on website usage, indicating that achieving engagement in website-delivered physical activity interventions is challenging [70]. Moreover, one quarter of the participants in the IG and SU did not start a tailored module at all,

and 13.7% of controls used Active-online independently of the study, suggesting some degree of contamination in the IG and CG. This may have reduced a potential effect but reflects the real-life delivery mode used in this study. While correlations between log-in frequency and weight change have been reported in a study focusing on a Web-based behavioural weight loss programme [160], the role of frequency and duration of use of Active-online on changes in physical activity behaviour could not be clarified in this study.

Because of the challenges that we face with stand-alone Web-based interventions that are freely accessible on the Internet, it may be more promising to embed a programme like Active-online in a wider context of health promotion. Possibilities for better utilisation of Active-online may be its application in a workplace setting, the "prescription" of Active-online to patients in primary care, or the inclusion of Active-online in a larger health promotion packet targeting different health issues, for example, in a community setting. Two studies that have evaluated Web-based tailored interventions in a primary care setting have reported increases in physical activity levels after 1 month [161] and after 6 weeks [162]. A study in two manufacturing and two office sites showed high levels of engagement in a Web-based and monitoring device–based physical activity and weight management programme in a wide range of employees [163]. A computer-tailored (but not Web-based) intervention for nutrition and physical activity in a workplace setting demonstrated increases in the frequency of strengthening and flexibility exercise compared to a delayed group [118]. A Web-based workplace health promotion programme targeting nutrition, stress, and physical activity did not outperform print materials used in the control group, even though improvements in some physical activity variables were reported in both groups [164]. Further research may investigate possibilities of integrating Web-based interventions in a wider health promotion context. Marcus et al especially highlight the urgent need for research on Internet-based physical activity programmes within the context of primary care [165].

Strengths and Limitations

A strength of the study was the delivery of the Web-based intervention under real-life conditions, not in a controlled setting. There were no face-to-face contacts or other factors that may increase compliance, because they do not represent realistic conditions for open access Web-based interventions. Furthermore, objective physical activity assessment was used in a subsample of participants in addition to the questionnaires. We included SU of Active-online as an additional study arm. Frequency and duration of use of Active-online were monitored using objective data from the Active-online user database, making it possible to look at the relation between use of Active-online and physical activity changes. Other strengths are the long-term follow-up and the large number of participants included in the randomised study.

Several reasons may be responsible for the limited effectiveness of Active-online. The website was tested in 2003 and acceptability was generally good; participants especially liked the individual counselling, the pleasant tone, and the simple structure and design [17]. However, Internet technology is changing rapidly and Active-online may already be slightly out-of-date. Furthermore, Active-online is based on the transtheoretical model of behaviour change, which was regarded as promising at the time when Active-online was developed, but has more recently been subject to some debate regarding its potential to change behaviour [166, 167]. In addition, baseline physical

activity levels were already quite high in the study sample, with around 280 minutes total reported activity time per week; thus a ceiling effect may have occurred.

This study has several limitations. A rather low overall response of around 50%, as observed in other studies [153], was expected based on the experiences of the feasibility study [79] and was taken into account when calculating the sample size. High drop-out attrition has been recognised as a common problem in Internet-based studies [168]. Nonresponse in this study was differential between groups, with higher drop-outs in the IG and SU than in the CG. Differences between responders and nonresponders [153] and higher drop-out rates in intervention groups have been observed in other studies in the domain of physical activity [7] and nutrition [69, 169]. The smaller number of recruited SU and the fact that they only represented 7.4% of all visits on Active-online during the recruitment period limits conclusions about the effectiveness of Active-online in this group. The time spent on Active-online recorded in the database may not represent the actual time spent interacting with the intervention, because Active-online may have been opened in the background while the user was browsing other websites opened simultaneously. On the other hand, Active-online users could print their feedback reports and read them offline. If study participants revisited Active-online without using their password, the estimated number of visits presented here may be conservative. Last, due to a technical problem, the reminder emails to revisit Active-online were not sent out according to the original schedule for registered users of Active-online at 2, 4, and 7 months.

Conclusions

The present study showed limited effectiveness of Active-online in a randomised sample of volunteers from the general adult population when offered as a stand-alone intervention delivered online under real-life conditions. Further research may investigate the potential of Web-based physical activity interventions integrated in a wider context, for example, primary care or workplace health promotion.

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6 Comparison of Trial Participants and Open Access Users of a Web-Based Physical Activity Intervention regarding Adherence, Attrition, and Predictors of Repeated Participation

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Abstract

Background: Web-based interventions are popular for promoting healthy lifestyles such as physical activity. However, little is known about user characteristics, adherence, attrition, and predictors of repeated participation on open access physical activity websites.

Objective: The focus of this study was Active-online, a Web-based individually tailored physical activity intervention. The aims were (1) to assess and compare user characteristics and adherence to the website (a) in the open access context over time from 2003 to 2009, and (b) between trial participants and open access users; and (2) to analyse attrition and predictors of repeated use among participants in a randomised controlled trial compared with registered open access users.

Methods: Data routinely recorded in the Active-online user database were used. Adherence was defined as: the number of pages viewed, the proportion of visits during which a tailored module was begun, the proportion of visits during which tailored feedback was received, and the time spent in the tailored modules. Adherence was analysed according to six one-year periods (2003-2009) and according to the context (trial or open access) based on first visits and longest visits. Attrition and predictors of repeated participation were compared between trial participants and open access users.

Results: The number of recorded visits per year on Active-online decreased from 42 626 in 2003-2004 to 8343 in 2008-2009 (each of six one-year time periods ran from April 23 to April 22 of the following year). The mean age of users was between 38.4 and 43.1 years in all time periods and both contexts. The proportion of women increased from 49.5% in 2003-2004 to 61.3% in 2008-2009 ($P < .001$). There were differences but no consistent time trends in adherence to Active-online. The mean age of trial participants was 43.1 years, and 74.9% were women. Comparing contexts, adherence was highest for registered open access users. For open access users, adherence was similar during the first and the longest visits; for trial participants, adherence was lower during the first visits and higher during the longest visits. Of registered open access users and trial participants, 25.8% and 67.3% respectively visited Active-online repeatedly ($P < .001$). Predictors of repeated use were male sex (odds ratio [OR] = 1.2, 95% confidence interval [CI] = 1.04-1.38) and increasing age category in registered open access users, and age 46-60 versus < 30 years (OR = 3.04, 95% CI = 1.25-7.38) and Swiss nationality ($OR_{nonSwiss}$ = 0.64, 95% CI = 0.41-1.00) in trial participants. Despite reminder emails, attrition was much higher in registered open access users compared with trial participants, with a median lifetime website usage of 0 days in open access users and 290 days in trial participants.

Conclusions: Adherence, patterns of use, attrition, and repeated participation differed between trial participants and open access users. Reminder emails to encourage repeated participation were effective for trial participants but not for registered open access users. These issues are important when interpreting results of randomised controlled effectiveness trials.

6.1 Introduction

In recent years, Web-based interventions targeting different health issues such as nutrition [69], smoking [68], physical activity [70, 71] or multiple health behaviours [72] have become popular. These interventions have several advantages, such as interactive designs, the possibility of tailoring information to individual users, the potential to reach large audiences at relatively low costs, and the ease with which users can get involved, that is, people can use the intervention at home.

To maximise effectiveness, it is important for developers of such interventions to know more about user characteristics, adherence (the extent to which individuals use the content of the Internet intervention) [170]), nonusage attrition (whether individuals discontinue use of an Internet intervention) [168]), and predictors of repeated Internet intervention use. Studies reporting these issues have done so mostly in the context of randomised controlled trials (RCT) [130, 134, 153, 159, 171, 172] or in other controlled study settings [163]. However, the use of the intervention in a trial context may not reflect the use of the intervention in an open access context. This is an important issue, as programme effectiveness is likely to depend on adherence to and use of websites. If adherence is higher among trial participants (eg, due to higher motivation among trial participants and the efforts of the study staff to increase adherence), effectiveness may be overestimated; if adherence is lower among trial participants (eg, due to a higher burden of additional data assessments), effectiveness may be underestimated.

Few studies have described use and users of open access websites in the domain of smoking [135, 173], mental health [174, 175], and drinking [176]. Even fewer studies have done so in the domain of physical activity. To our knowledge, there is only one study that has described rates and determinants of repeated participation in an open access Web-based programme aimed at healthy lifestyles that has emphasised healthy body weight and physical activity [177].

In Switzerland, a Web-based tailored physical activity intervention (Active-online) [178] developed between 1999 and 2003, has been freely available as an open access programme since 2003. Continuous data collection pertaining to website visitors provides an opportunity to analyse user characteristics and patterns of intervention use and adherence over time. The effectiveness of the intervention was assessed in a Web-based RCT in 2006-2007 [179] after the study design had been tested in a feasibility study in 2003 [79].

The aims of the present study were: (1) to assess and compare user characteristics and adherence to the website (a) in an open access context over time from 2003 to 2009, and (b) between participants in an RCT and open access users (all open access users and the subgroup of registered open access users only), and (2) to

analyse attrition and potential predictors of repeated use of the website in trial participants compared with registered open access users.

6.2 Methods

Intervention Programme

Active-online is an individually tailored programme to promote physical activity targeting adults aged 30 to 60 years. Active-online is freely available on the Internet in the three main languages of Switzerland: German, French, and Italian. At the start of the programme, users find a language selection page followed by a welcoming page that explains the programme and provides additional information and motivational material (see Figure 6.1 and Figure 6.2). At the beginning of the tailored intervention, a new window opens where two modules are offered: one module on everyday health-enhancing physical activity (HEPA) and endurance training (the HEPA module), and one module on strength and flexibility training (the strength module) (Figure 6.2). Visits are recorded in the database as soon as a new window is opened (after the welcoming page) where one of the two tailored modules can be selected.

Users may visit Active-online without registering, or they may register. Registration is very brief and involves leaving an email address. Registered users receive a password which allows them to revisit the website and follow changes in their physical activity behaviour. Registered users receive reminder emails that contain a link to revisit the website after 2, 4, and 7 months.

Figure 6.1 Screenshot of the welcoming page of Active-online

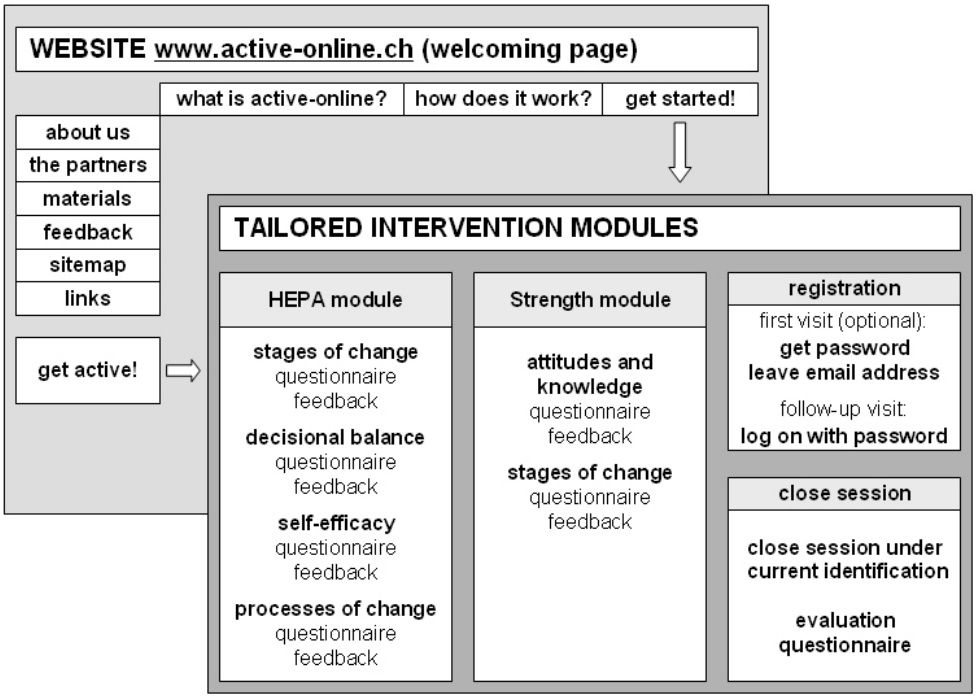

Figure 6.2 Structure of Active-online and the tailored intervention modules

The HEPA module offers a maximum of four individually tailored feedbacks based on the transtheoretical model of behaviour change [80]. Stages of change are assessed according to a seven-stage concept focusing on current behaviour (moderate- and vigorous-intensity activities) as well as on intention to change [81]. The module on strength and flexibility training offers a maximum of two tailored feedbacks. Questionnaires preceding each feedback include between 5 and 23 questions and can be completed in a few minutes each. It is unlikely that visitors complete all parts of both tailored modules during one visit, thus repeated visits are encouraged (with reminder emails to registered users). Moreover, repeated visitors who answer the questions obtain individually tailored feedback on changes since their last visit.

Randomised Controlled Effectiveness Trial

This RCT is described in detail elsewhere [179]. Briefly, participants were recruited in 2006 by advertisements in magazines, newspapers, and on websites. The advertisements asked for volunteers to participate in a Web-based physical activity study. After completing an online baseline questionnaire with items on demographics, general health, and physical activity behaviour, participants assigned to the intervention group were forwarded to the open access programme, Active-online, and directed to use the intervention. (Participants assigned to the control group were forwarded to a simple nontailored website that contained general information on physical activity and health.) To replicate the conditions of open access use, participants assigned to the intervention group had access to the general instructions on the website; they did not receive additional instructions in how to use the intervention. All contacts were by email. Trial participants received reminder emails to revisit the Active-online website at 9, 10, and 11 months after baseline. (Participants assigned to the control group received no

reminder emails.) Follow-up assessments as part of the requirements of the RCT took place at 6 weeks, 6 months, and 13 months. While registration on Active-online was not compulsory for open access users, trial participants were automatically registered in order to analyse their intervention use.

Time Periods of Intervention Use, Data Collection, and Variables Included in the Analyses

In April 2003, Active-online was officially launched with a promotional event. Data from the open access period were included for six one-year time periods through April 2009. Each one-year time period started on April 23 and ended on April 22 of the following year. Data from the effectiveness trial were included from May 1, 2006, through September 30, 2007.

The total number of visits on Active-online (including visits on the welcoming page) was available from the Internet provider. However, the absolute numbers were difficult to interpret because these depended on the software used to assess them and whether visits by web crawlers could be identified, for example. For both open access users and trial participants, visits on Active-online were captured in the Active-online user database as soon as the new browser window for the selection of one of the two tailored modules was opened (see Figure 6.2), whereas visits that did not go beyond the welcoming page were not recorded.

For each visit that was captured in the Active-online user database, starting time and date, finishing time and date, number of pages viewed, and time spent within the tailored modules were recorded in addition to responses to the questionnaires preceding each tailored feedback.

During the study period, between April 23, 2003, and April 22, 2009, more than 250 000 visits were counted on Active-online (including visits not going beyond the welcoming page and excluding visits by web crawlers). For the present study, only those visits that went beyond the welcoming page and were recorded in the Active-online user database during the study period were included. These numbered 113 290. Figure 6.3 shows the inclusion and exclusion of visits that served as the basis for the analyses in this study. We excluded 219 visits that were obvious test visits of the research group and another 64 visits because the start times and end times did not correspond. Furthermore, 232 visits were excluded because they exceeded 60 minutes as we assumed these visits were not properly terminated. Users who received all tailored feedbacks, read them online, and used the option to download further materials could easily have spent half an hour or more on Active-online. The rationale to use a cutoff of 60 minutes was to allow for potential distractions during a visit and to make sure that no serious visits were excluded. Another 13 visits were excluded due to other recording problems, and 1917 records were deleted because they represented double visits of the same session. Finally, 69 records of individuals who had participated in the feasibility study [79] were dropped. Thus, 110 776 visits were included, of which 107 208 (96.8%) were recorded as first visits.

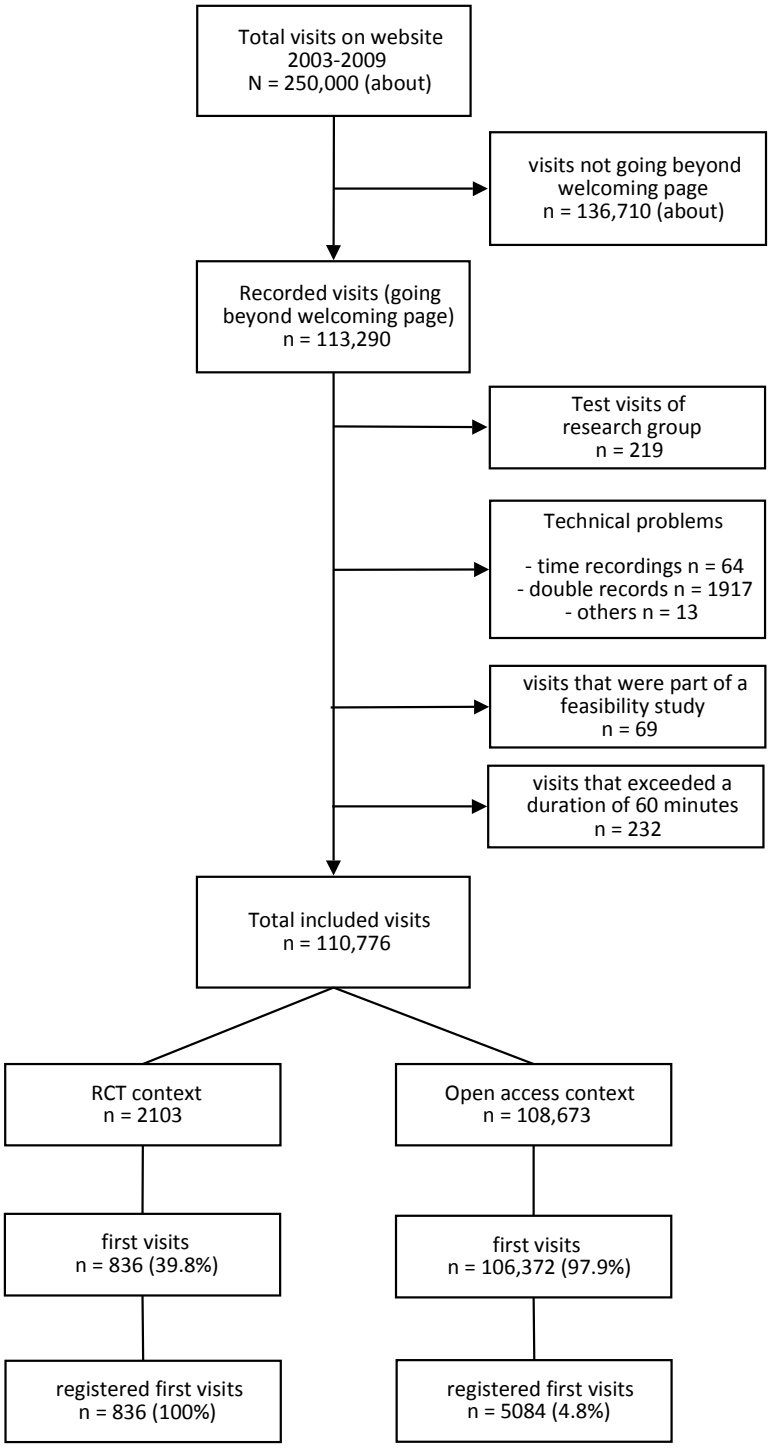

Figure 6.3 Inclusion and exclusion of records used in the analyses

Of the 110 776 visits, 108 673 were recorded in the open access context and 2103 during the RCT. For the analysis of time trends, open access visits were stratified according to the six one-year periods between 2003 and 2009. The number of recorded and first visits and the proportion of first visits resulting in registration are displayed in Table 6.1 for each time period and for the RCT. Of all open access visits, 2.1% were recorded as repeated visits. The corresponding proportion was 60.2% during the RCT.

Table 6.1 Recorded website visits in the open access context (according to the six time periods from 2003-2009) and during the RCT

	Visits recorded in database	First visits (% of recorded visits)	First visits resulting in registration (% of first visits)
Open access programme use Time period (23 April - 22 April)			
2003 - 2004	42 626	41 699 (97.8%)	2263 (5.4%)
2004 - 2005	25 392	25 026 (98.6%)	784 (3.1%)
2005 - 2006	12 776	12 517 (98.0%)	592 (4.7%)
2006 - 2007	9847	9539 (96.9%)	610 (6.4%)
2007 - 2008	9689	9451 (97.5%)	513 (5.4%)
2008 - 2009	8343	8140 (97.6%)	322 (4.0%)
Total (2003 - 2009)	**108 673**	**106 372 (97.9%)**	**5084 (4.8%)**
RCT [a] (May 1, 2006 to September 30, 2007)	**2103**	**836 (39.8%)**	**836 (100%)**

[a] Trial participants were automatically registered within Active-online.

The proportion of women among Active-online users and the mean age of visitors were included in the analyses as demographic variables. The main measure of physical activity was the proportion meeting the current Swiss recommendations for health-enhancing physical activity (HEPA): 30 minutes or more of moderate intensity activities on 5 or more days per week or 20 minutes or more of vigorous intensity activities on 3 or more days per week [30]. Additional potential predictors of repeated participation were available for trial participants only. These were smoking, BMI, education, and nationality. For the comparison of repeated participation between open access users and trial participants, only registered open access users were included (n = 5084, 4.8% of all open access users) because repeated visits could only be tracked for participants who had registered.

Adherence, defined as the extent to which individuals experienced the content of the website [170], is reported as the number of pages viewed on Active-online, the proportion of visits that resulted in starting a tailored module, the proportion of visits when at least 3 minutes were spent in a tailored module (assuming that a minimum of 3 minutes is required to get involved with the intervention), the proportion of visits when at least one tailored feedback (HEPA or strength module, see Figure 6.2) was received, and the time spent in the tailored modules. These measures of adherence are commonly used to describe the extent to which individuals use the material on Web interventions [170, 172]. Analysis of adherence was based on first visit to compare open access dissemination of the intervention across time periods, and on first visit and longest visit to compare adherence of open access users with adherence of trial participants. During open access dissemination, most visits were first visits so that analysing by longest visit yielded almost identical results.

Attrition describes the phenomenon that participants stop using the intervention [168]. Nonusage attrition refers to participants not returning to the intervention for repeated visits [168]. We also report attrition in terms of the duration of a single visit. In this sense, attrition refers to users who discontinue their visit at a specific point in time versus those who continue their visit beyond that point.

Comparisons are reported between trial participants (all of whom were registered, according to the study design), open access users (including both registered and unregistered open access users), and the subgroup of open access users who had registered and received a password to revisit Active-online.

Statistical Analyses

Demographic variables were compared between open access users and trial participants using t-tests and chi-square tests. Continuous variables measuring the use of Active-online (number of pages viewed and time spent in the tailored modules) were positively skewed. For these variables, therefore, the median and the interquartile range (IQR) are reported. The Wilcoxon-Mann-Whitney test and the chi-square test were used to compare use of Active-online between trial participants and open access users. Assuming that differences between time periods followed a time trend rather than a random pattern, a nonparametric test for trend across ordered groups developed by Cuzick [180] was performed for continuous variables, and a chi-square test for trend was performed for categorical variables to assess potential time trends across the six time periods. Logistic regression was used to assess potential predictors of repeated use of the website.

Nonusage attrition curves were based on the proportion of visitors still using the website up to a specific number of weeks or months after the first visit versus those who had stopped using it. The date of each user's last visit was designated as the date when programme usage ended. The nonusage attrition curves are presented over 18 months (considered a suitable timeframe for trial participation) and over 12 weeks (for comparison with other published attrition curves). Similarly, attrition curves based on the duration of single visits (first visits and longest visits) are presented, which correspond to the proportion of visitors who had continued to use the intervention within a single session versus those who had ended the session after a specific number of minutes. Duration was defined as the time spent in the tailored modules as recorded in the user database; therefore, individuals that did not enter a tailored module have been assigned a duration of zero. STATA 9.2 (STATACorp LP, College Station, TX, USA) was used for the analyses.

6.3 Results

User Characteristics

The yearly number of open access visits recorded in the Active-online database decreased from 42 626 in 2003-2004 to 8343 in 2008-2009. In the open access context, the proportion of women using Active-online increased from 49.5% in 2003-2004 to 61.3% in 2008-2009 (*P* [for trend] < .001). The mean age of open access users was between 38.4 years (95% confidence interval [CI] 38.0-38.8) in 2008-2009 and 40.4 years (95% CI 40.1-40.7) in 2005-2006 and 2006-2007. The proportion of open access users meeting the HEPA recommendations was between 39.9% in 2004-2005 and 42.6% in 2005-2006 (*P* [for trend] = .015).

Among open access Active-online users, 55.1% were women, while 74.9% of trial participants were women (*P* < .001). The mean age of open access users was 39.1 years (95% CI 39.0-39.2) compared with a mean age of trial participants of 43.1 years (95% CI 42.2-44.0) (*P* < .001). The proportion of individuals meeting the current Swiss HEPA recommendations did not differ significantly between open access users (40.9%) and trial participants (44.5%, *P* = .27).

Adherence to and Use of the Intervention

There were differences, but no consistent trends over time, in adherence to Active-online among open access users (based on the analysis of first visits). In general, use of the intervention among open access users was higher in 2003-2004, 2005-2006, and in 2006-2007, but lower in 2004-2005 and after 2007 (Table 6.2). Between 2003 and 2009, open access users who started a tailored module spent an average of 7.5 minutes in the programme, with a median duration of 4.2 minutes. The subgroup of registered open access users who started a tailored module spent an average of 17.7 minutes in the programme, with a median duration of 15.0 minutes.

For first visits, adherence to Active-online was highest for registered open access users (Table 6.2). Compared with all open access users, adherence was lower among trial participants. Trial participants visited fewer pages, and the proportion that started a tailored module, that spent at least 3 minutes in the modules, and that received at least one tailored feedback (HEPA or strength module) was smaller. However, trial participants who started a module tended to stay in the intervention longer.

Analysing adherence according to longest visit, we found that results remained very similar to the results for first visit among open access users, indicating that the first and longest visit were identical among these users. This was not true for trial participants, however. As was the case for first visits, registered open access users achieved the highest adherence when results were based on longest visit. Trial participants' adherence was considerably higher during the longest visit than during the first visit (indicating that the first visit was not the longest visit) and was higher compared with all open access users.

Table 6.2 Adherence at first visit according to time periods during open access use 2003-2009, and at first and longest visit according to open access context and randomised controlled trial

		Median (IQR) number of pages viewed per visit	Number of visits (%) when a tailored module was started	Number of visits (%) when at least 3 min were spent in the tailored modules	Number of visits (%) when at least one tailored feedback was obtained	Median (IQR) minutes spent in tailored module per visit (when a module was started)	Median (IQR) minutes spent in tailored modules per visit (when at least 3 min spent in modules)
Comparison of time periods[a] during open access use (based on first visits) [a]							
first visits	2003-2004	16 (9-28)	29 967 (71.9%)	19 349 (46.4%)	24 973 (59.9%)	4.2 (1.8-11.4)	8.4 (4.8-15.6)
	2004-2005	11 (4-21)	16 465 (65.8%)	9341 (37.3%)	13 132 (52.5%)	3.6 (1.2-8.4)	7.2 (4.2-13.8)
	2005-2006	19 (11-31)	8851 (70.7%)	5593 (44.7%)	7277 (58.1%)	4.2 (1.8-11.4)	9.0 (4.8-15.6)
	2006-2007	21 (13-32)	6661 (69.8%)	4154 (43.5%)	5716 (59.9%)	4.2 (1.8-10.8)	8.4 (4.8-15.6)
	2007-2008	19 (11-30)	6015 (63.6%)	3728 (39.4%)	5152 (54.5%)	4.2 (1.8-10.2)	8.4 (4.8-14.4)
	2008-2009	16 (11-25)	4818 (59.2%)	2639 (32.4%)	4090 (50.3%)	3.0 (1.2-7.8)	6.6 (4.2-11.4)
	P Value [b]	< .001	< .001	< .001	< .001	< .001	< .001
Comparison of open access users and RCT participants (based on first visits)							
first visits	Open access: all users	16 (9-27)	72 777 (68.4%)	44 804 (42.1%)	60 340 (56.7%)	4.2 (1.8-10.2)	8.4 (4.8-15)
	Open access: registered users only	42 (30-57)	4892 (96.2%)	4643 (91.3%)	4629 (91.1%)	15.0 (8.4-24.0)	15.6 (9.6-24.6)
	RCT	7 (2-21)	322 (38.5%)	265 (31.7%)	250 (29.9%)	9.0 (3.6-15.6)	10.8 (6.0-16.2)
	P Value [c]	< .001	< .001	< .001	< .001	< .001	< .001
Comparison of open access users and RCT participants (based on longest visits)							
longest visits	Open access: all users	16 (9-27)	72 943 (68.5%)	44 985 (42.2%)	60 531 (56.8%)	4.2 (1.8-10.2)	8.4 (4.8-15.0)
	Open access: registered users only	43 (31-57)	5021 (96.5%)	4789 (92.0%)	4779 (91.8%)	15.6 (9.0-24.6)	16.2 (10.2-25.2)
	RCT	23 (8-38)	626 (74.4%)	554 (65.8%)	549 (65.2%)	12.0 (5.4-18.6)	13.2 (7.8-20.4)
	P Value [c]	< .001	< .001	< .001	< .001	< .001	< .001

[a] Each one-year time period started on April 23 and ended on April 22.

[b] *P* Values are based on chi-square test for trend (categorical variables over time) and test for trend developed by Cuzick (continuous variables over time).

[c] *P* Values for both the comparison between open access users (all) and trial participants, as well as between registered open access users and trial participants. *P* Values are based on chi-square tests (comparisons between open access users and trial participants for categorical variables) and Wilcoxon-Mann-Whitney test (comparisons between open access users and trial participants for continuous variables).

Attrition

Figure 6.4 and Figure 6.5 show nonusage attrition curves for open access users (all open access users and subgroup of registered open access users only) and for trial participants over 18 months and over 12 weeks (for comparison with other published attrition curves, see [163, 168]). The median lifetime website usage (time when 50% of users had stopped using the intervention) [172] was 0 days for open access users (all open access users and subgroup of registered open access users only) and 290 days for trial participants. In trial participants, the first two reminder emails after 9 and 10 months resulted in a relatively high proportion of individuals returning to Active-online by clicking on the link in the reminder email; however, fewer individuals returned after the third reminder. Reminder emails sent to registered open access users did not show the same effect: fewer than 6% were still using the website after the first reminder was sent out at two months.

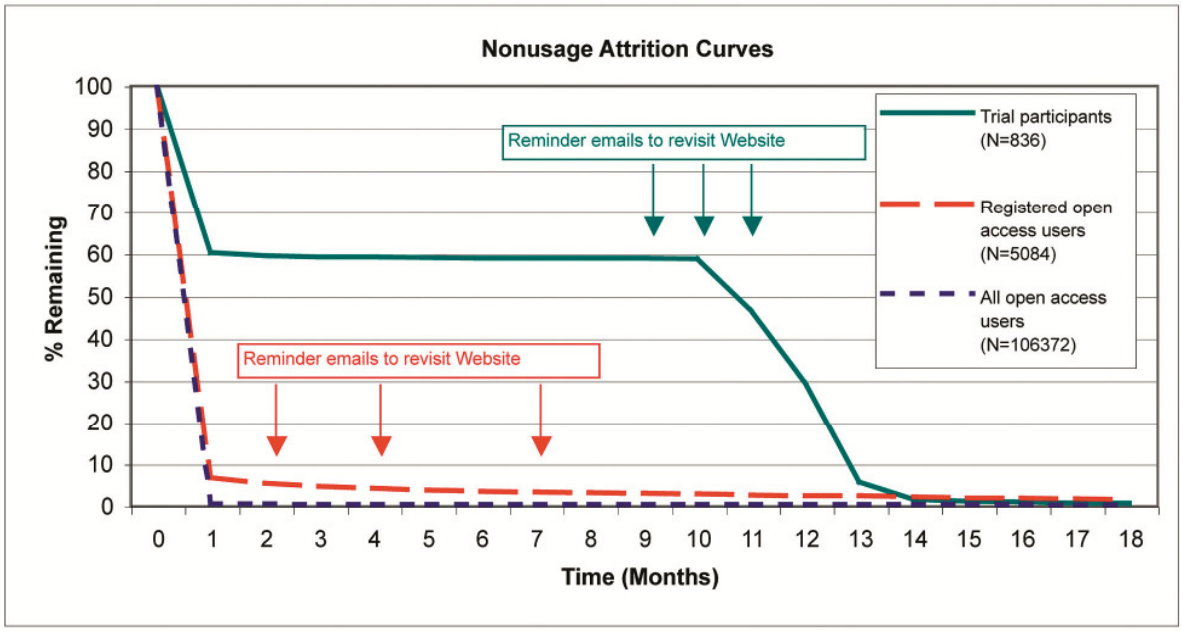

Figure 6.4 Nonusage attrition curves for open access users and trial participants over 18 months

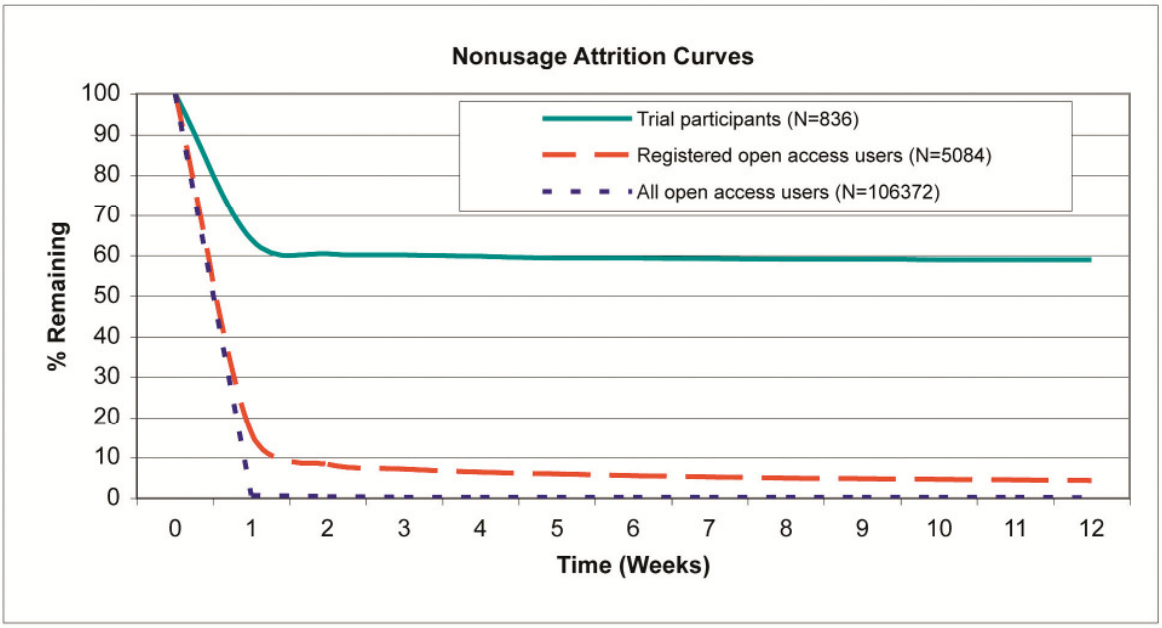

Figure 6.5 Nonusage attrition curves for open access users and trial participants over 12 weeks

Figure 6.6 and Figure 6.7 present attrition curves for the time spent in the tailored modules during the first visit and during the longest visit, respectively, for open access users (all open access users and subgroup of registered open access users only) and for trial participants. Registered open access users spent more time in the tailored modules both during their first visit and during their longest visit compared with all open access users and compared with trial participants. The majority of trial participants did not spend much time in the tailored modules during their first visit (Figure 6.6); however, the proportion spending more time in the tailored intervention

was much higher for longest visits (Figure 6.7). In contrast, the curves are very similar for first and longest visits of open access users (all open access users and subgroup of registered open access users only), indicating that first and longest visits were identical.

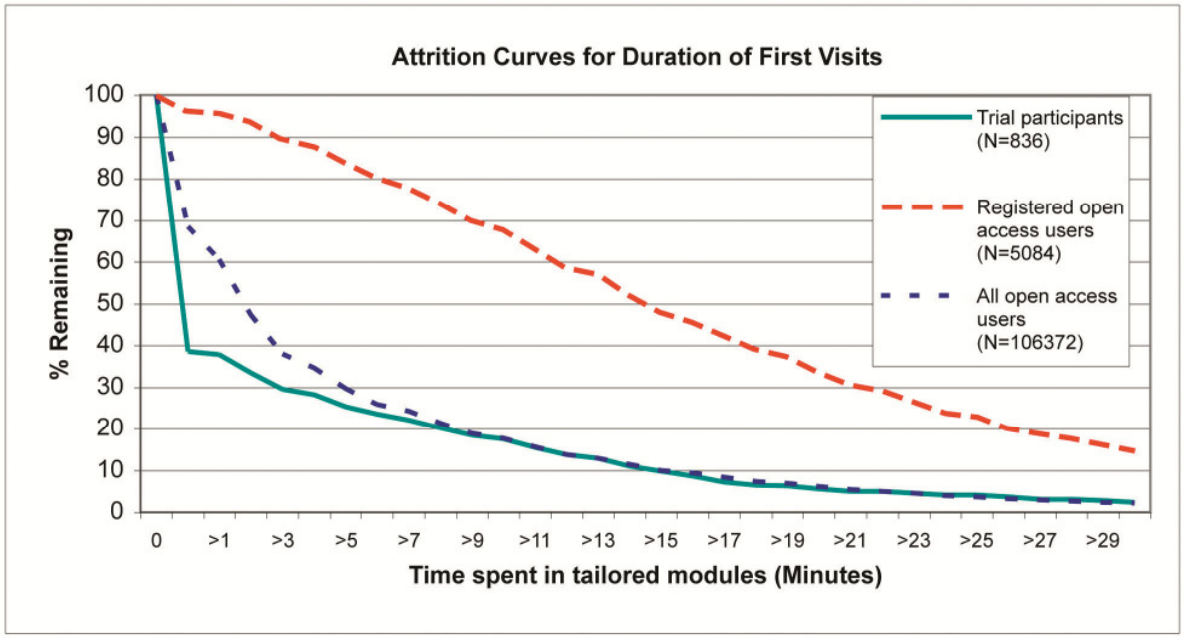

Figure 6.6 Attrition curves for the duration of the first visit for open access users and trial participants

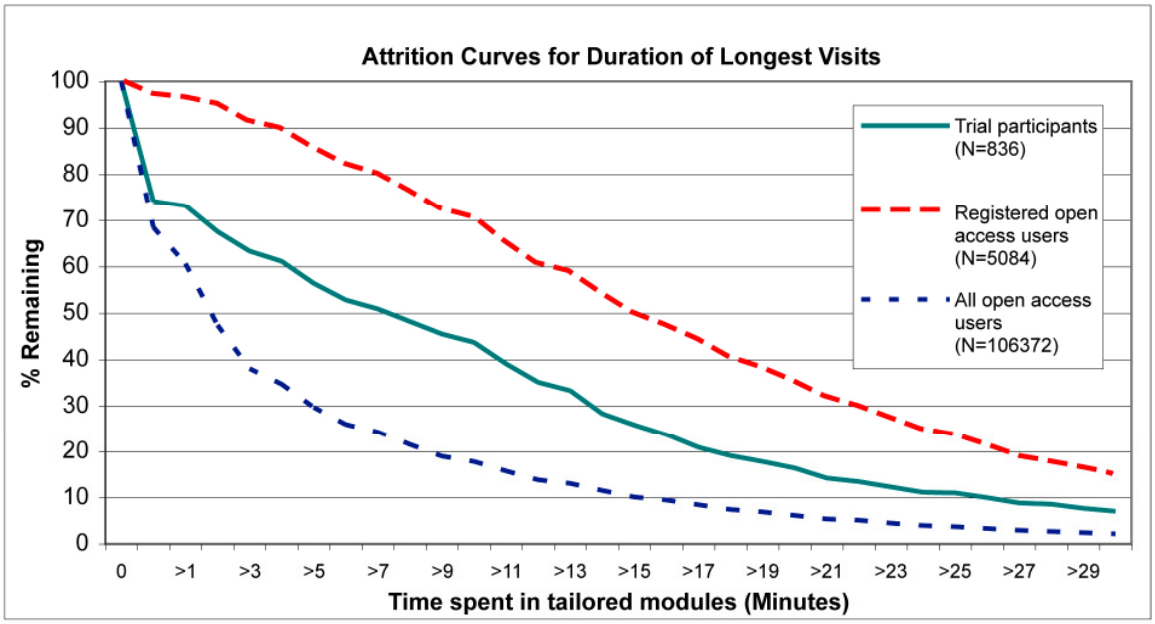

Figure 6.7 Attrition curves for the duration of the longest visit for open access users and trial participants

Predictors of Repeated Participation

In total, 1312 (25.8%) of open access users who registered and received a password and 558 (67.3%) of the trial participants returned for a repeated visit ($P < .001$). Table 6.3 displays potential predictors of repeated participation for registered open access users and for trial participants. Men and older individuals were significantly more likely to visit Active-online repeatedly in the open access context. Among trial participants, only the age group of 46-60 years (compared with < 30 years) was a significant predictor in the adjusted model, while gender did not predict repeated participation. Meeting the HEPA recommendations was not associated with repeated participation in registered open access users. In trial participants, however, there was a nonsignificant tendency for individuals not meeting the HEPA recommendations not to have returned for a repeated visit. Not having Swiss nationality achieved borderline significance as a predictor of lower rates of repeated participation in trial participants. Furthermore, there was a tendency for more highly educated individuals to have returned for a repeated visit; however these associations were not significant. There were no effects for smoking and BMI.

6.4 Discussion

Principle Results and Comparison with Prior Work

The present study aimed to assess user characteristics, adherence, attrition, and predictors of repeated use in trial participants and open access users of a Web-based physical activity intervention. The most important findings were differences in adherence, attrition, and repeated participation between trial participants and open access users. Furthermore, reminder emails had a differential effect on attrition in trial participants and open access users. Assessing the data over time, there was an increase in the proportion of women using Active-online but no consistent trends in terms of adherence.

The yearly number of recorded visits on Active-online decreased from over 40 000 in 2003-2004 to less than 9000 in 2008-2009. The most likely reason for this decrease was a decline in promotional efforts because there has been no active promotion of the website since 2008. Despite the decrease in the absolute number of visits, it is encouraging that even without active promotional strategies, Active-online still yielded around 23 visits per day in 2008-2009. Furthermore, no consistent time trends in adherence and patterns of individual intervention use were observed in open access users between 2003 and 2009.

Different reasons may be responsible for the increase in the proportion of women using Active-online between 2003 and 2009. For one thing, the proportion of women using the Internet has increased steadily in Switzerland from 23% in 1997 to 44% in 2006 [181]. Moreover, women are generally more interested in health information and use a wider spectrum of information sources [182]. Specifically, "online" women are more likely to use the Internet to look for health information than "online" men [183, 184].

Table 6.3 Predictors of repeated participation for registered open access users and for trial participants

	Registered open access users (2003-2009)				Trial participants			
	N	% repeated visits	unadjusted OR (95% CI)	adjusted OR (95% CI) [a]	N	% repeated visits	unadjusted OR (95% CI)	adjusted OR (95% CI) [a]
Gender								
Female	2886	24.1	1.00	1.00	626	66.3	1.00	1.00
Male	2197	28.0	**1.23** (1.08-1.39)	**1.20** (1.04-1.38)	210	70.5	1.21 (0.86-1.70)	0.79 (0.39-1.62)
Age category (years)								
<30	1270	20.5	1.00	1.00	151	53.6	1.00	1.00
30-45	2111	25.9	**1.36** (1.15-1.60)	**1.37** (1.13-1.64)	324	65.7	**1.66** (1.12-2.46)	1.61 (0.71-3.66)
46-60	1370	28.2	**1.52** (1.27-1.82)	**1.48** (1.21-1.81)	269	75.1	**2.61** (1.71-3.98)	**3.04** (1.25-7.38)
>60	332	35.8	**2.17** (1.67-2.82)	**2.26** (1.68-3.04)	92	72.8	**2.32** (1.32-4.05)	1.72 (0.57-5.20)
Met HEPA recommendations								
yes	1587	24.4	1.00	1.00	347	70.3	1.00	1.00
no	2697	25.8	1.07 (0.93-1.24)	1.11 (0.96-1.29)	489	65.2	0.79 (0.59-1.07)	0.76 (0.56-1.03)
Smoking	not available							
yes					125	64.8	1.00	1.00
no					711	67.8	1.14 (0.77-1.70)	1.03 (0.69-1.56)
BMI	not available							
<=25					501	67.5	1.00	1.00
25-30					227	68.7	1.06 (0.76-1.48)	0.93 (0.65-1.32)
>30					106	64.2	0.86 (0.56-1.34)	0.79 (0.50-1.25)
Education	not available							
compulsory school					29	51.7	1.00	1.00
Apprenticeship					289	67.8	1.97 (0.91-4.24)	1.73 (0.78-3.81)
High school					124	63.7	1.64 (0.73-3.70)	1.82 (0.79-4.19)
higher professional education, upper vocational school					189	70.9	**2.27** (1.03-5.03)	1.95 (0.86-4.41)
University					205	67.8	1.97 (0.90-4.31)	1.74 (0.78-3.91)
Nationality	not available							
Swiss					737	68.4	1.00	1.00
non Swiss					99	59.6	0.68 (0.44-1.05)	**0.64** (0.41-1.00)

[a] Adjusted for sex, age category, and whether HEPA recommendations were met. Additional adjustment for the other potential predictors in the model (RCT only) did not change the results.

Trial participants differed in several ways from open access users. Adherence of trial participants during the first visit was generally lower. Only the small proportion that became involved with the intervention spent as much or more time in the tailored modules compared with open access users. The additional baseline data assessment in the trial context is a likely reason for the low use during the first visit in trial participants. However, comparing trial participants and participants of the feasibility study [79], in the latter group adherence was higher and more

similar to the patterns observed in open access users (data not shown). Therefore, adherence may vary in different controlled study settings.

Trial participants were significantly more likely to visit the website repeatedly compared with open access users. Furthermore, when analysing longest visits (Table 6.2), we found that adherence was similar or higher in trial participants compared with all open access users. However, registered open access users still showed higher adherence during their longest visit. In a study comparing public registrants of a cognitive behaviour therapy website with trial participants, the latter were more likely to adhere to the full treatment programme [174, 185]. In that study, trial participants were contacted weekly by phone, suggesting that the formal structure of the trial and the personal contacts may have increased compliance in trial participants compared with public registrants [174, 185].

In the open access context, registration did not achieve high levels of repeated participation (Figure 6.4 and Figure 6.5). This indicates that reminder emails (with the same content) may not have the same effect in different contexts. Having agreed to participate in a study, trial participants may have felt more committed to react to reminder emails. We did find, however, that adherence during the first visit was significantly higher among registered open access users compared with unregistered users (Table 6.2). For example, there was a large difference in visit duration between registered open access users and all open access users. The differences in adherence were supported by the attrition curves for the duration of the first and longest visits (Figure 6.6 and Figure 6.7). The registration process itself is very brief and cannot explain the large difference in visit duration. Therefore, registered open access users seem to have been more motivated to use the intervention thoroughly compared with unregistered users.

Open access users and trial participants who started a tailored module spent an average of 7.5 and 9.2 minutes in the modules, respectively. Other studies have found similar visit durations, for example, an average of 9 minutes was found among participants of a randomised study regarding another physical activity website [134], an average of 7.1 minutes per visit was found on a tailored physical activity Internet intervention in a randomised study setting [159], and an average of 7 minutes was found for visitors of a smoking cessation website [122].

Only about 2% of the open access visits on Active-online between 2003 and 2009 were repeated visits (Table 6.1). A Web-based behaviour change programme for healthy body weight and healthy lifestyle, in which an email reminder strategy similar to ours was used, resulted in about 10% of users visiting the website more than once [177]. However, registration was compulsory for users, making it easier for the study investigators to detect repeated visits and possibly resulting in selection by more motivated users. Two smoking cessation websites yielded almost 20% [135] and 27% [173] of registered visitors returning to the website, respectively. When considering only registered users in our study, one quarter of the registered open access users and two thirds of the trial participants visited the intervention more than once.

In a previous study, the main predictors of repeated participation in a behaviour change programme for healthy body weight were older age, never having smoked, meeting the guidelines for moderate physical activity and vegetable consumption, and being obese [177]. In our study, older age was confirmed as a predictor of repeated

participation, but smoking, BMI, and meeting HEPA recommendations were not. We did not obtain information about vegetable consumption. The only other significant predictors documented in our study were male sex among open access users (which was not significant in trial participants) and Swiss nationality, which achieved borderline significance in trial participants only. There was a tendency for more highly educated trial participants to have been more likely to return, an effect that was also reported for an online smoking cessation programme [135]. In another study, repeated use of an interactive coaching programme for smoking cessation was predicted by female sex and older age, among other smoking-related variables [173].

Nonusage attrition was much higher for open access users (all open access users as well as the subgroup of registered open access users only) than for trial participants. Similar, although less pronounced, results have been reported for spontaneous users of a cognitive behaviour therapy website compared with participants in an RCT through the same website [174]. Attrition curves of open access visitors to other websites in the domains of cognitive behaviour therapy [175] and the promotion of sensible drinking [176] were also comparable (see Ware et al [163], Figure 2, which shows different published attrition curves).

Limitations

The open structure of Active-online has advantages regarding dissemination and use of the intervention in that visitors are free to switch between modules, to open several windows concurrently, and to use the tailored intervention without registering. Thus, more individuals may be willing to participate in the intervention. However, this open structure also has some limitations. For example, a repeated visit of an unregistered user is recorded as a new first visit. Furthermore, an individual may open more than one tailored intervention browser window resulting in multiple new visits being recorded in the database. Individuals are also free to stop the intervention at any point, which can produce large amounts of missing data if the intervention is terminated before all questionnaires are completed. Nevertheless, our study results provide insight into an open access Web-based physical activity intervention delivered under real-world conditions and allow comparisons of use and users over time and in different contexts.

Another limitation is the lack of information on the socio-demographic background of open access users and additional potential predictors of repeated website usage. During the development of Active-online it was decided not to include questions ascertaining socio-demographic variables (with the exception of sex and age) at the start of the tailored intervention. There was a concern that this may discourage entering the intervention for individuals who may be unwilling to reveal personal information or to spend time completing questions not related to tailored feedback. Ideally, a newer version of Active-online may include a brief questionnaire with questions related to smoking, BMI, socio-economic status, education, and nationality, for example. Finally, we compared open access users visiting Active-online between 2003 and 2009 with trial participants visiting the website between 2006 and 2007. Thus, potential period effects may have influenced the differences observed in our analyses. However, Table 6.2 does not suggest specific time trends in adherence to the intervention; therefore, we think it was justifiable to use the full time range of data collected for open access users.

Conclusions

It is important to acknowledge that adherence, patterns of individual use, repeated participation, and attrition on a Web-based individually tailored physical activity intervention may differ between open access users and trial participants. Moreover, reminder emails to encourage repeated participation may not have the same effect in different contexts. These issues are important when interpreting and generalising results of randomised controlled effectiveness trials.

Acknowledgments

Active-online was developed at the Institute of Social and Preventive Medicine at the University of Zurich and was funded and supported by the Swiss Federal Office of Sport, Health Promotion Switzerland, Allez Hop, Suva, and Qualitop. The authors would like to thank Thomas Suter who programmed the website.

PART IV

PRAGMATIC EVALUATION APPROACHES IN PHYSICAL ACTIVITY PROMOTION: THE EXAMPLE OF ALLEZ HOP

7 Review of Evaluation Approaches during a Decade of Allez Hop

This chapter has been published as an invited article in a conference proceeding:

Wanner M, Martin-Diener E, Stamm H, Lamprecht M, Martin BW. 10 Jahre Allez Hop - Rückblick auf die selektiven Evaluationsansätze (10 years of Allez Hop - review of the selective evaluation approaches). In: Schriften der Deutschen Vereinigung für Sportwissenschaft Band 174: Sport und Gesundheit in der Lebensspanne. Knoll & Woll (Hrsg.), Jahrestagung der dvs-Kommission Gesundheit, 10.-11.04.2008. Bad Schönborn 2008: p 90-96.

7.1 Hintergrund

Das nationale Bewegungsförderungsprogramm Allez Hop wurde 1996 von drei Schweizer Krankenversicherungen zusammen mit dem Schweizerischen Olympischen Verband (SOV, heute Swiss Olympic) lanciert. Ziel war es, der zunehmenden Inaktivität in der Schweiz entgegen zu wirken. Kern der Kampagne sind Bewegungskurse die einmal wöchentlich von qualifizierten Allez Hop Leitenden angeboten werden. Die Kurse dauern ca. 10 Wochen und zielen darauf hin, dass die Teilnehmenden auch nach dem Kurs motiviert sind, sich weiterhin zu bewegen und allenfalls einem Sportverein anzuschließen. Die Kampagne startete in Zusammenarbeit mit Sportverbänden und deren angeschlossenen Vereinen. Während die Verbände vor allem für die Koordination und Organisation der Leiterausbildung und Kurse verantwortlich waren, wurden die Kurse formell von den Vereinen angeboten und durchgeführt. Dadurch sollte der erwünschte Transfer vom Allez Hop Kurs zum Vereinsmitglied erleichtert werden. Das Programmangebot umfasste anfänglich Gymnastik-, Walking- und Tenniskurse sowie Bewegungskurse im Wasser. Heute werden Kurse in Running, Walking, Nordic Walking, Wassergymnastik und Fitgym angeboten. Unterdessen werden die Kurse meist in eigener Verantwortung der Leitenden ohne Anbindung an einen Verein durchgeführt. Die Kurse sind kostengünstig und niederschwellig und erfordern keine besondere körperliche Fitness, sondern sind an inaktive und ungenügend aktive Erwachsene gerichtet. Mehr Informationen sind unter www.allez-hop.ch zu finden.

1999 stieg ein Krankenversicherer aus der Trägerschaft aus und Gesundheitsförderung Schweiz kam dazu, womit ein wichtiger nationaler Partner an Bord geholt wurde. Im Jahr 2001 zogen sich die zwei anderen Krankenversicherer zurück und Santésuisse übernahm als Dachverband aller Schweizer Krankenversicherer deren Platz in der Trägerschaft. Seit 2003 wird Allez Hop in einer öffentlich-privaten Trägerschaft vom Bundesamt für Sport (BASPO), Gesundheitsförderung Schweiz, Swiss Olympic und Santésuisse getragen. Mit diesem Trägerschaftswechsel wurde Allez Hop zudem offiziell von einer Projekt- in eine Geschäftstätigkeit überführt.

Die in jedem Jahr steigenden Kurskosten sowie Budgetkürzungen führten dazu, dass 2004 ein Franchising-System eingeführt wurde, wodurch das Programm an finanzieller Unabhängigkeit gewann. Gegen eine jährliche Gebühr können sich ausgebildete Allez Hop Leitende eine Lizenz kaufen. Dafür können sie unter dem Label Allez Hop eigenständig Kurse durchführen und erhalten eine Palette von Dienstleistungen der Geschäftsstelle.

Die Entwicklung von Allez Hop führte zu einer zunehmenden Institutionalisierung des Programms und dadurch zu einer Verankerung in der Gesellschaft. Bis 2003 stieg die jährlich durchgeführte Kurszahl bis auf über 2000 an.

Bis im Jahr 2006 wurden über 16 600 Kurse durchgeführt. Pro Jahr werden bis zu 20 000 Teilnehmende von Allez Hop bewegt. Allez Hop wurde von Privaten als Umsetzungs-, nicht als Forschungsprojekt initiiert, wobei kein umfassendes Evaluationskonzept Bestandteil war. Trotzdem wurden im Budget auch Finanzen für punktuelle Evaluationen aufgenommen.

7.2 Die verschiedenen Evaluationsphasen von Allez Hop

Drei größere Phasen bilden die Grundpfeiler der Evaluation von Allez Hop. Dazwischen wurden die Kurs- und Teilnehmerstatistiken sowie Hintergrunddaten analysiert. Im Jahr 2005 fand eine Evaluation des Ausbildungsbereichs statt. Seit 2006 steht eine teilautomatisierte internetbasierte Evaluationsplattform für eine persönliche Kursauswertung für die Kursleitenden sowie für ein Monitoring bereit. 2007 wurden die ausgebildeten Allez Hop Leitenden online befragt, um die Positionierung von Allez Hop im wachsenden Markt der Erwachsenensportangebote zu untersuchen. Im Folgenden werden die einzelnen Evaluationsphasen beschrieben.

Phase 1 (1997-1998) [9, 10]

Die erste Evaluationsphase dauerte von 1997 bis 1998 und nahm die Bevölkerung, die Kursteilnehmenden sowie die Verbände, Vereine und Leitenden unter die Lupe. Tabelle 7.1 stellt die verschiedenen Evaluationsschritte dieser Phase mit den Fragestellungen, Erhebungsmethoden und weiteren Datenquellen für die jeweilige Ebene dar. Wichtige Fragestellungen betrafen die Charakteristika der Teilnehmenden (im Vergleich zur Schweizer Bevölkerung) sowie die Erwartungen, Motivation, Kursbeurteilung und allfällige Verhaltensänderungen. Weiter sollten Kenntnisse über die teilnehmenden Verbände und Vereine, die Kursleitenden und deren Erfahrungen sowie die Kursaktivitäten der Leitenden gemacht werden.

Phase 2 (1998-1999) [9, 11]

Im Zentrum dieser zweiten Evaluationsphase stand sowohl die Fortführung der bestehenden Untersuchungsteile als auch eine Reihe neuer Fragen und Probleme. Als Schwerpunktthemen wurden das in der ersten Phase erkannte Problem der Mehrfachteilnahme sowie der fehlende Erfolg beim Transfer in die Vereine formuliert, weiter sollte die Aktivität der Leitenden in ihrer Tätigkeit sowie mögliche Probleme bei Organisation und Durchführung der Kurse beleuchtet werden. Kurs- und Teilnehmerstatistiken ermöglichten quantitative Einschätzungen über den Verlauf der Kampagne. Tabelle 7.2 zeigt die Fragestellungen und Erhebungsmethoden dieser Evaluationsphase auf.

Tabelle 7.1 Evaluationsschritte in der Phase 1: Ebene, Fragestellungen, Methoden und weitere Datenquellen

Ebene	Fragestellungen	Erhebungsmethoden	weitere Datenquellen
Bevölkerung	· Bewegungsverhalten · Stellenwert von Bewegung und Sport · Bestimmung der Zielgruppe für Allez Hop Kurse · Vergleich mit Kursteilnehmenden	· telefonische Befragung einer repräsentativen Stichprobe von Personen zwischen 18 und 74 Jahren in deutscher und französischer Schweiz im März 1997, N=625	· Schweiz. Gesundheitsbefragung 1992/93 · Befragung Sport - Bewegung - Gesundheit 1993 · Befragung zur Sportaktivität 1994
Kursteilnehmende	· Erreichen der Zielgruppe · Merkmale der Teilnehmenden · Erwartungen · Beurteilung · Verbesserungsmöglichkeiten · Verhaltensänderungen · Erfahrungen	· schriftlicher Fragebogen bei Kursbeginn, Sommer 1997, N=1738 · schriftlicher Fragebogen bei Kursabschluss, Herbst 1997, N=1607 · telefonische Nachbefragung, Januar 1998, N=369	
Verbände, Vereine, Kursleitende	· Rolle und Erfahrungen der Verbände · Zusammenarbeit zwischen Leitung der Allez Hop Kampagne, Verbänden, Vereinen und Kursleitenden · Merkmale der Leitenden · Merkmale der teilnehmenden Vereine (im Vergleich zum Schweizer Durchschnitt) · Erfahrungen der Leitenden · "inaktive" Leitende (ausgebildet, aber bieten keine Kurse an), mögliche Probleme in Ausbildung und Kursorganisation	· teilstrukturiertes Interview mit verantwortlichen Verbandsvertretern, Sommer 1997, N=5 · schriftliche Befragung der aktiven Leitenden, April 1997 bis Januar 1998, N=215 · telefonische Kurzbefragung von Leitenden, die 6 Monate nach Abschluss der Ausbildung noch keinen Kurs durchgeführt hatten, Dezember 1997, N=50	· repräsentative Untersuchung zur Situation der Sportvereine in der Schweiz, 1997

Kleine Standortbestimmung 2001-2002 [91]

Die Evaluationen der Phasen 1 und 2 lieferten wertvolle Hinweise zum Verlauf und Erfolg von Allez Hop sowie zu möglichen Verbesserungen. Optimierungen und Modifikationen wurden implementiert, das Kursangebot wurde überarbeitet, sogenannte Allez Hop Treffs wurden eingeführt als Folgeangebote für Allez Hop Kursteilnehmende zur Reduktion von Mehrfachteilnahmen, und Anstrengungen zur Verankerung von Allez Hop in der französischen und italienischen Schweiz wurden verstärkt. Systematische Evidenz, ob diese Maßnahmen gegriffen hatten, fehlten seit 1999, deshalb sollte im Sommer 2002 eine kleine Standortbestimmung durchgeführt werden, die Hinweise auf den Stand der Kampagne vermitteln und als Grundlage für die weitere Planung dienen sollte. Wegen knappen zeitlichen und finanziellen Ressourcen wurden keine umfangreichen neuen Datenerhebungen durchgeführt. Das Bewegungsverhalten der Schweizer Bevölkerung wurde aufgrund bestehender Daten analysiert. Kurs- und Teilnehmerstatistiken gaben Aufschluss über die Entwicklung der Kampagne in den verschiedenen Regionen. Die routinemäßig bei Kursabschluss ausgefüllten Fragebogen der Kursleitenden und Teilnehmenden gaben weiter Aufschluss über die Profile, das Bewegungsverhalten und die Kursbeurteilung.

Tabelle 7.2 Evaluationsschritte in der Phase 2: Ebene, Fragestellungen und Methoden

Ebene	Fragestellungen	Erhebungsmethoden
Kurse	· Entwicklung der Kurse · Entwicklung der einzelnen Kursdisziplinen · Entwicklung der Teilnehmerzahlen · regionale Verteilung der Kurse · saisonale Schwankungen	Kurs- und Teilnehmerstatistiken 1997-1999
Kursteilnehmende	· Weiterverfolgen der Fragestellungen aus der Phase1 · Mehrfachteilnahmen · Vereinsbeitritte und Anschlussangebote · Nachhaltigkeit	· schriftlicher Fragebogen bei Kursabschluss, 1998 bis Juni 1999, N=2757 (1998) und N=1663 (1999) · telefonische Nachbefragung von Teilnehmenden aus Kursen im 1998, April 1999, N=300 · telefonische Nachbefragung von Teilnehmenden aus Kursen anfangs 1999, Oktober 1999, N=300 · 2. telefonische Nachbefragung von Teilnehmenden aus Kursen im 1997 die bereits bei einer Nachbefragung 1998 mitgemacht hatten, April-Mai 1999, N=300
Verbände, Vereine, Kursleitende	· Weiterverfolgen der Fragestellungen aus der Phase 1 · Hinweise auf Ursachen für zögernden Fortschritt von Allez Hop in der französischen Schweiz · "inaktive" Leitende · Verbindungen zwischen Allez Hop und Vereinen in Bezug auf die Mehrfachteilnahmen · Vergleich mit Phase 1 (Profil der Leitenden, Kurseinschätzung)	· telefonische Befragung von im 1998 aktiven Leitenden, April 1999, N=298 · Fokusgruppe mit aktiven Leitenden, September 1999, N=8 · telefonische Befragung inaktiver Leitender, November 1999, N=160 · Gruppengespräche mit den Verantwortlichen von SOV und Verbänden, März und Dezember 1999, N=6

Phase 3 (2004-2006) [12, 13]

Das im November 2004 gestartete Evaluationsprojekt hatte die folgenden Fragestellungen zum Gegenstand: 1) Untersuchung der Bekanntheit, Nutzung und Beurteilung von Allez Hop auf Bevölkerungsebene (basierend auf Daten des Bewegungssurvey, einer repräsentativen Bevölkerungsbefragung zur Erhebung von Prävalenzdaten im Bewegungsverhalten, N=811), 2) Profil der Kursteilnehmenden der Kurse, die im April 2005 starteten (Eintrittsfragebogen bei allen Kursteilnehmenden von Walking und Nordic Walking Kursen im April 2005, N=2157), 3) Beschreibung der institutionellen Entwicklung von Allez Hop (standardisierte Interviews mit Mitgliedern des Steuerungskomitees von Allez Hop, N=8; Kurs- und Teilnehmerstatistiken 1996-2005; inhaltliche Analyse von Dokumenten wie Geschäftsberichten, Strategiepapieren etc.), und 4) Kursteilnehmende und ihre Erwartungen, Kursbeurteilungen und Änderungen im Bewegungsverhalten (Fragebogen bei Kursbeginn im April 2005, N=2157, Fragebogen bei Kursabschluss im Juli 2005, N=1587, Fragebogen 3 Monate nach Kursabschluss in einer Untergruppe in drei Regionen im Oktober 2005, N=169).

Evaluation im Ausbildungsbereich von Allez Hop [14]

Gegenstand dieser Evaluation war eine detaillierte Analyse der Ausbildung und Ausbildungsstruktur von Allez Hop unter den Gesichtspunkten Umfang, Inhalte, Abläufe, Kosten, Rahmenbedingungen sowie Vorschläge zu deren Optimierung. Zu diesem Zweck wurden zwischen Februar und Mai 2005 10 Personen, die mit der

Ausbildung von Allez Hop zu tun hatten (Geschäftsführer, Ausbildungsverantwortliche, Ausbildnerinnen, etc.), persönlich oder telefonisch mit offenen Fragen interviewt. Zudem wurden die vorhandenen Unterlagen zu Aus- und Weiterbildung studiert und mit anderen vergleichbaren Leiterausbildungen verglichen.

Teilautomatisierte internetbasierte Kursevaluationen

Seit 2006 wurde eine standardmäßige Kursevaluation eingeführt. Eine persönliche Kursauswertung soll die Bereitschaft der Leitenden zum Mitmachen erhöhen. Für die Abwicklung wurde ein teilautomatisiertes Verfahren entwickelt. Kursleitende bestellen beim Anmelden ihres Kurses online die Eintritts- und Abschlussfragebogen. Die automatisch codierten und gedruckten Fragebogen werden den Leitenden per Post zugestellt. Die ausgefüllten Fragebogen werden nach Kursabschluss zurückgeschickt und zentral eingescannt. Der Auswertungsbericht eines einzelnen Kurses wird automatisch generiert, der Email-Versand des Berichts an die Leitenden wird manuell ausgelöst. Die aggregierten Daten lassen ein kontinuierliches Monitoring der Kursteilnehmenden zu.

Internetbefragung von ausgebildeten Allez Hop Leitenden 2007 [186]

Allez Hop steht stellenweise in Konkurrenz zu anderen Anbietern von niederschwelligen Bewegungsangeboten in der Schweiz. Im Zentrum einer Internetbefragung von Personen, die in den vergangenen Jahren eine Ausbildung zum Allez Hop Leitenden absolviert hatten, stand die Einbettung von Allez Hop im aktuellen Markt für Erwachsenensportangebote. Konkrete Fragestellungen waren unter anderem die Häufigkeit und der organisatorische Rahmen der Kursangebote unter dem Allez Hop Label (im Vergleich zu Kursen, die in eigener Regie oder unter anderen Organisationen angeboten werden), Motivationen für und Erfahrungen aus der Leitertätigkeit, Erfolgsfaktoren und Probleme bei der Kursplanung und -durchführung, die Beurteilung des Images von Allez Hop, eine Einschätzung der Veränderungen bei Allez Hop (Franchising, Trägerschaft etc.), sowie Wünsche und Verbesserungsvorschläge von Seiten der Leitenden. Zur Beantwortung dieser Fragen wurden im Juni 2007 alle Personen, die seit 2001 eine Allez Hop Ausbildung absolviert hatten, per Email zur Internetbefragung eingeladen (N=1234, Rücklauf N=540).

7.3 Fazit

Die Resultate der einzelnen Evaluationen ermöglichten die kontinuierliche Weiterentwicklung und Optimierung von Allez Hop, sodass Allez Hop trotz einschneidender Veränderungen wie Trägerschaftswechsel, Einführung des Franchising-Systems und Budgetkürzungen auch nach 10 Jahren noch nationale Ausstrahlung genießt und jährlich bis zu 20 000 Teilnehmende bewegt. Die Zielgruppe der ungenügend Aktiven kann erreicht und die Erwartungen der Teilnehmenden mehrheitlich erfüllt werden. Allez Hop spricht vor allem Frauen im mittleren Alter an (90% der Teilnehmenden sind Frauen, das Durchschnittsalter beträgt etwa 50 Jahre). Hinweise, dass in diesem Bevölkerungssegment die körperliche Inaktivität zwischen 1997 und 2002 abgenommen hat, erlaubt die Schweizerische Gesundheitsbefragung (Abnahme der Zahl an Inaktiven um 6 Prozentpunkte bei Frauen über 45 Jahren [31]). Aufgrund von methodischen Schwierigkeiten und des Problems, ein nicht selektives Sample von

Kursteilnehmenden für Nachbefragungen zu motivieren, konnte die langfristige Wirksamkeit der Allez Hop Kampagne in Bezug auf eine Erhöhung der körperlichen Aktivität bei den Teilnehmenden noch nicht direkt nachgewiesen werden.

8 Allez Hop, a Nation-Wide Programme for the Promotion of Physical Activity in Switzerland: What is the Evidence for a Population Impact after one Decade of Implementation?

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Abstract

Objectives: To present evidence for a population impact of a national physical activity promotion programme after a decade of implementation.

Methods: The programme Allez Hop offered local physical activity courses (mainly walking and Nordic walking) once a week over 12 weeks. Data from a pretest posttest survey in 2005 course participants (N=2157 at baseline (of 4130, 52.2%), 1587 at first follow-up (73.6%); smaller subsample with second follow-up) and from repeated cross-sectional national surveys have been analysed regarding changes in physical activity behaviour.

Results: The total number of Allez Hop courses was 18 684 between 1997 and 2008. 89.2% of participants were women, the mean age was 48.5 years. The proportion meeting the physical activity recommendations was 31.7% at baseline, in participants with first follow-up data it increased from 33.1% to 42.3% ($p<0.001$). On the population level in the main user group of Allez Hop (middle-aged women) the proportion not engaging in any sport decreased from 50.1% (1997) to 47.2% (2002) and to 43.1% (2007) ($p<0.01$). Walking/hiking was the second most frequently performed sport (33.7%) in 2007, with the most remarkable increase since 2000 (+11.1%).

Conclusions: Allez Hop was successfully implemented for more than a decade, reached middle-aged women and a high proportion of insufficiently active individuals. Changes in participants' physical activity behaviour must be interpreted cautiously because of low response rates and short follow-up. However, indications for behavioural changes were observed at the population level, even though these data do not allow a causal link to Allez Hop.

8.1 Introduction

Physical activity has been recognised as an important public health issue [187] and many countries are currently in the process of developing and implementing respective policies and strategies [188]. Attempts at promoting sports for all have an even longer history. Given the solid evidence on the health effects of walking [189], many countries are now promoting such activities specifically, for example the "Walking the Way to Health" programme in England [190] and the "Paths to Health" programme in Scotland [191]. While there is some evidence about the effectiveness of interventions for the promotion of walking [192], there is only very limited documented evidence for the effectiveness of sport programmes in promoting physical activity at the population level and only few national multi-year physical activity promotion programmes have been systematically analysed [3, 193-195].

Switzerland (population of 7.1 million in 1996) has a strong tradition of sport clubs with about one quarter of the adult population being members [196], it has successfully implemented the national programme "Youth and Sport" for adolescents since the 1970ies, and it has an excellent walking infrastructure including a network of around 60 000 km hiking trails. Nevertheless, the first national representative data on physical activity behaviour in Switzerland showed that the proportion of individuals reporting less than one vigorous exercise episode per week increased from 35.7% in 1992 to 39.4% in 1997 [31].

Allez Hop as a nation-wide programme for the promotion of physical activity was launched in 1997 as a joint initiative of three Swiss health insurance companies and the Swiss Olympic Association, the umbrella organisation of Swiss sport federations. Later, the single health insurance companies were replaced by Santésuisse, their national umbrella organisation, and the foundation Health Promotion Switzerland as well as the Swiss Federal Office of Sport joined the partners behind the project. In 2003 the overall responsibility for the programme changed from the Swiss Olympic Association to the Federal Office of Sport. The core of the programme were local physical activity courses offered by trained and qualified Allez Hop instructors once a week for about 12 weeks, targeted at inactive and insufficiently active adults. Course disciplines included gymnastics, walking, tennis, water gymnastics, Nordic walking, running, and Fitgym (indoor conditioning exercises). The budget of Allez Hop was around 1.5 million Euros per year between 1998 and 2001 and about 0.8 million Euros thereafter. The budget was originally participation-driven, with increasing costs for each additional course. To absorb these costs despite a decreasing budget, a franchising system was introduced in 2004 requiring Allez Hop instructors to obtain a licence in order to offer courses under the label “Allez Hop”. In addition, Allez Hop implemented self-financing strategies through merchandising and course offers for companies, generating 0.3 million Euros annually by the year 2006. Allez Hop has always been an implementation and not a research project. There was no constant and consistent evaluation strategy, but several evaluation projects have been carried out [9, 97, 197, 198]. Based on findings that a number of participants took part in more than one course, so-called Allez Hop "meetings" were created for experienced participants wishing to continue their physical activities in a structured format with qualified guidance.

The experiences of a national long-term physical activity programme with the promotion of leisure-time walking as one of its main aims may be of interest to other countries as well. Therefore this publication is looking at the following research questions: What was the success in developing the programme and what was its reach over more than a decade? What were the characteristics of its users and what were indications for behavioural change in them? What were the indications for changes in behavioural patterns at the population level?

8.2 Methods

Data Assessments

Development and Utilisation of the Programme Allez Hop

The central course registration system used for the financial reimbursement of instructors and the advertisement of courses provided the Allez Hop course database. Allez Hop instructors registered the courses they offered over the Internet or by mail. Data regarding the development of Allez Hop courses were derived from that database and could be stratified by course discipline and year.

Course Evaluations in 2005

A written questionnaire survey was carried out among all course participants of Allez Hop walking and Nordic walking courses that started in April and ended in July 2005. Participants were asked to complete questionnaires with items on course expectations, course satisfaction, physical activity behaviour and socio-demographic variables at the beginning (baseline) and the end (first follow-up) of the course. In a subsample in three regions (Aargau representing the German speaking, Romandie the French speaking, and Tessin the Italian speaking part of Switzerland), course participants were furthermore asked to complete a second follow-up assessment three months after the end of the courses in October. An originally planned third follow-up after one year was not carried out because of the low response already at the second follow-up (see result section for response).

Chi-squared tests for categorical variables and t-tests for continuous variables were used to examine differences between regions at baseline. McNemar tests were applied to examine changes in physical activity behaviour over time.

Swiss Health Survey 1997, 2002, and 2007

The Swiss Health Survey is a representative repeated cross-sectional survey assessing data on a number of health variables, including physical activity behaviour. The survey has been carried out every five years since 1992 in a random sample of Swiss adults above 15 years of age. Computer-assisted telephone interviews were used to assess the data presented here (1997, 2002, and 2007). The numbers of participants (response) for the respective years were: 13 004 (69%), 19 706 (64%), and 18 760 (66.3%). In order to be representative of the Swiss population, the data were weighted according to gender, age, linguistic region and nationality. To compare physical activity behaviour between survey years, standard errors were calculated using the complex sample command, and z-tests were used to derive *P* Values. The survey is described in more detail elsewhere [199].

Sport Surveys in 1999 and 2007

Two representative cross-sectional sport surveys were carried out in 1999 and in 2007. The main purpose of the surveys was the assessment of sport preferences and habits in the Swiss population. In 1999, a representative sample of the population aged 14 to 74 years was selected based on a random-random procedure and

interviewed using computer-assisted telephone interviews (N=2064, response 56.8%). In order to represent the Swiss population, the data were weighted according to age, household size, and language region. Similarly, the survey in 2007 was carried out in several regionally representative samples aged 15 to 74 years using a random-random procedure. Data were assessed using computer-assisted telephone interviews (N=10 262, response 55.0%). To account for the different regional sample sizes and to represent the general Swiss population, the data were weighted according to gender, age and region. The surveys are described in more detail elsewhere [196, 200].

Outcome Measures

The main outcome measure in the 2005 course evaluations was the proportion of participants meeting the health-enhancing physical activity (HEPA) recommendations (≥30 minutes of moderate intensity activities on ≥5 days per week or ≥20 minutes of vigorous intensity activities on ≥3 days per week). On the population level, the proportion of the Swiss population that did not engage in any sport, fitness activities, or gymnastics was analysed for 1997, 2002 and 2007. The proportion of individuals engaging in specific sport activities was assessed in 2000 and 2007 (of respondents who reported to participate in any sport).

8.3 Results

Participation in Allez Hop

Figure 8.1 shows the development of Allez Hop courses according to the different course disciplines between 1997 and 2008 (data for 2008 not available by course discipline). An increasing number of courses were offered with a peak of 2174 courses in 2003 and a levelling off thereafter. The total number of registered courses amounts to 18 684. Nordic walking evolved as the main course discipline after 2003. In more recent years, about one third to one quarter of the courses were Allez Hop "meetings”.

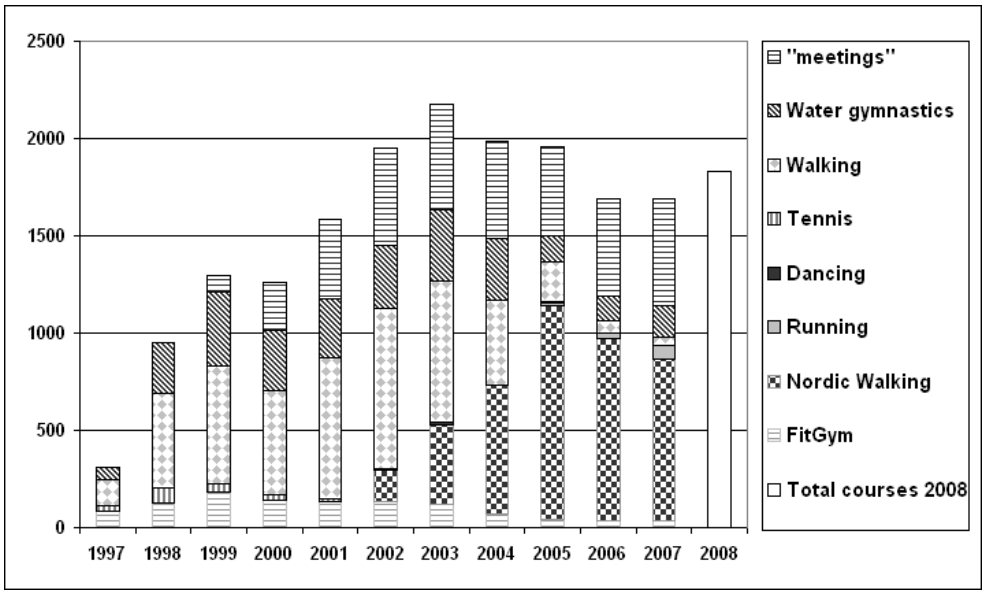

Figure 8.1. Development of Allez Hop courses and "meetings" between 1997 and 2008, by course discipline

Note: Data were not available by course discipline for 2008.

Course Evaluations in 2005: Response

A total of 356 walking and Nordic walking courses started in April 2005. Around 6000 questionnaires were handed out to course instructors. The estimated number of course participants, based on a mean number of 11.6 individuals per course [97], was 4130. Of those, 2157 completed the baseline questionnaire (52.2%) at the beginning of the courses. Records from baseline and first follow-up (beginning and end of the courses) were available for 1587 participants (73.6% of baseline respondents). There were no significant differences between respondents and non-respondents at the first follow-up regarding gender (P = .87), age (P = .52), and meeting the HEPA recommendations (P = .81).

In the subsample selected for participation in the second follow-up, 483 (358 in German speaking, 81 in French speaking, and 44 in Italian speaking Switzerland) of the 580 questionnaires distributed at baseline were returned (83.3%). First follow-up questionnaires were available for 313 participants (64.8% of baseline respondents). Of 216 individuals who agreed to take part in the second follow-up assessment, 169 responded (78.2%). This corresponds to a response of 29.1% of the 580 distributed questionnaires and of 35.0% of the 483 baseline respondents. Complete records regarding physical activity behaviour for all three assessments were available for 141 individuals. There were no significant differences between those who responded at the second follow-up and those who did not regarding gender (P = .34), age (P = .20), and meeting the HEPA recommendations at baseline (P = .11).

Course Evaluations in 2005: Characteristics of Participants at Baseline

At baseline, 89.2% of the course participants were female (N=2157). The mean age was 48.5 years with a range of 13 to 87 years. Of the respondents, 2.4% were from the Italian speaking, 17.9% from the French speaking and 79.7% from the German speaking part of Switzerland. The proportion of women was highest in the Italian speaking part with 95.7%; in the French and German speaking parts the corresponding values were 92.7% and 88.5%, respectively ($P = .02$). The mean age was highest in the French speaking part with 51.0 years compared to 50.2 years in the Italian and 47.8 years in the German speaking part ($P < .01$).

31.7% of the participants with complete physical activity data (N=1822) met the HEPA recommendations at baseline. The proportion was highest in the German speaking part with 33.2% compared to the French (27.2%) and the Italian speaking part (16.7%, $P = .01$), although the number of complete responses from the Italian part was very low.

Course Evaluations in 2005: Changes in Behaviour

The proportion meeting the HEPA recommendations increased significantly from 33.1% at baseline to 42.3% at the first follow-up (individuals with complete data at both time points, N=1213, $P < .001$). The patterns were similar in all regions with significant increases in the German ($P < .001$) and the French speaking part ($P = .001$), but a non-significant increase in the Italian speaking part.

For the subgroup participating in all three surveys including the second follow-up (N=141), the proportion meeting the HEPA recommendations increased significantly from 30.5% at baseline to 40.4% at the first follow-up ($P = .03$), but decreased to baseline levels at the second follow-up in autumn (27.7%, $P = .006$). There were no significant differences between baseline and second follow-up ($P = .62$). The patterns were similar in the German speaking and the Italian speaking part. In the French speaking part, physical activity levels increased from 29.2% (baseline) to 33.3% (first follow-up) and to 41.7% (second follow-up), however these changes were not significant.

At the second follow-up, 36.0% of the respondents participated in either another Allez Hop course (11.0%) or an Allez Hop "meeting" (18.3%) or both (6.7%). 4.8% had joined a sport club after the end of the Allez Hop course.

Changes in Behaviour at the Population Level

Figure 8.2 shows the changes in the proportion of men and women (by age group) that did not engage in any sport, fitness activities, or gymnastics based on the Swiss Health Survey. In the main user group of Allez Hop (women aged 45 to 54 years), the proportion decreased from 50.1% in 1997 to 47.2% in 2002 and to 43.1% in 2007 ($P < .01$). The corresponding proportions for men of the same age group were 46.8% in 1997, 49.8% in 2002, and 45.0% in 2007 (not significant).

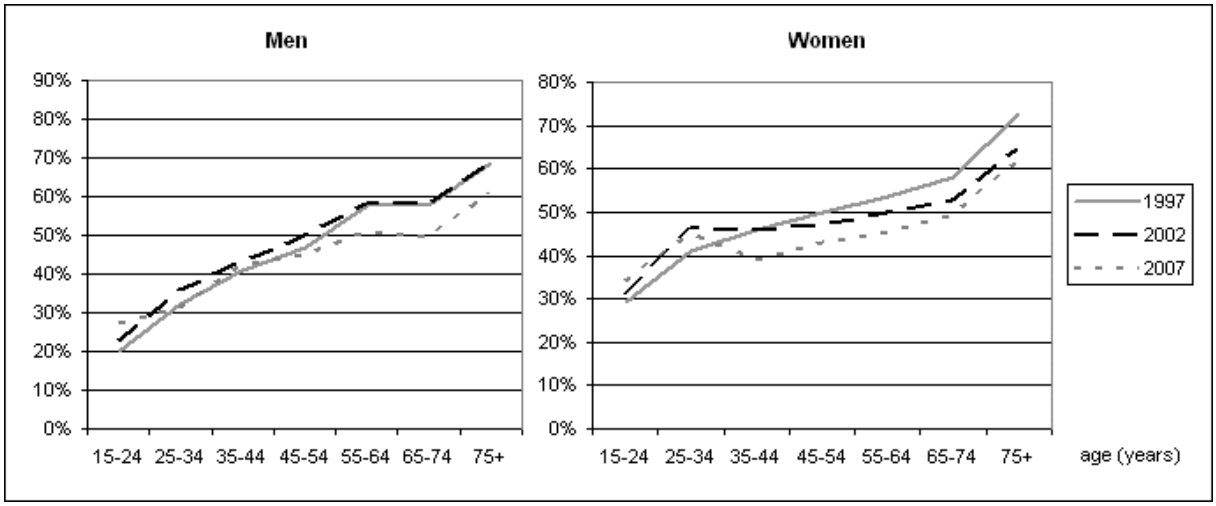

Figure 8.2. Changes in the proportion of men and women with less than one vigorous intensity activity episode per week (based on the Swiss Health Survey) between 1997 and 2007

Source: Swiss Statistics: Swiss Health Survey 1997, 2002, 2007. Lamprecht und Stamm Sozialforschung & Beratung AG (www.sportobs.ch). 1997: N=12 999; 2002: N=19 698; 2007: N=18 745.

Between 1999 and 2007, the proportion of individuals who participated in any sport increased from 71.8% to 72.9% in the Swiss sports surveys, the proportion doing sports at least once a week even from 62.9% to 66.7%. Table 8.1 presents the proportion of men and women who engaged in specific sport activities in 1999 and 2007 (of those who participated in any sport, 1999: N=1481; 2007: N=7481). The presented activities refer to those sports named by ≥10% of individuals. After bicycling/mountain biking, walking/hiking was the second most popular sport (33.7%) according to the 2007 sport survey. Walking/hiking was not only one of the most popular sport activities, it has also experienced the most remarkable increase with 11.1% between 1999 and 2007.

Table 8.1. Most popular sport activities in Switzerland in 1999 and 2007 for men and women aged 15-74 years (including those sports named by at least 10% of the population)

	Men (aged 15-74 years)		Women (aged 15-74 years)	
	Level 1999	Level 2007	Level 1999	Level 2007
Bicycle, mountain bike	31.9%	38.4%	31.5%	31.7%
Walking/hiking [a]	18.2%	29.4%	26.9%	37.9%
Swimming	21.1%	20.7%	31.3%	30.0%
Skiing	19.2%	22.9%	16.9%	20.6%
Jogging/running	19.6%	19.1%	15.7%	14.6%
Fitness training	8.2%	11.2%	14.8%	16.8%
General gymnastics	7.3%	7.7%	26.4%	15.6%

[a] Walking/hiking was composed of two thirds hiking and one third walking, the latter including 47% Nordic walking, 20% walking, and 33% brisk walking in 2007

8.4 Discussion

Allez Hop, a nation-wide programme to promote physical activity, has been successfully implemented in Switzerland for more than a decade. Over 18 000 courses were realised with a mean of 11.6 participants per course [186], resulting in around 200 000 participants in total, though up to one third of them may have been multiple participants. The main user group were middle-aged women, and Allez Hop has succeeded in reaching a high proportion of insufficiently active individuals (68.3% in 2005 compared to 64.1% in the general Swiss population in 2002 [31]). Although the reduction in funding coupled with the change to a franchising system did not result in a large decrease regarding course numbers, the slight decrease after 2003 may be attributable to a delayed effect of these budgetary changes. Other reasons may be a high number of trained instructors not offering any courses [186], dwindling institutional support, and other private and commercial organisations starting to offer similar physical activity courses competing Allez Hop.

Allez Hop has reached quite a high level of awareness in the Swiss population which has moreover risen continuously. According to a demographic market research survey, only 8% of the population in Switzerland had heard about Allez Hop in March 1998 before the start of a large advertising campaign [97, 201]. Two months after the end of the campaign in July 1998, 21% had heard about Allez Hop [201]. According to two population surveys, 20% and 22% of the population had heard about Allez Hop in 2001 and 2002, respectively [12]. Finally in 2004, 26% knew about Allez Hop [12]. The national programme "Youth and Sport" has reached a much higher level of awareness (86.2% in 2004) [12], however, "Youth and Sport" has been implemented for more than 30 years based on the national law on the promotion of physical education and sport (1972), has a federal budget of about 37 million Euros per year, and is well disseminated in the population with more than half a million adolescents participating in the programme every year. Despite the difference in levels of awareness, the acceptance and appreciation of the two programmes in the population was similarly high (data not shown [12]).

Previous [9] and current evaluation attempts have not succeeded in creating satisfying evidence for changes in physical activity behaviour in Allez Hop course participants. The data presented in this article showed an increase in physical activity behaviour between the beginning (April) and end of the courses (July), but activity levels were back to baseline levels at the second follow-up in October. It is unclear whether this indicates a lack of effectiveness of the intervention, or whether physical activity levels actually improved after taking into account seasonal variations in behaviour. This distinction was not possible due to the lack of a synchronous control group. Furthermore, the low response made it impossible to carry out a third follow-up 1 year after baseline in April when spontaneous physical activity levels would be expected to be higher than in autumn or winter. Therefore, the results do not allow meaningful interpretation. Different reasons are responsible for these limitations. Firstly, Allez Hop started as an implementation rather than a research project, and measuring behavioural changes was not a priority. Secondly, there was a lack of an overarching evaluation concept and there were changing conditions regarding sponsorship, political priorities and organisational aspects [13]. Planning of programme development and evaluation was thus difficult in the long term. There is no doubt that a randomised study design would be desirable to test the effectiveness of Allez Hop thoroughly compared with a control group in order to account for

seasonal variations in physical activity behaviour; however, in community-wide studies this may be challenging, and quasi-experimental, or even good time series population surveillance might be all that could be achieved to improve future evaluations. It is generally acknowledged that randomised controlled trials are often not feasible or even inappropriate to evaluate public health interventions [87, 88]. Further analyses of the 2005 course evaluations showed that acceptance and appreciation of the programme was high in participants overall (data not shown, but comparable to results published for course evaluations in 2006 and 2007/08 [198]).

Data from population-based cross-sectional surveys show increases in physical activity levels in the main user group of Allez Hop (middle-aged women) between 1997 and 2007, and remarkable increases especially in walking (including Nordic walking), which became one of the most popular activities offered in Allez Hop courses. In fact, Allez Hop has probably contributed to the rise of Nordic walking in Switzerland. These data indicate a potential impact on the population level, even though they do not allow a causal link to specific programmes like Allez Hop. The high level of awareness and appreciation of Allez Hop in the population [12] support evidence for a positive impact on the population level.

Ideally, large population-based programmes such as Allez Hop are based on national physical activity promotion policies which justify and support the programme politically. Since 2000, Switzerland has a "Federal Government's Concept for a National Sport Policy" [202] in which Allez Hop is named as one measure to promote physical activity in adults [203]. This commitment was renewed for the period 2007-2010 [203]. Nevertheless, Allez Hop as a national implementation project was terminated at the end of 2008 and only the instructors' training was integrated into the new concept "Sports for Adults" of the Swiss Federal Office of Sport. Two regional organisations are continuing with the label Allez Hop in the Italian and the French speaking parts of Switzerland.

Although it seems obvious that long-term planning and implementation of physical activity promotion projects – ideally coupled with repeated evaluation and adaptation - are desirable, this is far from the norm. Out of the four national programmes from European countries analysed in the 1990ies [194], only the Finnish "Fit for Life" is still active ten years later. Not only Allez Hop, but also "The Netherlands on the Move" and the English "Active for Life" have been discontinued, in the earlier case together with the transfer of the responsibility for physical activity promotion from the "Netherlands Olympic Committee*Netherlands Sports Confederation NOC*NSF" to the new National Institute for Sport and Physical Activity, in the latter case with the dismantlement of the organising "Health Education Authority" [204].

It is possible that local, regional or entirely private structures can take over the legacy of Allez Hop. However, particularly the outreach to insufficiently active individuals can be a challenge in systems where only the training of instructors, but not the recruitment of participants, has support from national public institutions, as the limited evaluation results available from the national seniors' sports programme are indicating [205].

In summary, even in a country with well established sport structures [196], Allez Hop has succeeded in reaching a previously underserved proportion of the population over more than a decade. Awareness has improved in the general population and the number of courses has increased accordingly. Methodological limitations do not allow direct inference about the effectiveness of the programme regarding changes in physical activity behaviour in

participants. Although no causal link can be established, population-level data indicate changes in physical activity patterns in the main user group of Allez Hop and similar offers. Continuing implementation and an overall evaluation concept are desirable in large population-based programmes such as Allez Hop, ideally based on a national physical activity policy.

What is already known:

Physical activity is an important public health issue. There is some evidence about the effectiveness of interventions for the promotion of walking, however there is only limited evidence for the effectiveness of sport programmes in promoting physical activity at the population level, and only few national multi-year physical activity promotion programmes have been systematically analysed.

What this paper adds:

A large population-based physical activity promotion programme in Switzerland succeeded in reaching a previously underserved proportion of the population over more than a decade. Population level data strongly indicate changes in physical activity behaviour in the main user group of the programme, in middle-aged women.

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9 A Semiautomated Web-Based Approach for Routine Evaluation of Physical Activity Courses

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Abstract

Routine course evaluation within the nationwide physical activity promotion programme Allez Hop was introduced to monitor and optimise the programme. A semiautomated Web-based system was developed to collect, store, analyse and disseminate data. The system was pilot-tested in the canton of Aargau in 2006 with strong encouragement of course instructors to participate in the evaluation. It was also openly available to Allez Hop instructors from mid-2007 until the end of 2008 with no specific measures to encourage participation. Feasibility was good in both settings. 65% of courses participated during the pilot phase and 1% of courses during the open phase, indicating that encouragement of course instructors is needed to increase participation in the evaluation.

Zusammenfassung

Im nationalen Bewegungsförderungsprogramm Allez Hop wurden routinemässige Kursevaluationen eingeführt, um das Programm zu optimieren. Für die Sammlung, Speicherung, Auswertung und Kommunikation der Daten wurde ein halbautomatisiertes, internetbasiertes System entwickelt. In einer Pilotphase wurde dieses System in Bewegungskursen im Kanton Aargau im Jahr 2006 eingesetzt. Alle Kursleitenden wurden ausdrücklich ermuntert, an der Evaluation teilzunehmen. Zwischen Mitte 2007 und Ende 2008 stand das System ausserdem den Allez Hop-Leitenden zur Verfügung, ohne dass zu einer Teilnahme speziell ermuntert wurde. Die Machbarkeit war gut. Während der Pilotphase nahmen 65% der Kurse teil, zwischen 2007 und 2008 nur 1% der Kurse. Dies deutet darauf hin, dass eine ausdrückliche Ermunterung der Kursleitenden wichtig ist, um die Teilnahme zu erhöhen.

9.1 Introduction

Interventions targeting individuals in community settings are effective in producing short-term changes in physical activity [206]. Longer-term changes in behaviour may be achieved with interventions that promote moderate intensity physical activity, particularly walking, and that are not facility-dependent [206]. Such an approach in Switzerland is Allez Hop, a nationwide campaign to promote physical activity among insufficiently active individuals launched in 1997 by three Swiss health insurance companies and the Swiss Olympic Association [9]. The core of the programme were inexpensive local physical activity courses (e.g. Nordic walking, running, water gymnastics) offered by qualified Allez Hop instructors once a week for about 10 weeks. From 2003 on, a joint contract between the Federal Office of Sport, Health Promotion Switzerland, the Swiss Olympic Association and

Santésuisse (the governing body of the Swiss health care insurance companies) ensured the continuation of Allez Hop. At the end of 2008, Allez Hop was transferred to the new concept “Erwachsenensport” (“Sport for adults”), which combines different programmes for adults including senior sport offers.

Evaluation plays an important role for further development and optimisation of population-based physical activity promotion programmes. Routine course evaluations within the programme Allez Hop were introduced with the aim to monitor course participants' characteristics as well as their expectations and satisfaction, and thus ensure a high quality of the programme. A semiautomated Web-based system was developed to facilitate data assessment, storage, and analysis. Furthermore, the system was designed to produce separate analyses of single courses and to combine these results in a comprehensive feedback report which can be sent to each course instructor by email. Such a feedback report may increase participation in these evaluations. In 2006, the system was first used in the campaign “Der Aargau bewegt sich” (“Aargau is moving”) with strong encouragement of course instructors to participate in the evaluation. From mid-2007 until the end of 2008, the system was open to all Allez Hop instructors in the German speaking part of Switzerland via the Allez Hop course registration website. No specific measures were introduced to encourage participation.

The aim of the present publication is to compare data assessed between 2007 and 2008 when the system was routinely available to Allez Hop instructors in the German speaking part of Switzerland with data assessed during the pilot phase in the canton of Aargau in 2006. It was of interest how much the course evaluation was used by Allez Hop instructors from mid-2007 on and whether optional participation in the course evaluation yielded results comparable to those obtained during the pilot testing.

9.2 Methods

Semiautomated Web-Based Evaluation System

During the pilot phase, course instructors willing to participate in the evaluation were provided with the required number of questionnaire sets including a title page explaining the evaluation, a pre-course questionnaire and a post-course questionnaire. Instructors completed the questionnaires with their course participants before and after the course. Completed questionnaires were returned by mail and were scanned. A course-specific, automated feedback report was generated for each single course and sent to the respective instructor by email. The report contained information on the characteristics of the course participants, their physical activity levels, their expectations before the course and their satisfaction after the course.

From mid-2007 on, participation in the evaluation was openly available to Allez Hop course instructors in the German speaking part of Switzerland. When registering their courses on the Allez Hop website, instructors had the possibility to order the evaluation questionnaire sets by selecting the questionnaire option in a list of Allez Hop course materials. The requested number of questionnaire sets was automatically generated with a course number and a unique participant’s identification number. An automated email with the attached questionnaires was released to the print office of the Federal Office of Sport. Together with other course material, the printed

questionnaires were sent to the instructors by mail before the beginning of the course. From there on the procedure continued as described above for the pilot phase.

Settings, Recruitment and Response

During pilot testing in 2006, all course instructors of the campaign “Der Aargau bewegt sich” were asked to participate in the course evaluations. Of around 80 courses with almost 1400 participants, 52 courses (65%) participated including a total of 861 participants (as declared by the instructors). Of those, 805 (93.5%) completed the pre-course questionnaire at the start of the course. 557 participants completed both pre- and post-course questionnaires corresponding to a response of 64.7%.

In the time period when the semiautomated course evaluation system was openly available to Allez Hop course instructors (mid-2007 until the end of 2008), around 2000 Allez Hop courses were registered in the German speaking part of Switzerland. Of those, 104 instructors ordered the questionnaire sets (5.2%), and valid questionnaires were sent back for 21 courses (20.2%). Pre-course questionnaires were returned for 129 individuals, 114 of them also had a valid post-course questionnaire (88.4%). In total, around 1% of the courses participated in the course evaluations.

9.3 Results

Description of Courses and Characteristics of the Respondents

Of the 52 courses in the pilot phase, 50.0% were offering Nordic walking, 34.6% running, and 5.8% walking. The course discipline was not specified for 9.6% of courses. Of the 21 courses participating in 2007/08, 81.0% were offering Nordic walking, 14.3% running and 4.8% water gymnastic.

Mean age of participants was 46.5 (±11.6) years in the pilot phase and the proportion of women was 80.9%. In 2007/08, mean age was also 46.5 (±11.8) years and the proportion of women was 85.1%. Table 9.1 displays physical activity levels (including those individuals with valid pre- and post-course data) according to the five-level indicator generally used in Switzerland [31]. Trained and regularly active individuals are considered as sufficiently active.

Table 9.1 Physical activity levels during the pilot phase and in 2007/08 before and after the courses

	Pilot phase		2007/08	
	pre-course	post-course	pre-course	post-course
trained (≥20 min of vigorous intensity activities on ≥3 days/week)	38.6%	50.0%	27.1%	32.3%
regularly active (≥30 min of moderate intensity activities on ≥5 days/week)	4.7%	4.1%	7.3%	9.4%
irregularly active (≥150 min of moderate intensity activities per week or ≥20 min of vigorous intensity activities on 2 days/week)	40.1%	38.6%	37.5%	40.6%
partially active (≥30 min of moderate intensity activities per week or ≥20 min of vigorous activities on 1 day/week)	12.2%	6.2%	25.0%	15.6%
inactive (minimal or no activities)	4.3%	1.1%	3.1%	2.1%
N	466	466	96	96
sufficiently active (trained or regularly active)	**43.3%**	**54.1%**	**34.4%**	**41.7%**

Course Expectations and Course Satisfaction

At the end of the courses, participants could agree or disagree with a number of items regarding their course. The following proportions are based on those participants completely or rather agreeing: 96.4% of participants both during the pilot phase and in 2007/08 were generally satisfied with their course; 95.6% (pilot phase) and 99.1% (2007/08) found that the course organisation was good; 95.4% (pilot phase) and 97.4% (2007/08) stated that the course instructor responded well to their needs and interests; 97.1% (pilot phase) and 98.2% (2007/08) found that the atmosphere in the course was pleasant.

Course expectations at the beginning of the courses were generally high. Figure 9.1 compares the expectations at the beginning of the courses with the satisfaction at the end of the courses (including those individuals with valid pre- and post-course data), both for the pilot phase and the courses in 2007/08. In general, the expectations were met; however, regarding well-being and physical discomfort, expectations were slightly higher than the satisfaction at the end of the courses.

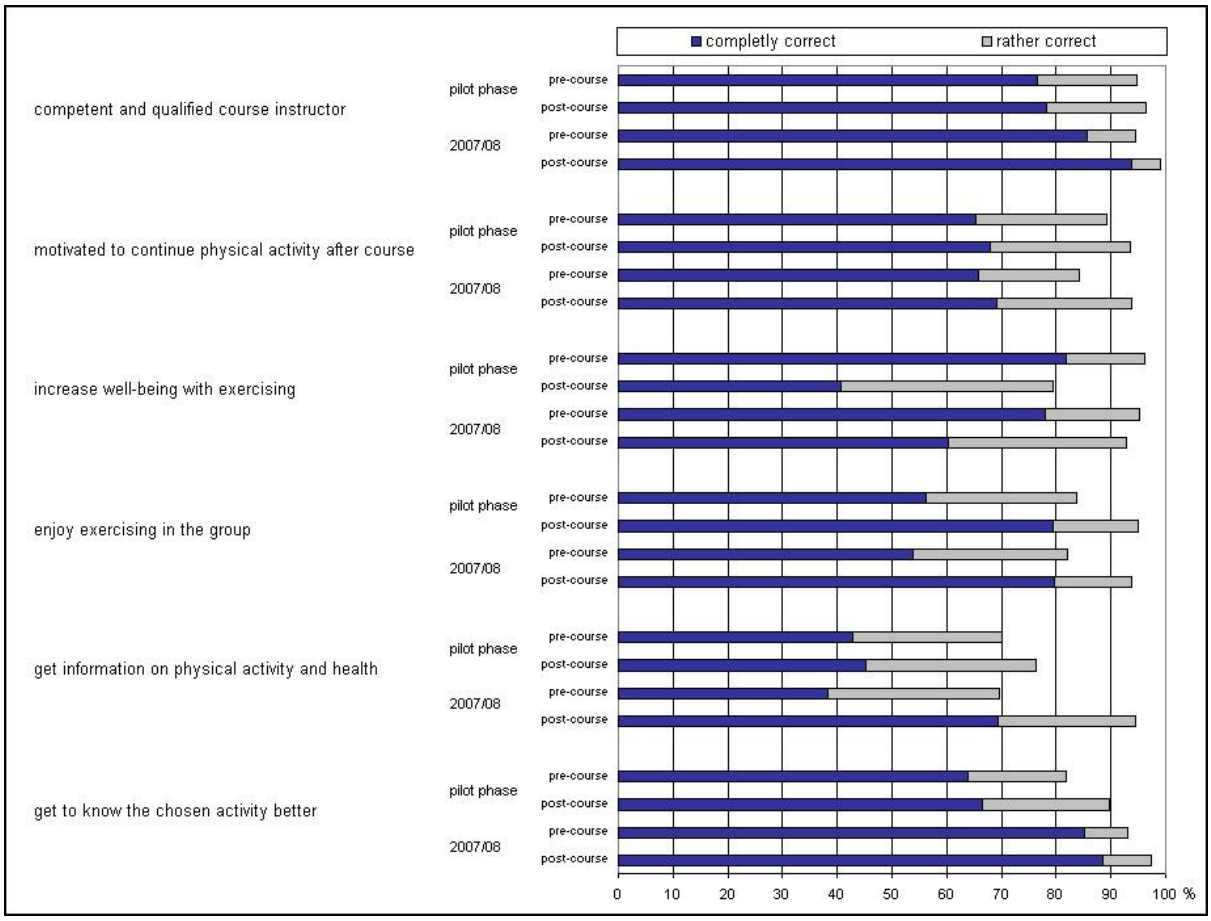

Figure 9.1 Comparison of expectations (pre-course) and satisfaction (post-course) of different aspects during the pilot phase in 2006 and in 2007/08

9.4 Conclusions

In general, the feasibility of the semiautomated Web-based system for routine evaluation of physical activity courses was good in both the pilot phase and the open phase setting. While encouragement of participation during the pilot phase yielded in two thirds of course instructors taking part in the course evaluations, participation was very low in 2007/08 when the system was openly available to Allez Hop instructors with no specific measures to encourage participation. Only one out of twenty Allez Hop instructors requested the questionnaire sets, and only one fifth of them also returned the questionnaires for scanning and analysing. Thus only around 1% of eligible Allez Hop courses have been evaluated between mid-2007 and the end of 2008 using the semiautomated course evaluation system. This number is very low and far below expectations. One reason for the low return rate may be that some instructors requested all possible course materials when registering their courses instead of making a selection of those items they were going to use. Furthermore, a pre-paid envelope for returning the questionnaires was only enclosed during the pilot phase.

The results obtained in the courses between 2007 and 2008, when the system was openly available to Allez Hop course instructors, compared well with data obtained during the pilot phase in the canton of Aargau in 2006, despite the large difference in participation rate. Furthermore, similar results have been reported in earlier course

evaluations [13]. This may indicate that the motivation of the course instructors to participate in the course evaluations does not influence the data obtained from their courses, and no selection bias has to be expected.

The courses generally succeeded in reaching a substantial proportion of irregularly active and partially active participants. Even though the expectations were high at the beginning of the courses, most participants were satisfied with their courses. Physical activity levels were higher during the pilot phase than in 2007/08, however, in both periods they increased from the beginning of the courses until the end.

Since the transfer of Allez Hop to “Sport for adults” it remains open how the semiautomated system may be incorporated in the new concept. In general, evaluation may play an important role at this stage in order to monitor the transfer to the new concept and its potential consequences. Thus, the semiautomated Web-based system may be a useful tool for routine course evaluations in “Sport for adult” courses. However, action will need to be taken to encourage more instructors to participate in the course evaluations and to return the questionnaires. More information and promotion may help to explain the advantages of participation, such as the personal course feedback and indications for maintaining a high quality of courses. For example, the system may be explained to course instructors in a newsletter, and more information may be provided on the website where the questionnaires can be ordered.

In conclusion, a semiautomated Web-based approach proved feasible for collecting, storing, analysing and disseminating standardised data of routine course evaluations in order to optimise and monitor a large, population-based intervention promoting physical activity. Once such a system has been developed, cost for additional data management is low. However, it remains a challenge to encourage course instructors to use such a service when openly available.

PART V

SPONTANEOUS CHANGES IN PHYSICAL ACTIVITY BEHAVIOUR: AN ISSUE IN THE EVALUATION OF PHYSICAL ACTIVITY INTERVENTIONS

10 Physical Activity Levels and Determinants of Change in Young Adults: A Longitudinal Panel Study

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Abstract

Background: There is growing concern about physical inactivity in adolescents and young adults. Identifying determinants that are associated with low levels of physical activity and with changes in physical activity levels will help to develop specific prevention strategies. The present study describes the prevalence and potential determinants of physical activity behaviour and behaviour changes of young adults. The study is based on the Swiss Household Panel (SHP), a longitudinal study assessing social changes in a representative sample of Swiss households since 1999.

Methods: Data is collected yearly using computer-assisted telephone interviews. Information is obtained from each household member over 14 years of age. Participants between 14 and 24 years entering the SHP between 1999 and 2006 were included (N=3068). "Inactive" was defined as less than 1 day/week of at least 30 minutes of moderate physical activity, "no sport" as exercising less than once a week. Age, gender, nationality, linguistic region, household income, education, membership in a sport club, reading, and Internet use were included as potential determinants of physical activity behaviour and behaviour change.

Results: In both young men and young women, the prevalence of inactivity, "no sport", and non-membership in a sport club was increasing with age. Women were less active than men of the same age. From one wave to the following, 11.1% of young men and 12.1% of young women became active, and 11.9% of men and 13.7% of women became inactive, respectively (pooled data over all eight waves). Non-membership in a sport club was the strongest predictor for "no sport" (OR_{men} 6.7 [4.9-8.9]; OR_{women} 8.1 [5.7-11.4]), but also for being inactive (OR 4.6 [3.5-6.0]; 4.6 [3.3-6.4]). Leaving a sport club (OR 7.8 [4.4-14.0]; 11.9 [5.9-24.1]) and remaining non-member (OR 7.8 [4.7-12.9]; 12.4 [6.4-24.1]) were the strongest predictors of becoming "no sport". Effects for becoming inactive were similar, though smaller (OR 5.9 [3.4-10.5] and 5.1 [2.7-9.6] for leaving a club, OR 5.1 [3.1-8.4] and 6.9 [4.0-11.8] for remaining non-member).

Conclusions: The most important findings were the strong effects of sport club membership on general physical activity. The correlation between sport club membership and exercise was not surprising in its nature, but in its strength.

10.1 Background

The importance of physical activity for health has been well documented both at the individual and at the population level [19]; it has also been accepted by international public health authorities [187, 207]. Current recommendations point out the importance of regular, ideally daily, physical activity of at least moderate intensity and the additional benefits of activities of vigorous intensity [208, 209]. While half an hour of moderate intensity physical activity is recommended for adults, adolescents should accumulate at least one hour per day [30].

At the same time, there is growing concern about low levels of physical activity in many countries [22, 210]. There are only a limited number of countries that can follow physical activity trends over several years based on national representative data. Most of these time series are based on repeated independent cross-sectional studies [211, 212] potentially confounded by cohort effects. While there is a number of longitudinal studies on physical activity behaviour [213], only few of them are based on representative population samples of sub-national regions [214] or even countries [215, 216].

In Switzerland, nationally representative data on physical activity in adults is available since the 1992 Swiss Health Survey [217], data relating to current recommendations for health-enhancing physical activity for the 2002 and 2007 Swiss Health Survey [30, 31]. With a prevalence of 41% sufficiently active individuals in 2007 they are in line with international estimates of physical inactivity. Young people report more physical activity than older ones, men more than women. The proportion of individuals with less than one vigorous exercise episode per week could be followed over 15 years: it increased from 36% to 39% between 1992 and 1997, but then decreased again to 37% by 2002 and to 32% by 2007 [30]. More detailed information was available for 1997, 2002 and 2007: participation in sports and exercise remained stable between 1997 and 2002 (and even increased in women), and increased slightly between 2002 and 2007. In both sexes the proportion walking or using their bicycle for daily transport decreased from 57.5% in 1997 to 49.5% in 2002 but increased again to 56.4% by 2007 [30, 58].

Data from cross-sectional studies indicate that the largest declines in physical activity levels with age occur in adolescents and young adults and above the age of 65 years [31]. Decreasing physical activity levels at younger ages are of special concern. Several determinants can influence physical activity behaviour [187]. These can be non-modifiable, such as age, gender, and social class, or modifiable. Modifiable determinants include personal factors (e.g. attitudes, motivation, self-efficacy), the social environment (e.g. family, peers, social support), and the physical environment (e.g. access to sport facilities, urban development, transport infrastructure, green spaces). Identifying determinants that are associated with changes in physical activity will allow to develop specific and effective prevention strategies for specific groups, for example adolescents and young adults. In a review of longitudinal studies on youth predictors of adulthood physical activity [213], associations were described with a number of variables in youth. The strongest associations were reported for high levels of physical activity, frequent participation in sport, membership in a sport club, good cardio-respiratory fitness and high marks in physical education at school. In a recent review of quantitative reviews for the National Centre on Clinical Excellence NICE [218], the following demographic, behavioural and cultural correlates of physical activity in

children and adolescents have been identified: male gender (moderate to large positive association), age in adolescence (small to moderate negative), previous physical activity (moderate), sport participation (moderate, stronger in adolescent girls), smoking (moderate negative), and parental and social support (large positive).

Recent epidemiologic evidence suggests that too much sitting may be a cardiovascular and metabolic risk factor that is independent of physical inactivity [219]. Moreover, sedentary behaviour has been a concern in children and adolescents. According to displacement hypotheses, spending time in sedentary activities reduces the time spent participating in physical activity. Sedentary behaviour after school and on weekends was inversely related to physical activity in adolescents [220]. However, the relation between sedentary behaviour in general (mostly studied based on television viewing or as a collapsed variable based on different sedentary behaviours) and physical activity was indeterminate in children and adolescents [220]. This may be due to the fact that different types of sedentary behaviours show different associations with physical activity behaviour. While watching TV has been reported to inversely correlate with physical activity in a meta analysis [221], the literature regarding computer and internet use is equivocal: Inverse associations with physical activity have been reported for computer use/playing video games [215] and for the availability of computers/Internet at home [222], positive associations for working on computers [223] and computer use [224, 225], especially in young men [226], and no associations for leisure time internet use in adolescent girls [227, 228]. While reading/doing homework was not associated with physical activity, a combination of "productive" sedentary behaviours including reading/doing homework and working on a computer showed a positive correlation with physical activity behaviour [223]. Two other studies reported a significant positive association between reading and physical activity in both young men and young women [225] and in young women only [226].

In Switzerland, sport clubs are a central part of the sport structure and play an important role in sport promotion, especially in younger age groups. The proportion of sport club members is 62% in children aged 10-14 years and 47% in adolescents aged 15-19 years [229]. Sport clubs are organised locally in towns and villages, offering trainings for different age groups at least once a week. Usually supervised by qualified volunteer instructors, sport clubs are open to everyone at very low annual fees. Leaving a sport club at the crucial age of adolescence may be a factor, among others, associated with decreasing activity levels between youth and adulthood in Switzerland and other countries that have a tradition of sport clubs.

In repeated cross-sectional studies changes are only followed on the population level, so behavioural changes in individuals and groups that cancel out each other might go unnoticed. Longitudinal studies, such as the Swiss Household Panel (SHP), give the opportunity to describe behaviour and changes in behaviour at the individual level. They allow to gain estimates of the proportion of spontaneous behavioural changes to be expected in subgroups of the population and to assess determinants of physical activity behaviour and its changes. Longitudinal panel studies investigate several birth cohorts on repeated occasions. This publication describes the prevalence of physical activity of moderate and vigorous intensity among adolescents and young adults aged 14 to 24 years when entering the panel over up to 8 years of follow-up from 1999 to 2006. As well, it will quantify the role of potential determinants of physical activity behaviour and of changes in physical activity behaviour.

10.2 Methods

Study Population

The Swiss Household Panel is a longitudinal nationwide survey assessing living conditions and social changes in a representative sample of Swiss households since 1999. The panel is described in detail elsewhere [48]. Briefly, data is collected every year using centralised computer-assisted telephone interview (CATI) techniques. General information on the socio-demographic situation of the household and the household composition is provided by an adult reference person in each household. Individual information is obtained from each household member over 14 years of age. Questions include socio-demographic variables, health, well-being, political attitudes and behaviour, social networks and economic issues. The Swiss Household Panel was approved by the Research Commission of the University of Neuchâtel, which grants the conformity to the ethical standards of research on humans. Every year, each selected household receives a letter containing information about the panel, its aims, the length and content of the interviews, as well as the confidentiality, anonymity and exclusive use of the data for scientific research purposes. A few days later the survey institute contacts the households by telephone, and each member is free to participate or refuse participation.

The first wave of the panel started in 1999, when 14 174 households were randomly selected from the electronic telephone registry. Of these, 7063 households could be reached for basic information and 6001 answered the household questionnaire. In 5074 households with a total of 10 293 eligible individuals above 14 years of age, at least one individual interview was completed resulting in 7799 individual interviews (75.8%). Of the 7799 individuals, 1159 were young participants aged 14-24 years living in 842 households. Children 13 years and less in 1999 entered the panel as soon as they turned 14 years. Occasionally, some older subjects entered the panel at a later time point as well, for example because they returned to their household. In 2004, a new sample was added to the panel to compensate for attrition (more information on the Swiss household panel and the selection methods are available at www.swisspanel.ch).

The inclusion criteria for the present study were a) to be born between 1975 and 1992, b) to be between 14 and 24 years of age at the year of inclusion and c) to be between 14 and 26 years of age at the time of the interview for the respective wave. At the start of the panel in 1999, 1159 eligible adolescents and young adults participated in the individual interviews. Due to the refreshment of the panel in 2004, 740 individuals entered the panel in that year. Between 125 and 305 individuals entered the panel in the remaining years (2000, 2001, 2002, 2003, 2005, and 2006, see Table 10.1), resulting in a total sample of 3068 individuals (50.0% males, N=1534). These relatively high numbers of new entries of young individuals every year are due to the design of the panel that includes individuals from the age of 14 years on. Thus any child turning 14 would enter the panel in the respective year. Repeated participation of the 3068 individuals resulted in 9039 observations. The proportion of individuals providing data for 1 to 8 waves, respectively, were 29.1%, 19.8%, 18.9%, 7.8%, 8.2%, 5.9%, 5.0%, and 5.4%. The study adherence in the sample of adolescents and young adults aged between 14 and 26 years included in the present study is summarised in Table 10.1. We are aware that by following individuals over time using a panel

design, the initial age at entry is not fully determined by the birth cohort because not all participants started in 1999.

Table 10.1 Sample size, adherence, loss and (re-)recruitment of participants at each wave

		Adherence and loss of participants		recruitment and re-recruitment	
	total N	individuals who participated in previous wave	individuals lost since previous wave	New Individuals entering the panel	Individuals who participated before but not in previous wave
wave 1 - 1999	1159			1159	
wave 2 - 2000	1148	843	316 (27.3%)	305	
wave 3 - 2001	1134	865	283 (24.7%)	194	75
wave 4 - 2002	995	786	348 (30.7%)	125	84
wave 5 - 2003	915	721	274 (27.5%)	133	61
wave 6 - 2004	1373	564	351 (38.4%)	740	69
wave 7 - 2005	1149	879	494 (36.0%)	205	65
wave 8 - 2006	1166	807	342 (29.8%)	207	152

Note: In total, 1534 males and 1534 females were included in the analyses.

Measures

Physical Activity

Self-reported physical activity was assessed using two questions on activities with moderate intensity (number of days of at least 30 minutes) and one question on frequency of sport or exercise practiced individually or in a team. "Activities that get you at least a little bit out of breath" such as walking quickly, dancing, or gardening were named as examples of moderate activities; jogging, football, volleyball, and tennis as examples of sport activities and exercise. No minimum duration of exercise participation was taken into account. It was not possible to include a more detailed questionnaire on physical activity behaviour because this was only a minor topic in the Swiss Household Panel. Three dichotomous physical activity outcome measures were defined for activities of moderate and vigorous intensity and a combination of both: "inactive" was defined as less than one day of at least 30 minutes of moderate physical activity per week, "no sport" as exercising less than once a week. Finally the combination of "inactive" and "no sport" was defined as "completely inactive". The distribution of individuals in the different levels of moderate and vigorous intensity activities is shown in Table 10.2.

Table 10.2 Levels of moderate and vigorous physical activity at initial age when entering the study

		Males (N=1534)	Females (N=1534)
number of days with ≥30min of moderate activities per week			
inactive	0 day	23.4%	29.7%
active	1 day	22.6%	25.9%
	2 days	11.5%	12.0%
	3 days	27.7%	21.1%
	4 days	6.5%	3.9%
	5 days	3.8%	3.6%
	6 days	1.7%	1.5%
	7 days	2.8%	2.3%
frequency of engaging in sport activities			
"no sport"	never	9.6%	17.9%
	less than once a month	2.6%	3.2%
	at least once a month	6.6%	8.9%
active in sport	at least once a week	69.4%	63.2%
	every day	11.8%	6.8%
frequency of complete inactivity			
completely inactive	inactive and no sport	12.6%	20.6%
somewhat active		87.4%	79.4%

The grey background corresponds to the definition of the dichotomous physical activity outcome variables.

Potential Determinants of Physical Activity

Time-invariant and time-variant determinants were included in the analysis based on indications of existing cross-sectional studies. Time-invariant determinants included gender, initial age when entering the study, nationality (Swiss nationality versus no Swiss nationality), linguistic region (German, French or Italian speaking part) and size-adjusted household income over all waves (quintiles, adjusted for number and age of household members) as a proxy for socio-economic status. The lowest quintile of the size-adjusted household income represents an annual income of ≤33 070 Swiss Francs (around 22 000 Euro). Time-variant determinants at any time point included individual current age at each wave, membership in a sport club, education, Internet use, and reading. Education was included as reported at the time of the survey or as the highest education achieved if education was completed (compulsory school up to age 16; high school or apprenticeship/vocational low, typically from 16 to 20 years; vocational high/university from 21 to 26 years). Internet use as a recently emerged behaviour and reading as a more traditional one were included as leisure time activities representing sedentary behaviour (frequency of engaging in activity during leisure time, more than once a week versus less). TV viewing was only measured in 1999 and was not included in the analyses. Due to its strong correlation with age, education was only included in the univariate analyses but not in the adjusted models.

Statistical Analyses

For modelling the likelihood of binary outcomes as for low level of physical activity ("inactive", "no sport", "completely inactive"), a generalised estimating equation (GEE) model with a logistic link function and a binomial distribution was applied. Determinants of low levels of physical activity were estimated using pair-wise log odds ratios for the within-subject association. Determinants of change were analysed applying an independent correlation structure for the outcome conditional to previous physical activity level (change in physical activity). The GEE method is a generalisation of the general linear model (GLM) that permits to take into account within-subjects dependencies. The PROC GENMOD command in SAS was used. Estimates are reported as crude and adjusted odds ratios (OR) and their 95% confidence intervals (95% CI) for males and females separately.

The data were weighted in order to represent the population living in private households in Switzerland. Because of the panel study design, cross-sectional as well as longitudinal weights had to be applied. Cross-sectional weights extrapolated data to the population composition in each survey year and were re-scaled to keep the original sample size of the young population. Longitudinal weights extrapolated to the population resident in Switzerland in 1999 and in 2004 (refreshment sample introduced in 2004), respectively. The variables used in creating weights were gender, age, Swiss region and nationality (more details on the technical descriptions of the weights can be found at http://www.swisspanel.ch/doc/methodology.php?lang=en&pid=8). All analyses were carried out using SAS Version 9.1.

10.3 Results

Prevalence of Physical Activity Behaviour and of Potential Determinants

Table 10.3 shows the prevalence of physical inactivity, sport club membership and education by age category. In both young men and women, the prevalence of inactivity, "no sport", complete inactivity, and non-membership in a sport club was increasing with age, particularly in the three younger age groups. Comparing genders, women were clearly less active than men of the same age group, particularly regarding exercising and sport club membership. Over all age groups, the median size-adjusted household income was 47 000 Swiss Francs (29 000 Euro). In the sample, 83.0% had Swiss nationality, including 11.7% with a second nationality. 26.8% were living in the French speaking, 69.7% in the German speaking and 3.5% in the Italian speaking region of Switzerland. In terms of sedentary activities, 62.0% of participants were using the Internet every day and 49.9% were reading every day.

Table 10.3 Prevalence of physical inactivity, sport club membership and education by gender and age categories

	Males					Females				
Age	14-16	17-19	20-22	23-26	all ages [a]	14-16	17-19	20-22 [b]	23-26	all ages [a]
N of observations	1322	1257	1026	909	4514	1332	1250	986	957	4525
Physical inactivity										
% inactive [b]	19.0	22.9	31.7	26.7	24.8	24.6	29.2	34.5	36.3	30.6
% "no sport" [b]	13.6	22.0	28.1	28.1	22.6	23.0	30.1	37.6	37.1	31.2
% completely inactive [b]	8.3	13.8	21.6	20.0	15.6	14.4	20.9	26.7	29.2	22.1
Sport club membership										
% members [b]	63.2	56.2	49.3	47.1	54.3	49.6	41.0	30.2	32.1	39.2
Education										
compulsory school	67.0	0.0	0.0	0.0	17.3	65.9	0.0	0.0	0.0	18.7
high school	12.6	20.8	2.7	0.4	9.6	15.9	29.5	5.2	0.3	13.9
apprenticeship, vocational low	20.4	74.0	60.1	47.5	50.7	18.2	63.8	56.3	51.1	46.5
vocational high	0.0	1.1	11.1	19.4	7.4	0.0	1.1	7.0	12.0	4.4
university	0.0	4.1	26.2	32.7	15.0	0.0	5.6	31.6	36.6	16.5

Pooled data over all eight waves (1999-2006)

[a] all *P* Values from Wald test (GEE) comparing age categories were significant in males and in females ($P < .0001$)

[b] all *P* Values from Wald test (GEE) comparing men and women within age categories were significant for no sport ($P < .005$), for completely inactive ($P < .04$), and for membership in a sport club ($P < .0001$). For inactive, *P* values were significant ($P < .005$) except in the age group 20-22 years ($P = .3$).

Prevalence of Changes in Physical Activity Behaviour

Analysis of the pooled data over all eight waves resulted in 11.1% of young men and 12.1% of young women becoming active from one wave to the following, and in 11.9% of men and 13.7% of women becoming inactive, respectively. 8.9% of men and 12.4% of women became active in sport, while 11.7% and 14.1% changed their exercise status to "no sport", respectively. In men, 7.1% became somewhat active and 9.4% became completely inactive. The corresponding numbers for women were 9.8% and 11.1%, respectively.

Figure 10.1 shows the proportions of changes in inactive, "no sport", and completely inactive between any two consecutive non-missing waves for young men and young women. For all waves, the proportion of physically active individuals who remained active (remaining active, remaining active in sport, remaining somewhat active) were higher in men than in women. The proportion of physically inactive individuals who remained inactive (remaining inactive, remaining "no sport", remaining completely inactive) were higher in women than in men. The overall spontaneous changes from active to inactive and vice versa were relatively stable over waves and similar in men and women, ranging mostly from around 10% to 15%.

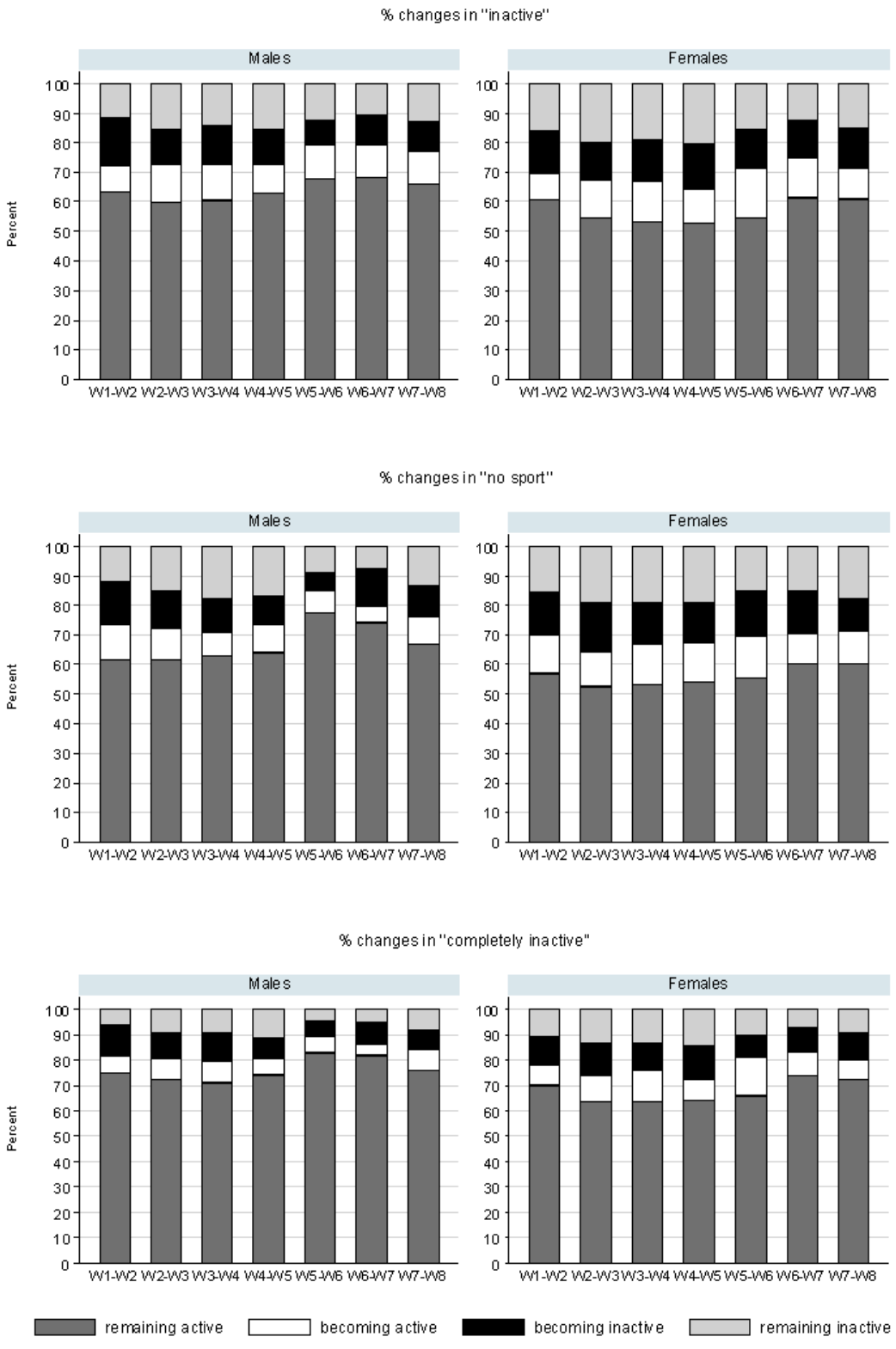

Figure 10.1 Prevalence of changes in physical activity behaviour by gender and wave, SHP 1999-2006

W1=1999, W2=2000, W3=2001, W4=2002, W5=2003, W6=2004, W7=2005, W8=2006.

There were significant differences between waves in the distribution of individuals within the four categories of changes in "no sport" in men ($P < .001$) and of changes in "inactive" in women ($P = .03$). In both genders the distribution of changes in "completely inactive" was significantly different between waves ($P < .01$).

Potential Determinants for Physical Activity Behaviour and Behaviour Change

To determine risk factors for inactivity and "no sport" and for changes in physical activity behaviour, selected time-variant and time-invariant determinants were included in the analysis. Table 10.4 shows the OR with 95% CI for inactivity and "no sport" for each variable separately (unadjusted) and adjusted simultaneously for all variables except education.

Table 10.4 Odds ratios for being physically inactive in young males and females

	men				women			
	"no sport"		inactive		"no sport"		inactive	
	unadjusted	adjusted [a]	unadjusted	adjusted [a]	unadjusted	adjusted [a]	unadjusted	adjusted [a]
Age category								
14-16 years	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
17-19 years	1.7 (1.3-2.2)	1.7 (1.2-2.3)	1.2 (0.9-1.5)	1.2 (0.8-1.6)	1.5 (1.3-1.8)	1.5 (1.1-2.1)	1.3 (1.1-1.5)	1.6 (1.1-2.2)
20-22 years	2.3 (1.8-2.9)	1.9 (1.4-2.8)	1.8 (1.5-2.3)	1.8 (1.2-2.4)	1.9 (1.5-2.4)	1.8 (1.3-2.6)	1.5 (1.2-1.9)	1.8 (1.2-2.5)
23-26 years	2.2 (1.7-2.9)	2.3 (1.5-3.5)	1.4 (1.1-1.8)	1.3 (0.9-2.0)	1.8 (1.4-2.3)	1.5 (1.1-2.2)	1.7 (1.3-2.1)	1.7 (1.2-2.6)
Sport club membership								
member	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
non-member	6.6 (5.4-8.1)	6.7 (4.9-8.9)	4.2 (3.5-5.0)	4.6 (3.5-6.0)	7.3 (6.0-8.9)	8.1 (5.7-11.4)	5.3 (4.4-6.5)	4.6 (3.3-6.4)
Education								
compulsory school	1.0		1.0		1.0		1.0	
high school	1.1 (0.8-1.5)		0.7 (0.5-1.0)		1.2 (0.9-1.6)		1.0 (0.8-1.3)	
apprenticeship, vocational low	2.1 (1.6-2.7)		1.5 (1.2-1.9)		2.2 (1.8-2.7)		1.9 (1.6-2.3)	
vocational high	2.0 (1.5-2.8)		1.6 (1.2-2.3)		1.2 (0.8-1.7)		1.0 (0.7-1.5)	
University	2.1 (1.6-3.0)		1.5 (1.1-2.0)		1.3 (1.0-1.8)		1.3 (0.9-1.6)	
Household Income								
Four higher quintiles	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lowest quintile	1.3 (0.9-1.7)	1.3 (0.9-1.9)	1.6 (1.2-2.0)	1.4 (1.0-2.1)	1.4 (1.1-1.8)	1.0 (0.7-1.4)	1.5 (1.2-2.0)	1.0 (0.7-1.4)
Nationality								
Swiss	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Non-Swiss	1.2 (0.8-1.6)	0.9 (0.5-1.5)	1.5 (1.1-2.0)	1.2 (0.8-2.0)	2.6 (1.9-3.4)	1.7 (1.1-2.7)	2.8 (2.1-3.6)	2.1 (1.3-3.2)
Language region								
German speaking	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
French speaking	1.1 (0.9-1.4)	1.1 (0.8-1.6)	1.7 (1.4-2.2)	1.6 (1.2-2.3)	1.5 (1.2-1.9)	1.4 (1.0-1.9)	2.4 (2.0-3.0)	2.2 (1.6-2.9)
Italian speaking	1.9 (1.1-3.5)	1.7 (0.7-3.8)	3.5 (2.1-5.8)	3.2 (1.6-6.2)	2.6 (1.5-4.3)	1.8 (0.9-3.7)	3.1 (2.0-4.8)	2.1 (1.1-3.8)
Internet use								
Rarely-never	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Every day	0.7 (0.6-0.9)	0.7 (0.5-0.9)	0.8 (0.7-1.1)	0.8 (0.6-1.0)	0.6 (0.5-0.8)	0.6 (0.5-0.8)	0.8 (0.7-1.1)	0.8 (0.6-1.1)
Reading								
Rarely-never	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Every day	1.0 (0.8-1.1)	1.0 (0.8-1.3)	1.0 (0.9-1.2)	1.0 (0.8-1.3)	0.9 (0.8-1.0)	0.7 (0.6-0.9)	0.9 (0.8-1.0)	0.8 (0.6-0.9)

All estimates and 95% CI are based on the pooled data using the GEE model with a pair-wise log ORs for the within-subject correlation, $n_{\text{male participants}}$=1534; $n_{\text{female participants}}$=1534)

[a] adjusted for all variables displayed in the table except education

Age higher than 16 years was a significant predictor for "no sport" in both genders and for "inactive" in women. In both genders, the (unadjusted) risk-enhancing effect of not being a member in a sport club was considerable for "inactive" (OR_{men} 4.2, 95% CI 3.5-5.0; OR_{women} 5.3, 95% CI 4.4-6.5) and even more so for "no sport" (OR_{men} 6.6, 95% CI 5.4-8.1; OR_{women} 7.3, 95% CI 6.0-8.9). In the full model adjusting simultaneously for all potential determinants (except education), the effect of sport club membership became even stronger (see Table 10.4). There was a tendency towards higher risks of inactivity and "no sport" among individuals living in households in the lowest quintile of income, however most OR were not significant. In the adjusted model, Non-Swiss nationality was a significant predictor for "inactive" (OR 2.1, 95% CI 1.3-3.2) and "no sport" (OR 1.7, 95% CI 1.1-2.7) in females only. The risk of being "inactive" was significantly higher in the French and Italian speaking regions compared to the German speaking one in men and in women even after adjusting for covariates. For "no sport" in the adjusted model, the risk was higher only for females in the French speaking part (borderline significance). Daily internet use was a protective factor for both outcomes and both genders (though borderline significant for "inactive" in males and non-significant for "inactive" in females) when adjusted for covariates. Daily reading was protective only in women. If education was also introduced in the multivariate model, all age categories became non-significant for both outcomes.

Table 10.5 shows the risk of becoming "no sport" or "inactive" for previously active individuals, including selected determinants, unadjusted and adjusted for all variables except education. In the adjusted model, age was no longer a significant predictor for becoming "inactive" or "no sport", neither in men nor in women. The risk of becoming "inactive" or "no sport" was clearly higher (with OR of up to 12) in both individuals who remained outside a sport club and those who had left one in the year preceding the observation (see Table 10.5). Compared to individuals who remained outside a sport club, those who had joined one had a slightly elevated risk of becoming inactive (men only, OR 2.7, 95% CI 1.1-6.3) and "no sport" (women only, OR 2.7, 95% CI 1.1-7.0), respectively. A lower household income was a borderline significant predictor for changing the exercise status to "no sport" in young men (OR 1.9, 95% CI 1.0-3.5). Nationality was not a significant predictor in the adjusted model neither in young men nor in young women. For young women, the risk of becoming "inactive" and "no sport" was significantly higher in the Italian speaking compared to the German speaking part of Switzerland. In the French speaking part the risk was only elevated for becoming "inactive". For young men, neither risk was related to linguistic region in the adjusted model. Daily internet use was a protective factor for becoming "inactive" and "no sport" in women but not in men. Daily reading was not associated with changes neither for "no sport" nor for "inactive" in both genders.

Table 10.5 Odds ratios for becoming physically inactive in previously active young males and females

	men				women			
	becoming "no sport"		becoming inactive		becoming "no sport"		becoming inactive	
	unadjusted	adjusted [a]	unadjusted	adjusted [a]	unadjusted	adjusted [a]	unadjusted	adjusted [a]
Age category								
14-16 years	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
17-19 years	1.7 (1.1-2.4)	1.7 (0.9-3.3)	1.3 (0.9-1.9)	1.0 (0.5-1.8)	0.9 (0.7-1.3)	0.9 (0.5-1.6)	1.1 (0.8-1.5)	1.2 (0.8-2.0)
20-22 years	2.0 (1.3-3.0)	1.7 (0.9-3.3)	1.8 (1.1-2.6)	1.7 (0.9-3.1)	1.1 (0.8-1.5)	1.1 (0.6-2.1)	1.3 (0.9-1.8)	1.4 (0.8-2.6)
23-26 years	1.9 (1.2-2.9)	1.8 (0.9-3.5)	1.3 (0.9-2.0)	1.2 (0.6-2.4)	1.1 (0.7-1.5)	0.7 (0.4-1.3)	1.4 (1.0-2.0)	1.5 (0.8-2.6)
Sport club membership								
remaining member	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
becoming member	1.4 (0.7-2.7)	1.3 (0.4-3.3)	2.1 (1.2-3.7)	2.7 (1.1-6.3)	1.5 (0.8-2.8)	2.7 (1.1-7.0)	2.1 (1.2-3.6)	1.6 (0.7-3.7)
becoming non-member	7.4 (4.9-11.0)	7.8 (4.4-14.0)	5.6 (3.9-8.1)	5.9 (3.4-10.5)	7.0 (4.5-11.1)	11.9 (5.9-24.1)	5.4 (3.5-8.5)	5.1 (2.7-9.6)
remaining non-member	9.2 (6.6-13.1)	7.8 (4.7-12.9)	5.2 (3.7-7.4)	5.1 (3.1-8.4)	10.7 (7.3-15.6)	12.4 (6.4-24.1)	7.9 (5.4-11.3)	6.9 (4.0-11.8)
Education								
compulsory school	1.0		1.0		1.0		1.0	
high school	0.4 (0.2-0.8)		0.4 (0.2-0.8)		0.8 (0.5-1.3)		1.0 (0.6-1.7)	
apprenticeship, vocational low	1.7 (1.1-2.7)		1.4 (0.9-2.3)		1.4 (0.9-2.0)		1.9 (1.3-2.9)	
vocational high	1.4 (0.7-2.6)		1.7 (0.9-3.2)		1.0 (0.5-1.9)		1.2 (0.6-2.4)	
University	1.4 (0.8-2.3)		1.0 (0.6-1.7		0.7 (0.5-1.2)		1.2 (0.8-2.0)	
Household Income								
Four higher quintiles	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lowest quintile	1.6 (1.1-2.4)	1.9 (1.0-3.5)	1.5 (1.0-2.3)	1.1 (0.6-2.1)	1.5 (1.1-2.1)	0.9 (0.5-1.6)	1.4 (1.0-2.0)	1.1 (0.6-1.7)
Nationality								
Swiss	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Non-Swiss	1.2 (0.8-2.0)	0.7 (0.3-1.5)	1.8 (1.1-2.8)	0.8 (0.4-1.9)	1.9 (1.1-3.3)	1.2 (0.5-2.7)	2.1 (1.2-3.2)	0.5 (0.2-1.3)
Language region								
German speaking	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
French speaking	1.0 (0.8-1.4)	1.3 (0.7-2.1)	1.7 (1.2-2.3)	1.4 (0.8-2.3)	1.4 (1.0-1.9)	1.4 (0.9-2.3)	2.1 (1.5-2.9)	1.8 (1.2-2.8)
Italian speaking	1.4 (0.6-2.9)	1.1 (0.4-3.3)	2.6 (1.3-5.4)	2.2 (0.8-6.1)	4.3 (2.1-8.7)	4.6 (1.5-14.3)	5.3 (2.3-12.2)	na [b]
Internet use								
Rarely-never	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Every day	0.7 (0.4-1.1)	0.6 (0.4-1.1)	0.8 (0.5-1.3)	0.8 (0.5-1.4)	0.6 (0.4-0.9)	0.5 (0.3-0.7)	0.7 (0.5-0.9)	0.7 (0.5-0.9)
Reading								
Rarely-never	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Every day	1.0 (0.7-1.3)	1.2 (0.8-1.9)	1.0 (0.7-1.3)	1.1 (0.8-1.7)	0.9 (0.7-1.2)	0.8 (0.5-1.3)	1.0 (0.8-1.3)	0.7 (0.5-1.1)

All estimates and 95% CI are based on the pooled data for the one year outcome conditional to previous physical activity level using the GEE model with an independent correlation structure for the within-subject association. Only observations were included with data for the preceding wave in individuals previously active in sports ($n_{male\ participants}$=951; $n_{female\ participants}$ =931) or previously active ($n_{male\ participants}$=933; $n_{female\ participants}$ =936)

[a] adjusted for all variables displayed in the table except education

[b] OR=12.7 (2.6-61.5), due to small numbers estimates become unreliable

10.4 Discussion

The Swiss Household Panel gives the opportunity to observe changes in physical activity behaviour over time and to assess potential determinants of physical activity behaviour and of behaviour changes. As observed in other studies [218], the data suggest an increase in inactivity levels with age for both young men and young women. In each age group, inactivity levels were lower in men than in women. The prevalence of membership in a sport club was higher among younger than among older individuals, and in each age group the proportion of members was higher in men than in women. A further finding of this longitudinal study was that, irrespective of age and gender, spontaneous changes from inactive to active and vice versa occurred between any two consecutive waves in the range of about 10% to 15%. Spontaneous changes from active to inactive were generally slightly more frequent than from inactive to active resulting in the observed overall decline in physical activity levels with age. Such spontaneous changes should be taken into account when planning physical activity intervention studies, especially regarding the calculation of sample sizes necessary to detect the expected effects.

The correlation between sport club membership and exercising in the cross-sectional analysis was not surprising in its nature [213], but in its strength (OR of 6.7 in young males and 8.1 in young females). For previously active individuals, leaving a sport club increased the risk of becoming "no sport" by a factor of 7.8 in young men and 11.9 in young women, risks comparable to the ones of permanent non-members (7.8 and 12.4, respectively). These findings can be expected because of the fact that structured sport activities are to a large extent carried out in the context of sport clubs. The lower but slightly increased adjusted risk of becoming "no sport" (women only) and becoming inactive (men only) among subjects who had joined a sport club may suggest a lag effect of previous non-membership. The most important findings of this study were the still strong effects of sport club membership on moderate physical activity with OR of 4.6 in both young men and women in the cross-sectional analysis (Table 10.4) and between 5.1 and 6.9 in the longitudinal analysis (Table 10.5). These effect sizes, derived from the multivariate models adjusting for other potential risk factors, were even bigger than the ones from the univariate analysis, indicating that it is necessary to control for possible confounding through other variables such as age or linguistic region.

The definition used for "inactive" was rather restrictive (less than one day of at least 30 minutes of moderate physical activity per week). When using a less restrictive definition (e.g. 0-1 day/week or 0-2days/week), the direction of the associations remained the same, although their strength was generally weaker (data not presented).

The Swiss Household Panel data allow to explore longitudinal physical activity patterns and changes above the cross-sectional dimension with its inherent limitations of causal inference and potential cohort bias. Its longitudinal aspect made it possible to model the conditional impact of changes in sport club membership on physical activity status in the following wave. It cannot be excluded that the effect observed in these data may not be exclusively causal and that losing interest in physical activity may be the reason for both leaving a sport club and declines in sport and physical activity levels. While such mechanisms are likely, they do not fully explain the strength of the

associations observed in this study and they do not nullify the important role of sport clubs for physical activity behaviour of young men and women in Switzerland. This role includes not only the provision of the physical environment necessary for many sports, but also qualified instruction and social support.

Compared to sport club membership, all other covariates included in the multivariate model were either non-significant or had much smaller effect sizes. Age was a predictor of being "inactive", but not of becoming "inactive", suggesting a more or less continuous decline after controlling for covariates. Low household income and a foreign nationality had an influence in subgroups, but it has to be taken into consideration that the survey only included subjects able to participate in a lengthy interview in German, French or Italian. Moreover, immigrants of lower socio-economic status are expected to be under-represented. If a more restrictive definition of nationality was used, namely exclusively Swiss instead of Swiss with a second nationality versus all others, stronger associations were detected (data not shown). Sedentary behaviour expressed as daily Internet use and daily reading was protective of being or becoming physically inactive rather than representing a risk. The discrepancy of these findings with other studies identifying sedentary behaviour as a risk factor [218] may be due to the choice of indicators which might be correlates of higher socio-economic status or higher intellectual activity. Moreover, different types of sedentary behaviour may show different associations with physical activity behaviour [226]. For example, a positive correlation with physical activity has been reported for "productive" sedentary behaviours including reading/doing homework and working on a computer [223], and for reading in both young men and young women in one study [225], and in young females but not in males in another study [226].

Education was not included in the multivariate models because of its strong correlation with age. For example, compulsory school is only attended up to age 17 years, and the youngest age to start university is 18 years. However, there may also be a socio-economic influence on education, with young adults from higher socio-economic backgrounds being more likely to go to high school and university. It was beyond the scope of this article to disentangle these aspects and to look at changes in educational tracks preceding changes in physical activity behaviour. Thus it was not possible to clarify the role of education as a potential confounder or as an intermediate factor on the causal pathway between age and physical activity. However, these questions may be explored in further analyses.

Strengths of the study were the large nationally representative sample, the possibility to analyse the data both cross-sectionally and longitudinally, and the number of years of follow-up. A limitation was the simple and global self-report measure used for physical activity assessment that did not allow reference to the current physical activity recommendations. Furthermore, the definition of moderate activities ("activities that get you at least a little bit out of breath") may have led to underreporting of light moderate activities. However, examples of moderate activities were provided such as brisk walking, gardening or dancing. Individuals engaging in moderate physical activity for a duration of less than 30 minutes per day could not be identified. There are no directly comparable data from the Swiss Health Survey, however the proportion engaging in at least 30 minutes of moderate physical activity on five or more days per week in the present study (8.3% in young men and 7.4% in young women) seems quite low. This was also a reason why different cut-offs were used to define active and inactive individuals,

even though no reference to the physical activity recommendations was possible. It would have been ideal to include TV viewing as a sedentary activity, however data on TV viewing were only available for 1999 and could thus not be included in these analyses. An important limitation of panel data is attrition (loss-to-follow-up) which can introduce a potential bias when it occurs differentially. However, among participants followed for several waves and among those followed only for one or two waves, the level of physical activity at the initial wave was very similar indicating that there was no differential attrition with regard to physical activity. In addition, as physical activity is only a minor topic in the household panel, it is unlikely that individuals dropped out because of physical activity behaviour changes. Furthermore, other factors that might cause higher drop-out rates in some population sub groups (such as socio-economic status and nationality) did not appear to be strongly correlated with physical activity behaviour in our study sample.

Conclusions

The study provides insight into the natural history of physical activity at the population level by presenting estimates of spontaneously occurring changes normally cancelled out in repeated cross-sectional surveys. In addition, it highlights the important role of sport clubs for sport activities and exercising and also for general physical activity in young people in Switzerland. More accurate measurements of physical activity and studies in other countries will allow to judge whether these findings can be generalised.

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PART VI

GENERAL DISCUSSION AND CONCLUSIONS

11 Discussion and Conclusions

11.1 Initial Situation

Physical inactivity is one of the important causes contributing to the chronic disease epidemic. Only 41% of the adult population in Switzerland meet the physical activity recommendations [58]. Therefore effective interventions are needed to increase physical activity on the population level. More traditional approaches in physical activity promotion include population-based structured activities such as local physical activity courses. With increasing use of computer and Internet technology, Internet-based computer-tailored approaches have become popular for the provision of personal counselling and support, because of the possibility to tailor motivational feedbacks to specific characteristics of individuals without the necessity of expensive face-to-face contacts.

Several physical activity promotion programmes exist in Switzerland on different levels (national, regional, in specific settings such as workplaces, schools, and primary care), including the Internet-based approach Active-online. However, evaluation of physical activity interventions does not have a great tradition in Switzerland, and only few interventions have been evaluated to some extent. Moreover, in Switzerland as well as internationally, not much is know about the effectiveness of the new generation of Internet-based tailored physical activity interventions when delivered in a real-world setting, since the few studies in this field have mainly tested the efficacy of an intervention in a controlled setting with small sample sizes. Therefore, the purpose of this thesis was to evaluate Active-online in a formative and summative way, monitoring users' characteristics and patterns of use and investigating the effectiveness of the programme in a real-life setting using a RCT design. Furthermore, the scientifically thorough approaches used to evaluate Active-online have been contrasted with more pragmatic evaluation approaches used to evaluate Allez Hop, another Swiss national programme to promote physical activity in the general adult population offering local physical activity courses by qualified course instructors.

11.2 Main Findings

The main findings of the thesis are summarised below structured along the objectives and representing the chronology of the chapters. The specific results are discussed in detail in the respective chapters.

Objective 1: To give an overview of Internet-based physical activity interventions including their strengths and limitations, and to review the evidence regarding their effectiveness.

- **The Internet has a great potential in different fields of physical activity and sport, and its importance in this field is likely to grow further as Internet penetration increases.** Today, the Internet and other information technologies are well established in a number of implementations in physical activity and sport, such as the development of equipment, technical training, membership management for clubs, promoting events, and providing access to results. Furthermore, these technologies also have a great potential in different new fields, such as support for sport and physical activity providers and professionals, facilitating access to offers and facilities, individual motivational counselling and support for becoming physically active, and exercise-generating video games. New developments can be expected to evolve in the future, and a combined application of different technologies may also be a likely development.
- **Evidence on the effectiveness of (Web-based) computer-tailored physical activity interventions is sparse and equivocal.** Computer technology has opened new possibilities for individual counselling without the necessity of face-to-face contacts. While first generation computer-tailored interventions have been delivered on paper, second generation interventions use new technologies such as the Internet to deliver the individual feedbacks. The Internet has proven feasible and useful to deliver computer-tailored physical activity interventions to individuals, and these kinds of interventions have become popular during recent years. However, reviewing the existing literature has shown that the evidence on their efficacy (based on studies carried out in controlled settings) is equivocal. Moreover, not much is know about the effectiveness of such interventions when delivered in an open access, real-life setting.

Objective 2: To assess the effectiveness of Active-online compared to a nontailored website in a Web-based RCT as part of the summative evaluation.

- **The Web-based individually tailored intervention Active-online was not more effective in increasing self-reported physical activity levels in a sample of media-recruited volunteers compared to a nontailored information website over 13 months, and no increases in physical activity behaviour were observed according to objective measures.** These results were obtained in a Web-based RCT in a real-life setting using a minimal contact strategy and open access delivery of the intervention over the Internet. Self-reported physical activity increased in spontaneous users of Active-online. However, objective measures based on accelerometers in a subgroup of study participants did not support the increases in self-reported activities, emphasising the importance of using objective measures when evaluating the effectiveness of physical activity interventions.

- **The individual use of Active-online in the setting of the effectiveness study was relatively low in general.** There was a tendency of higher intervention use resulting in greater behavioural changes. However, this association was attenuated when adjusted for stages of change according to the TTM at baseline, indicating that stage of change was both associated with the use of the intervention and with changes in physical activity behaviour, and was thus a confounder. Low adherence to Web-based interventions when they are delivered in an open access uncontrolled format seems to be a common problem.

Objective 3: To carry out an in-depth analysis of the user characteristics and patterns of individual use of Active-online as part of the formative evaluation.

- **Adherence to Active-online, patterns of use, attrition and repeated participation were differential in participants of the effectiveness trial and in open access users.** Furthermore, registered open access users showed higher adherence compared to both unregistered users and trial participants. On the other hand, attrition was lower in trial participants: While two thirds of trial participants returned to Active-online for repeated visits, only one quarter of registered open access users did so, indicating that specific elements of the intervention such as reminder emails (with the same content) may not have the same effect depending on the context of intervention delivery. These differences in intervention adherence, attrition and repeated use are important when interpreting and generalising results of RCTs assessing the efficacy or effectiveness of an intervention in a specific sample, because they decrease the external validity of a RCT.
- **The proportion of women visiting Active-online increased from just below 50% in 2003 to more than 60% in 2009, while the patterns of individual website use were relatively stable during the same time period.** The mean age of visitors was around 40 years and the proportion meeting the HEPA recommendations was around 40% during the whole time period. Even though there were some differences in the use of Active-online according to different variables such as the number of pages viewed, the median time spent in the tailored modules, the proportion of visits when a tailored module was started, and the proportion of visits when at least one tailored feedback was obtained, there was no clear trend towards increasing or decreasing adherence over time in general.

Objective 4: To summarise the stepwise approaches used in the evaluation of Allez Hop, to approach the question of a population impact of Allez Hop, and to present a new and innovative approach for the routine evaluation of Allez Hop courses using a semiautomated Web-based tool.

- **Several stepwise evaluations were conducted during a decade of Allez Hop on different levels (course participants, instructors, partners, stakeholders, population).** However, there was no long-term evaluation concept and no continuing responsibility for evaluations.

- **Evidence for changes in physical activity behaviour in Allez Hop course participants was limited due to methodological challenges. However, indications for behavioural changes were observed in the main user group of Allez Hop (middle-aged women) on the population level.** Even though these data do not allow a causal link to specific programmes, they give some indication of a possible impact on the population level. Furthermore, Allez Hop has been successfully implemented for more than a decade, reaching a high proportion of insufficiently active individuals and a high degree of acceptance and appreciation in participants as well as in the general population. Continuing implementation and an overall evaluation concept are desirable in large population-based programmes like Allez Hop, however this often proves to be difficult.
- **A semiautomated Web-based system was shown to be feasible for the routine evaluation of Allez Hop courses, however, participation rate on the course level was unexpectedly low during the open setting.** Participation was considerably higher during the pilot phase in a regional setting with strong encouragement of the instructors to participate. Nevertheless, data collected during the open setting was not different from data collected during the pilot phase. Providing the course instructors with an individual feedback report on their course as an incentive to participate in the evaluation did not seem to increase participation rates in the open phase. More information and promotion of this Web-based evaluation tool would probably be needed to increase participation.

Objective 5: To assess the size of spontaneous changes that occur in physical activity behaviour in individuals over time (without a specific intervention), with potential consequences for research addressing physical activity behaviour as the outcome.

- **Spontaneous changes in physical activity behaviour in individuals between two surveys one year apart occur in the range of 10% to 15%.** These changes from inactive to active and vice versa have been shown to be consistent across survey years (any two consecutive surveys between 1999 and 2007) and across age and gender. Even though in this thesis (Chapter 10) spontaneous changes have only been assessed in young individuals up to the age of 26 years, it has been shown in a preliminary analysis using the data from the Swiss Household Panel including all age groups that the size of spontaneous changes can be expected to be similar in older age groups [230]. It is important to be aware of such spontaneous changes, and they should be taken into account when calculating sample sizes in intervention studies and evaluations using self-report measures.

In conclusion, Active-online and Allez Hop are two different programmes for the promotion of physical activity in Switzerland, and different approaches have been used to evaluate the programmes. However, the evaluations have produced useful results for both programmes irrespective of design and methods applied. Different evaluation designs and methods are associated with different advantages, challenges and limitations.

Methodological challenges in programme evaluation in general, and related to Active-online and Allez Hop, will be discussed in detail in the following part (Chapter 11.3).

11.3 Methodological Challenges in the Evaluation of Public Health Interventions

General Issues

Experimental research designs like RCTs are common in clinical research, and there is general consensus that RCTs are the gold standard in the evaluation of medical technologies such as drugs, vaccines, etc. [88]. Due to random and ideally blinded allocation of treatment, observed changes between pretest and posttest assessments can be more reliably attributed to the effects of the intervention and thus internal validity is maximised. Moreover, if the association of interest is relatively simple and straightforward, such as the administration of a drug that leads directly to a defined biological response, clinical trials are very useful to provide evidence on the causal pathway. An increasing number of high-quality RCTs - in combination with the wide availability of computer and Internet technology to search for and access latest evidence - were a driving force for the development of evidence-based medicine [231], resulting in great improvements regarding methods and quality of available evidence in clinical research [87].

Based on the paradigm of evidence-based medicine, a similar approach has evolved in public health. Evidence-based public health has been defined in 1997 as the appropriate use of current best evidence to make decisions about the care of communities and populations in the domain of disease prevention and health promotion [232]. A later definition has taken up these issues but has in addition emphasised the community role in evidence-based public health [231]. Historically, public health has been evidence-based especially in the domains of health protection and disease prevention (e.g. control of noxious agents, screening) [232]. However, one of the greatest challenges of the evidence-based public health approach appears in the domain of health promotion due to inherent characteristics of health promotion in contrast with disease prevention [232]. Furthermore, in addition to evidence, "politics and timeliness" also play an important role in public health decision making [231].

The success of the efforts in clinical research encouraged the extension of RCT designs to the fields of public health and health policy, and RCTs have increasingly been promoted for the evaluation of public health interventions [87]. However, public health interventions are usually much more complex and they operate on behavioural, environmental and social levels. An adaptation of the RCT design for the evaluation of complex public health interventions is not straightforward, and evaluation of such interventions is difficult for several reasons:

- Complex public health interventions are often multifactorial and combine several different components, which causes problems identifying and separately assessing the effects of various components of the intervention [233].

- The causal pathways for public health interventions involve not just biological but also behavioural steps that need to be understood and measured in order to demonstrate a logical sequence between intervention and outcome [87].
- There is usually a time-lag between the intervention and the outcome(s) of that intervention [232, 234].
- Public health interventions, even if applicable in individuals, need to be applied over populations to be effective [88].
- Public health interventions usually involve long and complex causal pathways, and pathways can furthermore be affected by numerous characteristics of the population, the health system, or the environment [87]. In epidemiological terms, such a varying intervention-outcome association based on the presence or absences of external characteristics is called "effect modification" [87].
- While internal validity may be maximised using RCT designs, there are important restrictions to the external validity of RCTs for complex public health interventions [87]. Results cannot be generalised if trials are carried out under highly controlled conditions with motivated staff and participants.
- The implementation of public health interventions in large-scale studies is often imperfect regarding compliance and contamination between groups [87], and therefore, even if an intervention proved efficacious in a controlled setting, the real-life effectiveness can differ greatly.

It has therefore been argued that RCTs are often inappropriate for the scientific assessment of the performance and impact of large-scale interventions aimed at changing behaviours, and that, although evidence-based public health is possible and desirable, it must go well beyond RCTs [87].

On the other hand, RCTs may not always be extremely rigorous and controlled. The concept of "explanatory" and "pragmatic" trials has been introduced more than 40 years ago by two French statisticians, Schwartz and Lellouch (1967) [235] but has been taken up more recently [236] including a reprint of Schwartz and Lellouch's article in 2009 [237]. Trials aimed at confirming a physiological hypothesis specified as a causal relationship between administration of an intervention and some physiological outcome are called explanatory trials, while trials aimed at informing a clinical, health service or policy decision, where this decision involves the choice between two or more interventions, are called pragmatic trials [236]. While explanatory trials have an important role in providing knowledge, pragmatic trials try to maximise applicability of the trial's results to usual care settings [236]. In other words, explanatory trials test the efficacy of an intervention in an ideal situation, and pragmatic trials focus on the effectiveness. However, rather than a dichotomy there may be a continuum between explanatory and pragmatic trials [236]. It has recently been suggested that more trials should have a pragmatic attitude [236].

Other methods and data sources have been described to be suitable for evaluations of physical activity interventions [84]. The choice of adequate methods and designs may depend on the intervention, the target group, the stakeholders, the information needs, as well as on available resources. Ideally, several designs with different strengths and limitations should be combined [84].

Issues regarding the Evaluation of Web-based Interventions

There is a strong argument that Web-based interventions should also be evaluated online to maximise external validity [238]. Advantages of online evaluations are that participants can be recruited from diverse geographic regions, that no costly and time-consuming face-to-face contacts are necessary, and that administration of intervention and control conditions as well as collection of outcome measures can be completely automated [239]. However, online evaluations of Web-based interventions are prone to specific challenges. Online RCTs face methodological issues common to all trials but often altered by the change in context from face-to-face to online [238]. In addition, some problems may be unique to online trials, such as spamming [238] or the risk of contamination if the control group is accessing similar interventions somewhere else on the Internet [239]. Experiences in online recruitment have varied, some studies have succeeded in recruiting large sample sizes while others have not [238]. Randomisation has some advantages in online trials, for example, researchers cannot subvert the fully automated randomisation process, and it can be ensured that randomisation takes place after the baseline assessment [238]. However, a problem may be that participants can easily re-register using a different identity, therefore efforts are needed to minimise repeated registration of the same individuals.

There may be differences in online compared to conventional trials regarding the delivery and uptake of the intervention. On one hand, the Web-based intervention is standardised (even if tailored) in that there is no personal effect or a departure from the delivery protocol, which may be the case in personal counselling situations [238]. On the other hand, participants are completely free to use the intervention, and non-use is a recognised problem [168]. High drop-out rates regarding follow-up data assessments have also been named a common problem in online trials [168]. There are no general solutions to address this issue. While some studies could increase response by using postal or telephone reminders or by offering incentives, others could not [238]. Data quality and item non-response may be other threats of validity in both conventional and online trials. Online assessed data cannot be verified, but by assuring that randomisation takes place after baseline assessment, no systematic bias should be introduced if invalid data is entered [238]. Item non-response can easily be prevented during the programming of the online questionnaire by including mandatory questions. Other potential problems in online trials may occur in terms of technology, for example, programming the study website to be compatible with different browsers, and loss of data due to technical problems. Furthermore, assessing data other than self-report is not possible. Therefore, combinations of Web-based self-reported data assessments and other methods may be necessary. For example, sending accelerometers to study participants by mail as we did in our RCT on the effectiveness of Active-online may be a way to combine an automated Web-based study design with objective measures without the need of face-to-face contacts.

Issues regarding the Evaluation of Physical Activity Interventions

Challenges in the evaluation of public health interventions also depend on the health behaviour that is targeted with the intervention. Complex behaviours may introduce additional challenges. Physical activity is a complex

construct consisting of a variety of behaviours such as transport-related, work-related, and domestic activities, as well as leisure time activities including sport participation.

Therefore assessment is a specific issue in the evaluation of physical activity interventions. Physical activity is a multidimensional behaviour and no single assessment method or tool can capture all of its dimensions [43]. Moreover, there is no consensus "gold standard" for the measurement of physical activity [43], and different methods are prone to different limitations. In fact, it has been argued that no single method of physical activity assessment fully meets the criteria of being reliable, valid, practical, and non-interfering with usual activity [43]. In large surveys usually self-report instruments are used (some of which have been validated), while objective methods such as accelerometers are mostly used in smaller samples only. Accelerometers can overcome some of the limitations inherent to questionnaires (e.g. recall bias, social desirability), however they are not without problems either (inadequate assessment of upper body movements, cycling, swimming, loss of data due to malfunction or technical problems, lack of information regarding the context of physical activity, high costs, choice of cut-offs, and possibly influencing physical activity behaviour of participants). The choice of the most adequate measurement method also depends on the research question, the context of the study, and the constraints imposed by sample size, time, setting, and budget [43].

It might be tempting to simply ask people whether they engage in sufficient physical activity. However, the cut-off between sufficient and insufficient physical activity is not evident for many individuals. For example, the percentage of individuals able to choose correctly both the amount and the intensity for the moderate-intensity physical activity recommendations from a list of five and four options, respectively, was 16.9% according to the Swiss HEPA survey 2001 (N=1535) [29]. Similarly, the respective proportion was 18.3% in participants of the RCT described in Chapter 5 (N=1531, data not shown). Furthermore, around one quarter of the RCT participants classified as sufficiently active according to self-reported measures believed that they did not engage in sufficient physical activity for health, and a similar proportion of individuals classified as insufficiently active believed that they engaged in sufficient physical activity (data not shown). Data from the HEPA survey 2001 revealed that even 45.3% of insufficiently active individuals assumed to be sufficiently active [29], however the items to assess physical activity differed slightly in that survey [30].

Reflections on the Methods Used in the Evaluation of Active-online

Active-online was designed as a research project and evaluation played an important role from the beginning. The development of Active-online incorporated several formative evaluation steps [15-17, 90], and an outcome evaluation was rigorously planned after the programme was launched in 2003 with a feasibility study testing the design of a Web-based randomised effectiveness trial [79]. A considerable amount of time and resources was put into the outcome evaluation focusing not only on short-term but also on longer-term results. The main RCT presented in Chapter 5 may be described as a “pragmatic” rather than an “explanatory” trial. It was not the purpose of the trial to test the efficacy of Active-online under ideal and controlled conditions, but rather to test the effectiveness under real-life conditions: Study data assessment as well as intervention delivery were Web-based, there were no face-to-face contacts, and study participants were free to use the intervention. Such a study has

several advantages. For example, it has been argued that a Web-based intervention should also be tested using a Web-based study design [238]. Furthermore, it was expected that the adherence of trial participants may be comparable to the adherence that can be expected in open access users due to the similarity of the settings. However, as reported in our study comparing use of and adherence to Active-online in open access users and trial participants (Chapter 6), this was not the case, and trial participants' adherence during the first visit was even lower compared to open access users. Moreover, the feasibility study did not indicate that low adherence may be a problem [79], indicating that conducting a feasibility study does not eliminate all potential pitfalls.

To conduct the RCT over the Internet caused some problems. The system was automated, and email invitations for follow-up assessments were sent out automatically termed to each study participant's starting date. Automatisation involves potential risks, for example programming errors that may not be spotted immediately. In our study, reminder emails to revisit Active-online for participants of the intervention group and for spontaneous users were not sent out on time due to a technical problem, and this was not realised immediately despite extensive programmer's security checks. Due to the anonymous nature of a Web-based trial with contacts only by email, it is difficult to reach high response rates [168]. In our study, response was not extraordinary but realistic in comparison with other Web-based surveys [153].

For the recruitment of participants, similar channels were used as for the dissemination of Active-online (advertisements in newspapers, magazines, and on websites) with the aim to recruit individuals similar to spontaneous users of Active-online. Participants were explicitly recruited into a physical activity study and not into a general health study (which was the recruitment strategy in the feasibility study [79]). It is likely that with this approach the recruited individuals were more interested in physical activity, however the same can be expected of spontaneous Active-online users. Comparing trial participants with spontaneous users, there were some differences, e.g. regarding age and smoking habits. Recruiting the right target group has also been named as one difficulty in the evaluation of online interventions [153, 238]. Differences between the study population and the target population of an intervention will reduce external validity of the trial and thus limit generalisability.

Our effectiveness study does not give any indications regarding the efficacy of the programme under ideal conditions. The fact that there was a tendency of higher intervention use resulting in larger behavioural changes (even though this association disappeared when adjusting for stage of change at baseline) may point in this direction. Formally, efficacy should be tested in an optimal setting using a RCT design. However, we decided to concentrate our efforts and resources, and it may be argued that knowledge about the efficacy does not contribute much if real-life adherence differs vastly from that under optimal conditions.

A RCT assessing the efficacy or effectiveness is not sufficient for the evaluation of public health interventions. As suggested in the RE-AIM framework [6], other dimensions such as reach, implementation, and adoption should play a role as well. The formal process evaluation during the development of Active-online was important to adapt the programme to the needs of visitors, to learn about difficulties that users may encounter (including technical problems such as browsers that were not compatible with the programme), and to optimise the final version of the programme accordingly, but also to assess whether the target group could be reached. In addition to assessing

the reach of Active-online and the engagement of its visitors, the in-depth analysis of the users over time and the comparison of open access users and trial participants (Chapter 6) gave more information on challenges regarding the dissemination and implementation of Web-based physical activity interventions. These include low rates of repeated visits, short visit duration, a relatively low proportion of visitors starting the tailored modules, and even fewer getting a tailored feedback, as well as the need for resources in order to promote the programme to a large audience. The analyses emphasised especially that even in a "pragmatic" trial attempting to mirror real-life conditions as close as possible, adherence may differ between trial participants and open access users. This issue has to be considered when interpreting results of randomised effectiveness trials.

In summary, Active-online is one of the best evaluated physical activity promotion programmes in Switzerland. The different evaluation steps were carefully planned on a long-term basis and, when feasible, using rigorous designs. The evaluation of Active-online has provided knowledge and evidence regarding 1) the optimisation of the programme, 2) its reach and implementation, 3) the real-life effectiveness of the programme in a large group of volunteers and spontaneous users including self-report and objective measures of the outcome, 4) challenges associated with the real-life delivery, and 5) the feasibility of using a Web-based randomised study design for the large-scale outcome evaluation. Evidence from the evaluations does not indicate that more financial resources for Active-online would be justified at the moment. We could not provide information regarding the different elements of Active-online (some may be more important regarding effectiveness), and it is not completely clear why Active-online was not effective in an open access setting, although low adherence to the intervention may be one reason.

Reflections on the Methods Used in the Evaluation of Allez Hop

Allez Hop was a typical large-scale population-based public health programme with restrictions regarding the methods feasible to use in evaluations. The evaluation questions during the earlier years of the programme were driven by the specific information needs of the different players and less by scientific interest. Some of the results were not even available to all project partners. Evaluation approaches during the implementation of Allez Hop may be described as pragmatic, focusing especially on short-term results. More weight was put on formative evaluation, assessing the characteristics, expectations and satisfaction of course participants, the experiences of instructors, and of partners and sponsors. Due to the programme starting as an implementation rather than a research project, measuring behavioural changes was not a priority. There were some financial resources attributed to evaluation, but there was no long-term evaluation concept. Due to changes in sponsorship, there was also no continuing responsibility for the evaluation of the programme. However, data obtained in the different steps of process evaluation were very valuable and important to convince stakeholders and partners of the success of Allez Hop by providing estimates of the reach and acceptance of the population-based programme.

Two attempts to assess changes in physical activity behaviour in course participants were undertaken in 1997-1999 [9] and in 2005 (Chapter 8, [13]). Due to methodological limitations such as very low response rates and a lack of a comparison group, however, the results do not allow meaningful interpretation. Even if randomisation was not possible due to the format of the intervention, a comparison group would have been useful (two sample

instead of one sample pretest posttest design [84]). This comparison group would have to be similar to course participants regarding socio-demographic and physical activity behaviour. Furthermore, efforts to increase response rates are essential in future studies of this kind, e.g. by using incentives or recruiting volunteers that agree to participate in a longitudinal study with several data assessments.

Data on the impact of Allez Hop was also analysed on the population level using cross-sectional surveys (Swiss Health Survey 1997, 2002, 2007, and two sport surveys in 1999 and 2007). Even though such data sources do not provide evidence on causal associations and do not allow a link to a specific programme, they can play a role in evaluations and provide valuable information in combination with other data sources [84].

An innovative and novel semiautomated Web-based tool was developed for the routine evaluation of Allez Hop courses. While the tool itself proved feasible as well as easy and inexpensive to handle once developed, wider dissemination was only successful in the pilot phase with strong regional support, but not in an open setting (Chapter 9). More information for course instructors seems to be necessary to promote the tool among them, convince them of its usefulness, and increase participation in these course evaluations. An advantage of the Web-based tool is its easy adaptation to other contexts, and it is likely to be used in other evaluations in the future.

In addition to evidence, “politics and timeliness” also play an important role in decision making in public health [231]. The termination of Allez Hop as a national programme to promote physical activity in adults was based on administrative decisions rather than on evidence. This is a reality in public health especially when a programme is an implementation and not a scientific research project. Ideally, evaluation results should be taken as the basis for decisions regarding the future of a programme, however this is not always the case. Therefore, it may sometimes be justified to allocate resources directly to lobbying activities in addition to collecting evaluation data for an evidence base.

In summary, even though no formal outcome evaluation could be realised during the decade of Allez Hop, the programme has been evaluated extensively in a formative way on different levels (course participants, partners, sponsors, instructors, general population), which has produced various data and useful information that allowed optimisation and on-going support for the programme. A closer collaboration between implementers and researchers from the beginning, as well as continuing responsibility for evaluation would have been desirable in order to plan longer-term evaluation strategies and perhaps realise a thorough attempt to assess the effectiveness of the programme (even if a RCT design is not feasible). Continuing sponsorship, partners and thus responsibility would be an advantage in a national programme like Allez Hop for longer term planning of implementation and evaluation, and a national physical activity policy as a basis to justify and support the programme politically. Nevertheless, the information obtained in the respective evaluation steps was useful and addressed the specific needs of the partners at specific times.

11.4 Outlook and Recommendations

This thesis has brought up several issues in terms of evaluating physical activity interventions, with a focus on Internet-based approaches. Based on the results of the thesis and the experiences gained, some indications for the future are summarised below.

Evaluation of Physical Activity Interventions in General

- The results presented in this thesis and other recently published studies [77, 240] show that evaluation can add important information to the evidence base in physical activity promotion in Switzerland. It is recommended that evaluation plays an important role in physical activity promotion programmes in the future and that evaluation should be an integral part of a new project from the beginning. An evaluation concept may even be considered a prerequisite in applications for funding. Appropriate methods should be used to collect data depending on information need, feasibility, and available resources. Countries like the Netherlands which put great efforts into the development and evaluation of physical activity promotion programmes have adopted the "Intervention Mapping" protocol, which describes the stepwise process for evidence-based development of health promotion programmes, including a needs assessment, the definition of programme objectives, the selection of adequate methods and theories to realise behavioural changes, the design of the intervention including testing and production of materials, an implementation plan, and an evaluation plan [241]. In order to apply for funding in the Netherlands, a project must adhere to the Intervention Mapping protocol (Amika Singh, personal communication, colloquium on intervention mapping, 10.9.2009, Magglingen), with the aim to increase the quality and evidence-based development of physical activity interventions. In Switzerland, a similar approach is not yet established in general regarding physical activity promotion. However, applications for funding submitted to the Swiss Tobacco Fund need to include a presentation of the project management, organisation, and outcome assessment according to "quint-essenz" (www.quint-essenz.ch), a model for quality development in health promotion and prevention. Similarly, Health Promotion Switzerland refers to "quint-essenz" in their quality criteria for the assessment of funding applications (www.gesundheitsfoerderung.ch). The model "quint-essenz" was launched in 1997 by the Swiss Federal Office of Public Health and the Institute of Social and Preventive Medicine at the University of Zurich and was taken over by Health Promotion Switzerland in 2001. Today "quint-essenz" is managed in collaboration with the Bureau for Quality Development in Zurich and Radix, the Swiss centre of excellence for health promotion and prevention. "Quint-essenz" provides support and tools for planning, organising, managing and evaluating health promotion projects. A national standardised approach for funding applications of future physical activity projects based on quality criteria would be desirable in Switzerland.
- None of the evaluations presented in this thesis have focused on the cost-effectiveness of an intervention. Including information on the cost-effectiveness of public health interventions will become more and more important. In line, future evaluations of physical activity promotion programmes may not only investigate the effectiveness of an intervention, but include also an economic evaluation in terms of a cost-effectiveness

analysis. Cost-effectiveness analyses are common in clinical interventions [242], but would also be useful for those making decisions in the area of public health. Incorporating the costs that can be saved based on the impact of an intervention, in addition to the costs of the intervention, will strengthen the argumentation and show the full potential of public health interventions. Drummond et al (2008) argue that broadening the perspective of economic evaluations to include the full costs and benefits for all stakeholders is timely and consistent with recent policy developments [243]. Practical problems such as data limitations, measurement difficulties or limits in budgetary responsibilities should be overcome [243]. However, it has also been acknowledged that assessing the cost-effectiveness of public health interventions is associated with some key methodological challenges, such as attributing the effects (if a RCT design is not feasible), measuring and valuing health and other outcomes, identifying intersectoral costs and consequences, and incorporating equity considerations [244]. A review on the cost-effectiveness of Internet interventions revealed that only a limited number of studies have attempted to incorporate economic costs [245], and none of the included studies have looked at physical activity interventions. The authors emphasised the importance of including cost-effectiveness data in evaluations of Internet interventions [245].

Measurement of Physical Activity in Outcome Evaluations

- Up to today, most studies evaluating the efficacy or effectiveness of Web-based physical activity promotion programmes have only used self-report measures to assess the outcome variable [71]. Based on the discrepant results regarding changes in physical activity levels according to self-reported and objective data in our randomised effectiveness trial (Chapter 5), it is recommended to use a combination of self-report and objective measures in the outcome evaluation of physical activity interventions if feasible.
- For comparison reasons, we applied the short self-report instrument that is generally used for monitoring physical activity in Switzerland [30]. However, it may be worth applying a self-report measure that is also used internationally, such as the IPAQ, ideally even in its long form.
- It is difficult to justify the use of a non-validated self-report instrument to international peer reviewers. Therefore, it is recommended to use a validated international questionnaire such as the (long) IPAQ. Furthermore, the self-report instrument used to monitor physical activity in Switzerland should ideally be validated in a controlled validation study with a large enough sample in order to justify its use in future research.
- Based on the results presented in Chapter 10, it is recommended to take into account spontaneous changes in physical activity behaviour of about 10% to 15% in addition to the estimated effect size when calculating sample sizes in longitudinal intervention studies that aim to assess changes in behaviour. This is especially important when using self-report measures. It needs to be confirmed whether spontaneous changes of similar size are also observed when using objective measures, or whether these are due to misclassification based on the limitations of self-report instruments.

Web-based Tailored Interventions: Adherence and Effectiveness

According to the RCT described in Chapter 5, Active-online was not effective when tested under real-life conditions, and it was shown that adherence to the intervention was generally low during the whole study period, but also in open access users (Chapter 6). Higher adherence may result in more effective interventions, and effectiveness trials of programmes that succeeded in achieving a higher adherence may show the full potential of Web-based interventions. Furthermore, isolating the effect of specific elements in Web-based interventions may help to understand why an intervention was or was not effective. There are two approaches to attempt increasing adherence and use of an intervention: Offering the programme in a context rather than as a stand-alone website, and improving the intervention itself by incorporating elements that may increase its use:

- The anonymous nature of the Internet is probably one reason for the low adherence. To increase intervention use, programmes like Active-online may be embedded in a specific context such as in primary care, workplace or school settings. They could also be incorporated in larger multidimensional health promotion packages, or be targeted to specific groups. Feelok is an example of a Web-based interactive multidimensional programme for adolescents that is mainly disseminated in schools (see Chapter 4) [82]. On average, a visit in the Feelok module on physical activity lasts more than 20 minutes [82], which is much longer than what has usually been reported for other physical activity interventions (around 7-9 minutes [134, 159]), confirming that adherence may be increased when offering such a programme in a specific setting. Results from smaller studies have shown promising short-term results in a primary care [161, 162] and a workplace setting [163]. Future studies testing the effectiveness of programmes like Active-online in specific settings or in a wider public health context that include larger samples and longer-term follow-up assessments are encouraged. Specifically, there is a need for investigations into the effect of Internet-based physical activity programmes within the context of primary care [165].
- Further research may investigate the question of how to improve adherence to Web-based physical activity interventions when they are freely accessible on the Internet as stand-alone websites. Ways of increasing adherence to Web-based programmes may include: Regularly updating the content of the website [246], increasing the interactivity of the intervention [70], including objective measures of physical activity such as pedometers so that visitors can upload physical activity data and follow their changes objectively, compulsory registration, providing information on “real” physical activity offers such as courses and sport clubs (as this is the case in the programme Feelok [82]), combining Internet technology with other technologies such as mobile phones, and including environmental data in the Web-based intervention that can be tailored to the individual as well. Environmentally tailored interventions aim to increase awareness, use, and accessibility of existing physical activity resources as a method of primary prevention [247]. In terms of Web-based interventions, environmental tailoring is a novel approach that has so far only been presented at a conference, with the inclusion of Google Maps in a computer-tailored intervention for adolescents providing geographic information on physical activity facilities in the user’s neighbourhood [248].

- Mostly, Web-based tailored interventions are evaluated for their efficacy or effectiveness as "black boxes". These studies do not allow interpretations about why an intervention was or was not effective. Isolating the effect of particular Web-based programme components will help to shed light on these issues [249]. For example, dismantling designs [249], in which the active ingredients of an intervention are determined, can be used to assess the effects of specific elements in different study arms.

Future of Active-online

- Currently, Active-online is freely accessible on the Internet. Its content is still accurate and the design still seems to be appealing as the programme is regularly used. As long as this is the case, the minimal costs involved in keeping it running should be invested.
- Based on the results of the effectiveness trial, it does not seem justified to put more resources into its dissemination as a stand-alone open access intervention.
- Nothing is known about the effectiveness of Active-online in specific intervention contexts. One possibility for further research may be the testing of Active-online in a primary care setting, for example as part of a planned RCT investigating the effectiveness of face-to-face physical activity counselling in primary care.

Future of Allez Hop

- With the integration of Allez Hop in the new concept “Sport for Adults”, only the training of instructors, but not the recruitment of programme participants has support from national public institutions. In systems like this, the reach of insufficiently active individuals can be a challenge, as the limited evaluation results available from the national seniors’ sports programme have indicated [205].
- Allez Hop is continuing in the Italian (www.allez-hop.ch) and French speaking (www.allezhop-romandie.ch) parts of Switzerland, where regional organisations have taken over the label “Allez Hop”. Discussions are underway also in the German speaking part. These regional organisations have recognised the potential of a label like Allez Hop which has been implemented on a national level for more than a decade and which has reached a considerable level of awareness, acceptance and appreciation in the Swiss population.
- Since Allez Hop has been terminated at the end of 2008, the semiautomated Web-based tool for routine course evaluations is not in use anymore. However, the tool could be adapted to other needs and integrated in other programmes, for example to offer course evaluations and feedbacks to instructors trained within the concept "Sport for Adults".

11.5 Conclusions

Active-online and Allez Hop are among the best evaluated physical activity promotion programmes in Switzerland. While Active-online started as a scientific research project, Allez Hop was developed as an

implementation project. The evaluation approaches used for the two programmes differ, however both approaches have succeeded in generating valuable data for further development and optimisation of the programmes, and - to some extent – have contributed to the evidence base regarding the effectiveness of different approaches in physical activity promotion and challenges regarding their dissemination and implementation. This evidence is not only important for the existing programmes, but will also support informed decision making regarding the future allocation of resources and regarding the focus of upcoming projects. It is recommended that evaluation should be an integral part in the concepts of future physical activity promotion projects and play an important role throughout the development and implementation of a project.

References

1. U.S. Department of Health and Human Services: **Physical activity and health: a report of the Surgeon General**. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, The President's Council on Physical Fitness and Sports; 1996.
2. Martin BW, Mäder U: **Physical activity and health in Switzerland - where are we in 2009?** *Schweiz Z Sportmed Sporttraumatol* 2009, **57**(2):36.
3. Cavill N, Foster C, Oja P, Martin BW: **An evidence-based approach to physical activity promotion and policy development in Europe: contrasting case studies**. *Promot Educ* 2006, **13**(2):104-111.
4. Nutbeam D: **Evaluating health promotion - progress, problems and solutions**. *Health Promotion International* 1998, **13**(1):27-44.
5. Rossi PH, Freeman HE: *Evaluation: a systematic approach*. 5th edition. Newbury Park, California: SAGE Publications, Inc; 1993.
6. Glasgow RE, Vogt TM, Boles SM: **Evaluating the public health impact of health promotion interventions: the RE-AIM framework**. *Am J Public Health* 1999, **89**(9):1322-1327.
7. Napolitano MA, Fotheringham M, Tate D, Sciamanna C, Leslie E, Owen N, Bauman A, Marcus B: **Evaluation of an internet-based physical activity intervention: a preliminary investigation**. *Ann Behav Med* 2003, **25**(2):92-99.
8. Vandelanotte C, De Bourdeaudhuij I, Sallis JF, Spittaels H, Brug J: **Efficacy of sequential or simultaneous interactive computer-tailored interventions for increasing physical activity and decreasing fat intake**. *Ann Behav Med* 2005, **29**(2):138-146.
9. Stamm H, Lamprecht M, Somaini B, Peters M: **"Getting Switzerland to move": evaluation of a new "Sport for All" programme**. *Soz Praventivmed* 2001, **46**(1):20-28.
10. Somaini B, Hättich A, Hunold C, Lamprecht M, Peters M, Stamm H: **Evaluation der Phase I der "Allez Hop!"-Kampagne (Evaluation of phase 1 of the Allez Hop campaign)**. Bern: Schweizerischer Olympischer Verband; 1998.
11. Somaini B, Lamprecht M, Meyer C, Peters M, Stamm H, Hättich A, Zellweger U: **Evaluation der Phase II der "Allez Hop!"-Kampagne (Evaluation of phase 2 of the Allez Hop campaign)**. Bern: Schweizerischer Olympischer Verband; 2000.
12. Egger I, Reuter H: **Evaluation des Programms Allez Hop: Zwischenbericht (Evaluation of the programme Allez Hop: Interim report)**. Zurich: Institute of Social and Preventive Medicine, University of Zurich; 2005.
13. Egger I, Reuter H, Bauer G: **Evaluation des Programms Allez Hop (2004-2006): Schlussbericht Juli 2006 (Evaluation of the programme Allez Hop (2004-2006): Final report 2006)**. Zurich: Institute of Social and Preventive Medicine, University of Zurich; 2006.
14. Leister E: **Evaluationsbericht: Ausbildungsbereich Allez Hop. Analyse des Ausbildungsbereichs als Teil der Gesamtevaluation von Allez Hop (Evaluation report: Analysis of the training of Allez Hop instructors as part of the overall evaluation of Allez Hop)**. Magglingen: Eidgenössische Hochschule für Sport; 2005.

15. Martin-Diener E: **Kurzbericht zur Evaluation der Version 1 der Website www.active-online.ch (Short report on the evaluation of version 1 of the website www.active-online.ch)**. Institute of Social and Preventive Medicine, University of Zurich and Swiss Federal Institute of Sport Magglingen; 2001.
16. Martin-Diener E: **Kurzbericht zur Evaluation der Version 2 der Website www.active-online.ch (Short report on the evaluation of version 2 of the website www.active-online.ch)**. Institute of Social and Preventive Medicine, University of Zurich and Swiss Federal Institute of Sport Magglingen; 2002.
17. Martin-Diener E, Thuering N: **www.aktiv-online.ch: Akzeptanz eines interaktiven Programms zur Bewegungsförderung (www.active-online.ch: Acceptance of an interactive program to promote physical activity)**. In *Jahrestagung Schweizerische Gesellschaft für Sportmedizin: 2001*. Schweiz Z Sportmed Sporttraumatol; 2001:137.
18. Bouchard C, Blair SN, Haskell WL: **Why Study Physical Activity and Health?** In *Physical Activity and Health*. Edited by Bouchard C, Blair SN, Haskell WL. Champaign, IL: Human Kinetics; 2007:12.
19. Physical Activity Guidelines Advisory Committee: **Physical Activity Guidelines Advisory Committee Report 2008**. Washington, DC: U.S. Department of Health and Human Services; 2008.
20. Department of Health: **At least five a week: evidence on the impact of physical activity and its relationship to health**. Department of Health; 2004.
21. Byberg L, Melhus H, Gedeborg R, Sundstrom J, Ahlbom A, Zethelius B, Berglund LG, Wolk A, Michaelsson K: **Total mortality after changes in leisure time physical activity in 50 year old men: 35 year follow-up of population based cohort**. *Bmj* 2009, **338**:b688.
22. World Health Organization: **The World Health Report 2002: Reducing risks, promoting healthy lifestyle**. Geneva: WHO; 2002.
23. World Health Organization: **Global health risks: Mortality and burden of disease attributable to selected major risks**. Geneva: WHO; 2009.
24. Zarocostas J: **Twenty four risk factors responsible for nearly half of annual deaths, says WHO**. *Bmj* 2009, **339**:b4439.
25. Bouchard C, Blair SN, Haskell WL: **Why Study Physical Activity and Health?** In *Physical Activity and Health*. Edited by Bouchard C, Blair SN, Haskell WL. Champaign, IL: Human Kinetics; 2007:10.
26. Mokdad AH, Marks JS, Stroup DF, Gerberding JL: **Actual causes of death in the United States, 2000**. *Jama* 2004, **291**(10):1238-1245.
27. Danaei G, Ding EL, Mozaffarian D, Taylor BJ, Rehm J, Murray CJL, Ezzati M: **The preventable causes of death in the United States: comparative risk assessment of dietary, lifestyle, and metabolic risk factors**. *PLoS Med* 2009, **6**(4):e1000058.
28. Martin B, Beeler I, Szucs T, Smala A, Brügger O, Casparis C, Allenbach R, Raeber P-A, Marti B: **Economic benefits of the health-enhancing effects of physical activity: first estimates for Switzerland**. *Schweizerische Zeitschrift für Sportmedizin und Sporttraumatologie* 2001, **49**(3):131-133.
29. Martin BW: **Physical activity related attitudes, knowledge and behaviour in the Swiss population: comparison of the HEPA Surveys 2001 and 1999**. *Schweiz Z Sportmed Sporttraumatol* 2002, **50**(4):164-168.
30. Martin BW, Mäder U, Stamm HP, Braun-Fahrländer C: **Physical activity and health - what are the recommendations and where do we find the Swiss population?** *Schweiz Z Sportmed Sporttraumatol* 2009, **57**(2):37-43.
31. Lamprecht M, Stamm HP: **Bewegung, Sport, Gesundheit. Fakten und Trends aus den Schweizerischen Gesundheitsbefragungen 1992, 1997 und 2002 (Physical activity, sport, health. Facts and Trends from the Swiss Health Surveys 1992, 1997, and 2002)**. In *Statsanté Resultate zu den Gesundheitsstatistiken in der Schweiz*. Neuchâtel: Swiss Federal Statistical Office; 2006.
32. Swiss Federal Office of Sport, Swiss Federal Office of Public Health, Health Promotion Switzerland, Network HEPA Switzerland: **Health-Enhancing Physical Activity. A Base Document**. Magglingen: Swiss Federal Office of Sport; 2006.
33. Hardman AE: **Acute Responses to Physical Activity and Exercise**. In *Physical Activity and Health*. Edited by Bouchard C, Blair SN, Haskell WL. Champaign, IL: Human Kinetics; 2007:68-80.
34. U.S. Department of Health and Human Services: **Chapter 3: Physiologic responses and long-term adaptations to exercise**. In *Physical activity and health: a report of the Surgeon General*. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National

Center for Chronic Disease Prevention and Health Promotion, The President's Council on Physical Fitness and Sports; 1996:61-80.
35. U.S. Department of Health and Human Services: **2008 Physical Activity Guidelines for Americans. Be Active, Healthy, and Happy!** Washington: U.S. Department of Health and Human Services; 2008.
36. Janz KF: **Physical activity in epidemiology: moving from questionnaire to objective measurement**. *Br J Sports Med* 2006, **40**(3):191-192.
37. Ainsworth BE, Haskell WL, Whitt MC, Irwin ML, Swartz AM, Strath SJ, O'Brien WL, Bassett DR, Jr., Schmitz KH, Emplaincourt PO *et al*: **Compendium of physical activities: an update of activity codes and MET intensities**. *Med Sci Sports Exerc* 2000, **32**(9 Suppl):S498-504.
38. Rodoni Wetzel R: **Die Zuverlässigkeit der subjektiven Angaben zur körperlichen Aktivität der Schweizer Bevölkerung im Bewegungssurvey 2004 (Reliability of self-reported physical activity in the Swiss population in the HEPA Survey 2004)**. *Masterthesis.* University of Basel, University Hospital; 2009.
39. Bernstein M, Sloutskis D, Kumanyika S, Sparti A, Schutz Y, Morabia A: **Data-based approach for developing a physical activity frequency questionnaire**. *Am J Epidemiol* 1998, **147**(2):147-154.
40. Amati F, Barthassat V, Miganne G, Hausman I, Monnin DG, Costanza MC, Golay A: **Enhancing regular physical activity and relapse prevention through a 1-day therapeutic patient education workshop: A pilot study**. *Patient Educ Couns* 2007, **68**(1):70-78.
41. Costanza MC, Beer-Borst S, Morabia A: **Achieving energy balance at the population level through increases in physical activity**. *Am J Public Health* 2007, **97**(3):520-525.
42. Sallis JF, Saelens BE: **Assessment of physical activity by self-report: status, limitations, and future directions**. *Res Q Exerc Sport* 2000, **71**(2 Suppl):S1-14.
43. Dishman RK, Washburn RA, Schoeller DA: **Measurement of Physical Activity**. *Quest (00336297)* 2001, **53**(3):295-398.
44. Chinapaw MJ, Slootmaker SM, Schuit AJ, van Zuidam M, van Mechelen W: **Reliability and validity of the Activity Questionnaire for Adults and Adolescents (AQuAA)**. *BMC Med Res Methodol* 2009, **9**:58.
45. Slootmaker SM, Schuit AJ, Chinapaw MJ, Seidell JC, van Mechelen W: **Disagreement in physical activity assessed by accelerometer and self-report in subgroups of age, gender, education and weight status**. *Int J Behav Nutr Phys Act* 2009, **6**:17.
46. World Health Organization: **Surveillance of physical activity levels and patterns in the European Union: Background paper for the workshop on integration of physical activity data, Zurich, 25-26 February 2009**. Rom/Copenhagen: World Health Organization; 2009.
47. Calmonte R, Galati-Petrecca M, Lieberherr R, Neuhaus M, Kahlmeier S: **Gesundheit und Gesundheitsverhalten in der Schweiz 1992–2002. Schweizerische Gesundheitsbefragung (Health and Health Behaviour in Switzerland 1992-2002. The Swiss Health Survey)**. Neuchâtel: Federal Office of Statistics; 2005.
48. Zimmermann E, Budowski M, Gabadinho A, Scherpenzeel A, Tillmann R, Wernli B: **The Swiss Household Panel Survey: A Multidimensional Database for Monitoring Social Change**. In *Social Change and Social Reporting*. Edited by Joye D, Renschler I, Hainard F. Neuchâtel, Bern: UNESCO; 2003:137-156.
49. Esliger DW, Copeland JL, Barnes JD, Tremblay MS: **Standardizing and Optimizing the Use of Accelerometer Data for Free-Living Physical Activity Monitoring**. *Journal of Physical Activity & Health* 2005, **2**(3):366.
50. Freedson PS, Melanson E, Sirard J: **Calibration of the Computer Science and Applications, Inc. accelerometer**. *Med Sci Sports Exerc* 1998, **30**(5):777-781.
51. Nichols JF, Morgan CG, Chabot LE, Sallis JF, Calfas KJ: **Assessment of physical activity with the Computer Science and Applications, Inc., accelerometer: laboratory versus field validation**. *Res Q Exerc Sport* 2000, **71**(1):36-43.
52. Swartz AM, Strath SJ, Bassett DR, Jr., O'Brien WL, King GA, Ainsworth BE: **Estimation of energy expenditure using CSA accelerometers at hip and wrist sites**. *Med Sci Sports Exerc* 2000, **32**(9 Suppl):S450-456.
53. Hendelman D, Miller K, Baggett C, Debold E, Freedson P: **Validity of accelerometry for the assessment of moderate intensity physical activity in the field**. *Med Sci Sports Exerc* 2000, **32**(9 Suppl):S442-449.

54. Strath SJ, Bassett DR, Jr., Swartz AM: **Comparison of MTI accelerometer cut-points for predicting time spent in physical activity**. *Int J Sports Med* 2003, **24**(4):298-303.
55. Sjöström M, Oja P, Hagströmer M, Smith BJ, Bauman A: **Health-enhancing physical activity across European Union countries: The Eurobarometer study**. *Journal of Public Health* 2006, **14**(5):291-300.
56. Rutten A, Abu-Omar K: **Prevalence of physical activity in the European Union**. *Soz Praventivmed* 2004, **49**(4):281-289.
57. Bauman A, Bull F, Chey T, Craig CL, Ainsworth BE, Sallis JF, Bowles HR, Hagstromer M, Sjostrom M, Pratt M *et al*: **The International Prevalence Study on Physical Activity: results from 20 countries**. *Int J Behav Nutr Phys Act* 2009, **6**(1):21.
58. Stamm HP, Lamprecht M: **Das Bewegungsverhalten der Schweizer Bevölkerung. Zwischenbericht zur Aktualisierung des Indikators "Sport- und Bewegungsverhalten" des Sportobservatoriums (Physical activity in the Swiss population. Interim report updating the indicator "sport and physical activity" of the Sport Observatory)**. Zürich: Lamprecht und Stamm Sozialforschung und Beratung AG; 2009.
59. Hagstromer M, Oja P, Sjostrom M: **Physical activity and inactivity in an adult population assessed by accelerometry**. *Med Sci Sports Exerc* 2007, **39**(9):1502-1508.
60. Troiano RP, Berrigan D, Dodd KW, Masse LC, Tilert T, McDowell M: **Physical activity in the United States measured by accelerometer**. *Med Sci Sports Exerc* 2008, **40**(1):181-188.
61. Hawkins MS, Storti KL, Richardson CR, King WC, Strath SJ, Holleman RG, Kriska AM: **Objectively measured physical activity of USA adults by sex, age, and racial/ethnic groups: a cross-sectional study**. *Int J Behav Nutr Phys Act* 2009, **6**:31.
62. Sapkota S, Bowles HR, Ham SA, Kohl HW: **Adult participation in recommended levels of physical activity - United States, 2001 and 2003**. *MMWR Morb Mortal Wkly Rep* 2005, **54**(47):1208-1212.
63. Tremblay M, Wolfson M, Gorber SC: **Canadian Health Measures Survey: rationale, background and overview**. *Health Rep* 2007, **18 Suppl**:7-20.
64. Marcus BH, Williams DM, Dubbert PM, Sallis JF, King AC, Yancey AK, Franklin BA, Buchner D, Daniels SR, Claytor RP: **Physical activity intervention studies: what we know and what we need to know: a scientific statement from the American Heart Association Council on Nutrition, Physical Activity, and Metabolism (Subcommittee on Physical Activity); Council on Cardiovascular Disease in the Young; and the Interdisciplinary Working Group on Quality of Care and Outcomes Research**. *Circulation* 2006, **114**(24):2739-2752.
65. Hillsdon M, Foster C, Thorogood M: **Interventions for promoting physical activity**. *Cochrane Database Syst Rev* 2005(1):CD003180.
66. Hillsdon M, Foster C, Naidoo B, Crombie H: **The effectiveness of public health interventions for increasing physical activity among adults: a review of reviews: Evidence briefing**. London: Health Development Agency; 2004:1-37.
67. Muller-Riemenschneider F, Reinhold T, Nocon M, Willich SN: **Long-term effectiveness of interventions promoting physical activity: A systematic review**. *Prev Med* 2008.
68. Walters ST, Wright JA, Shegog R: **A review of computer and Internet-based interventions for smoking behavior**. *Addict Behav* 2006, **31**(2):264-277.
69. Oenema A, Tan F, Brug J: **Short-term efficacy of a web-based computer-tailored nutrition intervention: main effects and mediators**. *Ann Behav Med* 2005, **29**(1):54-63.
70. Vandelanotte C, Spathonis KM, Eakin EG, Owen N: **Website-delivered physical activity interventions a review of the literature**. *Am J Prev Med* 2007, **33**(1):54-64.
71. van den Berg MH, Schoones JW, Vliet Vlieland TP: **Internet-based physical activity interventions: a systematic review of the literature**. *J Med Internet Res* 2007, **9**(3):e26.
72. Oenema A, Brug J, Dijkstra A, de Weerdt I, de Vries H: **Efficacy and use of an internet-delivered computer-tailored lifestyle intervention, targeting saturated fat intake, physical activity and smoking cessation: a randomized controlled trial**. *Ann Behav Med* 2008, **35**(2):125-135.
73. Surbeck R, Martin-Diener E, Grize L, Spoerri A, Braun-Fahrländer C: **Swiss bike-to-work campaign: Did we reach the intended population?** *Schweiz Z Sportmed Sporttraumatol* 2009, **57**(2):78-80.
74. Marti B, Lamprecht M, Bächler J, Spring S, Gutzwiller F: **Bekanntheit, Nutzung und Bewertung des Vitaparcours: Vergleich zwischen 1997 und 2001 (Knowledge, use, and acceptance of vitaparcours: Comparison between 1997 and 2001)**. *Schweiz Z Sportmed Sporttraumatol* 2002, **50**(4):161-163.

75. Martin-Diener E, Anrig P, Capirone M, Martin BW: **SwitzerlandMobility, the national network for non-motorized traffic: A model project of intersectoral collaboration**. In *Book of Abstracts 1st Annual Conference of HEPA Europe: 2008; Glasgow, Scotland, UK*. University of Strathclyde; 2008:102.
76. Bize R, Surbeck R, Padlina O, Peduzzi F, Cornuz J, Martin BW: **Promotion of physical activity in the primary care setting: The situation in Switzerland**. *Schweiz Z Sportmed Sporttraumatol* 2008, **56**(3):112-116.
77. Schmid M, Egli K, Martin BW, Bauer G: **Health promotion in primary care: evaluation of a systematic procedure and stage specific information for physical activity counselling**. *Swiss Med Wkly* in press.
78. Jimmy G, Martin BW: **Implementation and effectiveness of a primary care based physical activity counselling scheme**. *Patient Educ Couns* 2005, **56**(3):323-331.
79. Thüring N, Martin-Diener E, Martin B, Bauer G: **Feasibility of a web-based randomised controlled trial for a tailored physical activity intervention**. *Schweiz Z Sportmed Sporttraumatol* 2009, **57**(2):56-60.
80. Prochaska JO, DiClemente CC, Norcross JC: **In search of how people change. Applications to addictive behaviors**. *Am Psychol* 1992, **47**(9):1102-1114.
81. Martin-Diener E, Thuring N, Melges T, Martin BW: **The Stages of Change in three stage concepts and two modes of physical activity: a comparison of stage distributions and practical implications**. *Health Educ Res* 2004, **19**(4):406-417.
82. Padlina O, Dössegger A, Jimmy G, Jeker M, Toggweiler S, Schmid J, Egli D, Zurbriggen M, Käsermann D, Hagi R *et al*: **Promotion of physical activity and sport in adolescents - first experiences of the Internet programme www.feelok.ch**. *Schweiz Z Sportmed Sporttraumatol* 2009, **57**(2):90-92.
83. WHO European Working Group on Health Promotion Evaluation: **Health Promotion Evaluation: Recommendations to Policy-Makers**. Copenhagen: World Health Organization; 1998.
84. U.S. Department of Health and Human Services: **Physical activity evaluation handbook**. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion; 2002.
85. Akobeng AK: **Assessing the validity of clinical trials**. *J Pediatr Gastroenterol Nutr* 2008, **47**(3):277-282.
86. Rabin BA, Brownson RC, Kerner JF, Glasgow RE: **Methodologic challenges in disseminating evidence-based interventions to promote physical activity**. *Am J Prev Med* 2006, **31**(4 Suppl):S24-34.
87. Victora CG, Habicht JP, Bryce J: **Evidence-based public health: moving beyond randomized trials**. *Am J Public Health* 2004, **94**(3):400-405.
88. Barreto ML: **Efficacy, effectiveness, and the evaluation of public health interventions**. *J Epidemiol Community Health* 2005, **59**(5):345-346.
89. Martin-Diener E: **Entwicklung eines internetbasierten, individualisierten Motivationsprogramms zur Bewegungsförderung. Schlussbericht (Development of an internetbased, individually tailored program to promote physical activity. Final report)**. Institute of Social and Preventive Medicine, University of Zurich and Swiss Federal Institute of Sport Magglingen; 2003.
90. Zimmermann-Sloutskis D, Martin-Diener E: **Körperliche Aktivität nach dem transtheoretischen Modell der Verhaltensänderung: interkultureller Vergleich bei der schweizerischen Bevölkerung: Kurzbericht (Physical activity based on the transtheoretical model of behaviour change: intercultural comparison in the Swiss population: Short report)**. Magglingen, Zürich: Swiss Federal Office of Sport, Institute of Social and Preventive Medicine of the University of Zurich; 2002.
91. Stamm H, Fischer A, Lamprecht M: **Evaluation der "Allez Hop!"-Kampagne: Jahre 2001 und 2002 (Evaluation of the Allez Hop campaign: 2001 and 2002)**. Zürich: L&S Sozialforschung und Beratung AG; 2002.
92. Sato K, Smith SL, Sands WA: **Validation of an accelerometer for measuring sport performance**. *J Strength Cond Res* 2009, **23**(1):341-347.
93. Rosandich EJ: **Sports equipment and technology**. *The Sport Journal* 2000, **3**(2).
94. Barris S, Button C: **A review of vision-based motion analysis in sport**. *Sports Med* 2008, **38**(12):1025-1043.
95. Padlina O, Jimmy G, Martin BW: **Acceptance of an Internet-based programme to train physical activity counsellors during the development phase and in regular use**. *Schweiz Z Sportmed Sporttraumatol* 2009, **57**(2):65-68.

96. Dössegger A, Studer O, Maeder U, Jimmy G, Rumo M, Mäder U, Martin BW: **From hepa.ch to COMPI - Internet-based exchange platforms for physical activity promotion professionals in Switzerland**. *Schweiz Z Sportmed Sporttraumatol* 2009, **57**(2):48-50.
97. Dössegger A, Nützi C, Kienle G, Ackermann B, Stutz S, Martin B: **Experiences in nationwide recruiting for the „Allez Hop“ Physical Activity Programme**. *Schweiz Z Sportmed Sporttraumatol* 2009, **57**(2):61-64.
98. Jackson F, Cooke K: **Active Scotland - Physical Activity at Your Fingertips**. In *Book of Abstracts 1st Annual Conference of HEPA Europe: 2008; Glasgow, Scotland, UK*. University of Strathclyde; 2008:34.
99. Craig CL, Tudor-Locke C, Bauman A: **Twelve-month effects of Canada on the Move: a population-wide campaign to promote pedometer use and walking**. *Health Educ Res* 2007, **22**(3):406-413.
100. Graves L, Stratton G, Ridgers ND, Cable NT: **Comparison of energy expenditure in adolescents when playing new generation and sedentary computer games: cross sectional study**. *Bmj* 2007, **335**(7633):1282-1284.
101. Ni Mhurchu C, Maddison R, Jiang Y, Jull A, Prapavessis H, Rodgers A: **Couch potatoes to jumping beans: A pilot study of the effect of active video games on physical activity in children**. *Int J Behav Nutr Phys Act* 2008, **5**:8.
102. Rimmer JA, Rowland JL: **Physical activity for youth with disabilities: a critical need in an underserved population**. *Dev Neurorehabil* 2008, **11**(2):141-148.
103. Chin A Paw MJ, Jacobs WM, Vaessen EP, Titze S, van Mechelen W: **The motivation of children to play an active video game**. *J Sci Med Sport* 2008, **11**(2):163-166.
104. Doshi A, Patrick K, Sallis JF, Calfas K: **Evaluation of physical activity web sites for use of behavior change theories**. *Ann Behav Med* 2003, **25**(2):105-111.
105. Sutherland LA, Wildemuth B, Campbell MK, Haines PS: **Unraveling the web: an evaluation of the content quality, usability, and readability of nutrition web sites**. *J Nutr Educ Behav* 2005, **37**(6):300-305.
106. Prochaska JO, DiClemente CC, Velicer WF, Rossi JS: **Standardized, individualized, interactive, and personalized self-help programs for smoking cessation**. *Health Psychol* 1993, **12**(5):399-405.
107. Velicer WF, Prochaska JO, Bellis JM, DiClemente CC, Rossi JS, Fava JL, Steiger JH: **An expert system intervention for smoking cessation**. *Addict Behav* 1993, **18**(3):269-290.
108. Kreuter M, Farrell D, Olevitch L, Brennan L: *Tailoring health messages. Customizing communication with computer technology*. Mahwah, New Jersey: Erlbaum; 2000.
109. Dijkstra A, De Vries H: **The development of computer-generated tailored interventions**. *Patient Educ Couns* 1999, **36**(2):193-203.
110. Oenema A, Brug J, Lechner L: **Web-based tailored nutrition education: results of a randomized controlled trial**. *Health Educ Res* 2001, **16**(6):647-660.
111. Strecher VJ: **Computer-tailored smoking cessation materials: a review and discussion**. *Patient Educ Couns* 1999, **36**(2):107-117.
112. Kroeze W, Werkman A, Brug J: **A systematic review of randomized trials on the effectiveness of computer-tailored education on physical activity and dietary behaviors**. *Ann Behav Med* 2006, **31**(3):205-223.
113. Marcus BH, Bock BC, Pinto BM, Forsyth LH, Roberts MB, Traficante RM: **Efficacy of an individualized, motivationally-tailored physical activity intervention**. *Ann Behav Med* 1998, **20**(3):174-180.
114. Marcus BH, Emmons KM, Simkin-Silverman LR, Linnan LA, Taylor ER, Bock BC, Roberts MB, Rossi JS, Abrams DB: **Evaluation of motivationally tailored vs. standard self-help physical activity interventions at the workplace**. *Am J Health Promot* 1998, **12**(4):246-253.
115. Campbell MK, James A, Hudson MA, Carr C, Jackson E, Oakes V, Demissie S, Farrell D, Tessaro I: **Improving multiple behaviors for colorectal cancer prevention among african american church members**. *Health Psychol* 2004, **23**(5):492-502.
116. Van Sluijs EM, Van Poppel MN, Twisk JW, Brug J, Van Mechelen W: **The positive effect on determinants of physical activity of a tailored, general practice-based physical activity intervention**. *Health Educ Res* 2005, **20**(3):345-356.
117. van Sluijs EM, van Poppel MN, Twisk JW, Chin APMJ, Calfas KJ, van Mechelen W: **Effect of a tailored physical activity intervention delivered in general practice settings: results of a randomized controlled trial**. *Am J Public Health* 2005, **95**(10):1825-1831.

118. Campbell MK, Tessaro I, DeVellis B, Benedict S, Kelsey K, Belton L, Sanhueza A: **Effects of a tailored health promotion program for female blue-collar workers: health works for women**. *Prev Med* 2002, **34**(3):313-323.
119. Marshall AL, Bauman AE, Owen N, Booth ML, Crawford D, Marcus BH: **Population-based randomized controlled trial of a stage-targeted physical activity intervention**. *Ann Behav Med* 2003, **25**(3):194-202.
120. Bock B, Graham A, Sciamanna C, Krishnamoorthy J, Whiteley J, Carmona-Barros R, Niaura R, Abrams D: **Smoking cessation treatment on the Internet: content, quality, and usability**. *Nicotine Tob Res* 2004, **6**(2):207-219.
121. Etter JF: **Internet-based smoking cessation programs**. *Int J Med Inform* 2006, **75**(1):110-116.
122. Etter JF: **Comparing the efficacy of two Internet-based, computer-tailored smoking cessation programs: a randomized trial**. *J Med Internet Res* 2005, **7**(1):e2.
123. Strecher VJ, Shiffman S, West R: **Randomized controlled trial of a web-based computer-tailored smoking cessation program as a supplement to nicotine patch therapy**. *Addiction* 2005, **100**(5):682-688.
124. Lenert L, Munoz RF, Perez JE, Bansod A: **Automated e-mail messaging as a tool for improving quit rates in an internet smoking cessation intervention**. *J Am Med Inform Assoc* 2004, **11**(4):235-240.
125. American Cancer Society: **Testing online smoking cessation programs**. *CA A Cancer Journal for Clinicians* 2005, **55**(1):6.
126. Hageman PA, Walker SN, Pullen CH: **Tailored versus standard internet-delivered interventions to promote physical activity in older women**. *J Geriatr Phys Ther* 2005, **28**(1):28-33.
127. King DK, Estabrooks PA, Strycker LA, Toobert DJ, Bull SS, Glasgow RE: **Outcomes of a multifaceted physical activity regimen as part of a diabetes self-management intervention**. *Ann Behav Med* 2006, **31**(2):128-137.
128. Marshall AL, Leslie ER, Bauman AE, Marcus BH, Owen N: **Print versus website physical activity programs: a randomized trial**. *Am J Prev Med* 2003, **25**(2):88-94.
129. McKay HG, King D, Eakin EG, Seeley JR, Glasgow RE: **The diabetes network internet-based physical activity intervention: a randomized pilot study**. *Diabetes Care* 2001, **24**(8):1328-1334.
130. Sciamanna CN, Lewis B, Tate D, Napolitano MA, Fotheringham M, Marcus BH: **User attitudes toward a physical activity promotion website**. *Prev Med* 2002, **35**(6):612-615.
131. Kosma M, Cardinal BJ, McCubbin JA: **A pilot study of a web-based physical activity motivational program for adults with physical disabilities**. *Disabil Rehabil* 2005, **27**(23):1435-1442.
132. Frenn M, Malin S, Brown RL, Greer Y, Fox J, Greer J, Smyczek S: **Changing the tide: an Internet/video exercise and low-fat diet intervention with middle-school students**. *Appl Nurs Res* 2005, **18**(1):13-21.
133. Vandelanotte C, De Bourdeaudhuij I: **Acceptability and feasibility of a computer-tailored physical activity intervention using stages of change: project FAITH**. *Health Educ Res* 2003, **18**(3):304-317.
134. Leslie E, Marshall AL, Owen N, Bauman A: **Engagement and retention of participants in a physical activity website**. *Prev Med* 2005, **40**(1):54-59.
135. Wang J, Etter JF: **Administering an effective health intervention for smoking cessation online: the international users of Stop-Tabac**. *Prev Med* 2004, **39**(5):962-968.
136. Thuering N: **Internetbasierte, randomisierte Wirksamkeitsstudie des Programms active-online.ch: Eine Machbarkeitsstudie**. Universität Zürich, Institut für Sozial- und Präventivmedizin; 2004.
137. Prochaska JO, Velicer WF, Fava JL, Rossi JS, Tsoh JY: **Evaluating a population-based recruitment approach and a stage-based expert system intervention for smoking cessation**. *Addict Behav* 2001, **26**(4):583-602.
138. Evers KE, Cummins CO, Prochaska JO, Prochaska JM: **Online health behavior and disease management programs: are we ready for them? Are they ready for us?** *J Med Internet Res* 2005, **7**(3):e27.
139. Spittaels H, De Bourdeaudhuij I, Brug J, Vandelanotte C: **Effectiveness of an online computer-tailored physical activity intervention in a real-life setting**. *Health Educ Res* 2007, **22**(3):385-396.
140. Spittaels H, De Bourdeaudhuij I, Vandelanotte C: **Evaluation of a website-delivered computer-tailored intervention for increasing physical activity in the general population**. *Prev Med* 2007, **44**(3):209-217.

141. Carr LJ, Bartee RT, Dorozynski C, Broomfield JF, Smith ML, Smith DT: **Internet-delivered behavior change program increases physical activity and improves cardiometabolic disease risk factors in sedentary adults: results of a randomized controlled trial**. *Prev Med* 2008, **46**(5):431-438.
142. Hurling R, Catt M, Boni MD, Fairley BW, Hurst T, Murray P, Richardson A, Sodhi JS: **Using internet and mobile phone technology to deliver an automated physical activity program: randomized controlled trial**. *J Med Internet Res* 2007, **9**(2):e7.
143. Vandelanotte C, De Bourdeaudhuij I, Brug J: **Two-year follow-up of sequential and simultaneous interactive computer-tailored interventions for increasing physical activity and decreasing fat intake**. *Ann Behav Med* 2007, **33**(2):213-219.
144. Norman GJ, Zabinski MF, Adams MA, Rosenberg DE, Yaroch AL, Atienza AA: **A review of eHealth interventions for physical activity and dietary behavior change**. *Am J Prev Med* 2007, **33**(4):336-345.
145. Neville LM, O'Hara B, Milat A: **Computer-tailored physical activity behavior change interventions targeting adults: a systematic review**. *Int J Behav Nutr Phys Act* 2009, **6**:30.
146. Dunton GF, Robertson TP: **A tailored internet-plus-email intervention for increasing physical activity among ethnically-diverse women**. *Prev Med* 2008, **47**(6):605-611.
147. Slootmaker SM, Chinapaw MJ, Schuit AJ, Seidell JC, Van Mechelen W: **Feasibility and effectiveness of online physical activity advice based on a personal activity monitor: randomized controlled trial**. *J Med Internet Res* 2009, **11**(3):e27.
148. Stamm H, Lamprecht M: **Structural and cultural factors influencing physical activity in Switzerland**. *Journal of Public Health* 2005, **13**(4):203-211.
149. Brug J, Oenema A, Campbell M: **Past, present, and future of computer-tailored nutrition education**. *Am J Clin Nutr* 2003, **77**(4 Suppl):1028S-1034S.
150. Bull FC, Jamrozik K, Blanksby BA: **Tailored advice on exercise--does it make a difference?** *Am J Prev Med* 1999, **16**(3):230-239.
151. Bull FC, Kreuter MW, Scharff DP: **Effects of tailored, personalized and general health messages on physical activity**. *Patient Educ Couns* 1999, **36**(2):181-192.
152. Bock BC, Marcus BH, Pinto BM, Forsyth LH: **Maintenance of physical activity following an individualized motivationally tailored intervention**. *Ann Behav Med* 2001, **23**(2):79-87.
153. Glasgow RE, Nelson CC, Kearney KA, Reid R, Ritzwoller DP, Strecher VJ, Couper MP, Green B, Wildenhaus K: **Reach, engagement, and retention in an Internet-based weight loss program in a multi-site randomized controlled trial**. *J Med Internet Res* 2007, **9**(2):e11.
154. Basler HD, Jäkle C, Keller S, Baum E: **Selbstwirksamkeit, Entscheidungsbalance und die Motivation zu sportlicher Aktivität [Self-efficacy, decisional balance, and the motivation to do vigorous exercise]**. *Zeitschrift für Differentielle und Diagnostische Psychologie* 1999, **20**:203-216.
155. Marcus BH, Rossi JS, Selby VC, Niaura RS, Abrams DB: **The stages and processes of exercise adoption and maintenance in a worksite sample**. *Health Psychol* 1992, **11**(6):386-395.
156. Nigg CR, Riebe D: **The Transtheoretical Model: Research review of exercise behavior and older adults**. In *Promoting exercise and behavior change in older adults: interventions with the Transtheoretical Model*. Edited by Burbank P, Riebe D. New York: Springer Publishing Company; 2002:147-180.
157. Abel MG, Hannon JC, Sell K, Lillie T, Conlin G, Anderson D: **Validation of the Kenz Lifecorder EX and ActiGraph GT1M accelerometers for walking and running in adults**. *Appl Physiol Nutr Metab* 2008, **33**(6):1155-1164.
158. Tucker P, Gilliland J: **The effect of season and weather on physical activity: a systematic review**. *Public Health* 2007, **121**(12):909-922.
159. Lewis B, Williams D, Dunsiger S, Sciamanna C, Whiteley J, Napolitano M, Bock B, Jakicic J, Getz M, Marcus B: **User attitudes towards physical activity websites in a randomized controlled trial**. *Prev Med* 2008, **47**(5):508-513.
160. Tate DF, Wing RR, Winett RA: **Using Internet technology to deliver a behavioral weight loss program**. *JAMA* 2001, **285**(9):1172-1177.
161. Woolf SH, Krist AH, Johnson RE, Wilson DB, Rothemich SF, Norman GJ, Devers KJ: **A practice-sponsored Web site to help patients pursue healthy behaviors: an ACORN study**. *Ann Fam Med* 2006, **4**(2):148-152.
162. Kypri K, McAnally HM: **Randomized controlled trial of a web-based primary care intervention for multiple health risk behaviors**. *Prev Med* 2005, **41**(3-4):761-766.

163. Ware LJ, Hurling R, Bataveljic O, Fairley BW, Hurst TL, Murray P, Rennie KL, Tomkins CE, Finn A, Cobain MR *et al*: **Rates and determinants of uptake and use of an internet physical activity and weight management program in office and manufacturing work sites in England: cohort study**. *J Med Internet Res* 2008, **10**(4):e56.
164. Cook RF, Billings DW, Hersch RK, Back AS, Hendrickson A: **A field test of a web-based workplace health promotion program to improve dietary practices, reduce stress, and increase physical activity: randomized controlled trial**. *J Med Internet Res* 2007, **9**(2):e17.
165. Marcus BH, Ciccolo JT, Sciamanna CN: **Using electronic/computer interventions to promote physical activity**. *Br J Sports Med* 2009, **43**(2):102-105.
166. Adams J, White M: **Why don't stage-based activity promotion interventions work?** *Health Educ Res* 2005, **20**(2):237-243.
167. Brug J, Conner M, Harre N, Kremers S, McKellar S, Whitelaw S: **The Transtheoretical Model and stages of change: a critique: observations by five commentators on the paper by Adams, J. and White, M. (2004) why don't stage-based activity promotion interventions work?** *Health Educ Res* 2005, **20**(2):244-258.
168. Eysenbach G: **The law of attrition**. *J Med Internet Res* 2005, **7**(1):e11.
169. De Bourdeaudhuij I, Stevens V, Vandelanotte C, Brug J: **Evaluation of an interactive computer-tailored nutrition intervention in a real-life setting**. *Ann Behav Med* 2007, **33**(1):39-48.
170. Christensen H, Griffiths KM, Farrer L: **Adherence in internet interventions for anxiety and depression**. *J Med Internet Res* 2009, **11**(2):e13.
171. van den Berg MH, Ronday HK, Peeters AJ, Voogt-van der Harst EM, Munneke M, Breedveld FC, Vliet Vlieland TP: **Engagement and satisfaction with an Internet-based physical activity intervention in patients with rheumatoid arthritis**. *Rheumatology (Oxford)* 2007, **46**(3):545-552.
172. Danaher BG, Boles SM, Akers L, Gordon JS, Severson HH: **Defining participant exposure measures in Web-based health behavior change programs**. *J Med Internet Res* 2006, **8**(3):e15.
173. Balmford J, Borland R, Benda P: **Patterns of use of an automated interactive personalized coaching program for smoking cessation**. *J Med Internet Res* 2008, **10**(5):e54.
174. Christensen H, Griffiths KM, Korten AE, Brittliffe K, Groves C: **A comparison of changes in anxiety and depression symptoms of spontaneous users and trial participants of a cognitive behavior therapy website**. *J Med Internet Res* 2004, **6**(4):e46.
175. Farvolden P, Denisoff E, Selby P, Bagby RM, Rudy L: **Usage and longitudinal effectiveness of a Web-based self-help cognitive behavioral therapy program for panic disorder**. *J Med Internet Res* 2005, **7**(1):e7.
176. Linke S, Murray E, Butler C, Wallace P: **Internet-based interactive health intervention for the promotion of sensible drinking: patterns of use and potential impact on members of the general public**. *J Med Internet Res* 2007, **9**(2):e10.
177. Verheijden MW, Jans MP, Hildebrandt VH, Hopman-Rock M: **Rates and determinants of repeated participation in a web-based behavior change program for healthy body weight and healthy lifestyle**. *J Med Internet Res* 2007, **9**(1):e1.
178. **Active-online**.
179. Wanner M, Martin-Diener E, Braun-Fahrländer C, Bauer G, Martin BW: **Effectiveness of active-online, an individually tailored physical activity intervention, in a real-life setting: randomized controlled trial**. *J Med Internet Res* 2009, **11**(3):e23.
180. Cuzick J: **A Wilcoxon-type test for trend**. *Stat Med* 1985, **4**(1):87-90.
181. **Regelmässige Internetnutzung nach Geschlecht [Regular internet use according to gender]** [http://www.bfs.admin.ch/bfs/portal/de/index/themen/21/02/ind7.indicator.70903.709.html

WebCite Cache: http://www.webcitation.org/5cn8NFbKo]
182. Horch K, Wirz J: **Nutzung von Gesundheitsinformationen [People's interest in health information]**. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 2005, **48**(11):1250-1255.
183. Fallows D: **How Women and Men Use the Internet**. *Volume 2008*. Washington, D.C.: Pew Internet & American Life Project; 2005.
184. Atkinson NL, Saperstein SL, Pleis J: **Using the internet for health-related activities: findings from a national probability sample**. *J Med Internet Res* 2009, **11**(1):e4.
185. Christensen H, Griffiths KM, Jorm AF: **Delivering interventions for depression by using the internet: randomised controlled trial**. *Bmj* 2004, **328**(7434):265.

186. Stamm H, Fischer A, Lamprecht M: **Evaluation des Bewegungsförderungsprogramms "Allez Hop". Resultate einer Internetbefragung von ausgebildeten Allez Hop Leiter/innen (Evaluation of the physical activity promotion programme "Allez Hop". Results of an internet-based survey of trained Allez Hop instructors)**. Zürich: L&S Sozialforschung und Beratung AG; 2007.
187. Cavill N, Kahlmeier S, Racioppi F: **Physical Activity and Health in Europe. Evidence for Action**. Copenhagen: WHO Regional Office for Europe; 2006.
188. Daugbjerg S, Kahlmeier S, Racioppi F, Martin-Diener E, Martin B, Oja P, Bull F: **Promotion of physical activity in the European region: Content analysis of 27 national policy documents**. *J Phys Act Health* 2009, **in press**.
189. Physical Activity Guidelines Advisory Committee: **Physical Activity Guidelines Advisory Committee Report 2008**. Washington, DC: U.S. Department of Health and Human Services; 2008:A-9.
190. Dawson J, Boller I, Foster C, Hillsdon M: **Evaluation of changes to physical activity amongst people who attend the Walking the Way to Health Initiative (WHI) - Prospective Survey**. Cheltenham: The Countryside Agency; 2006.
191. Steele K: **Paths to Health: 5th Annual Progress Report (1 September 2005 – 31 August 2006)**. 2006.
192. Ogilvie D, Foster CE, Rothnie H, Cavill N, Hamilton V, Fitzsimons CF, Mutrie N: **Interventions to promote walking: systematic review**. *Bmj* 2007, **334**(7605):1204.
193. Rootman I, Edwards P: **The best laid schemes of mice and men... ParticipACTION's legacy and the future of physical activity promotion in Canada**. *Can J Public Health* 2004, **95 Suppl 2**:S37-42.
194. Foster C: **Guidelines for health-enhancing physical activity promotion programmes. The European Network for the Promotion of Health-Enhancing Physical Activity**. Tampere: UKK Institute; 2000.
195. Vuori I, Lankenau B, Pratt M: **Physical activity policy and program development: the experience in Finland**. *Public Health Rep* 2004, **119**(3):331-345.
196. Lamprecht M, Fischer A, Stamm HP: **Sport Schweiz 2008: Das Sportverhalten der Schweizer Bevölkerung (Sport in Switzerland 2008: Sport behaviour in the Swiss population)**. Magglingen: Swiss Federal Office of Sport; 2008.
197. Wanner M, Martin-Diener E, Stamm HP, Lamprecht M, Martin B: **10 Jahre Allez Hop - Rückblick auf die selektiven Evaluationsansätze (Ten years of Allez Hop - retrospection and selective evaluation approaches)**. In *Schriften der Deutschen Vereinigung für Sportwissenschaft Band 174: Sport und Gesundheit in der Lebensspanne: 2008; Jahrestagung der dvs-Kommission Gesundheit, Bad Schönborn*. Edited by Knoll & Woll. Czwalina Verlag Hamburg; 2008:90-96.
198. Wanner M, Martin-Diener E, Popp C, Röthlisberger K, Ackermann B, Martin BW: **A semiautomated web-based approach for routine evaluation of physical activity courses**. *Schweiz Z Sportmed Sporttraumatol* 2009, **57**(2):93-95.
199. Swiss Federal Statistical Office: **Die Schweizerische Gesundheitsbefragung 2007 in Kürze. Konzept, Methode, Durchführung (The Swiss Health Survey in brief: Concept, methods, implementation)**. Neuchâtel: Swiss Federal Office of Statistics.
200. Lamprecht M, Stamm HP: **Sport Schweiz 2000: Sportaktivitäten und Sportkonsum der Schweizer Bevölkerung (Sport in Switzerland 2000: Sport activities and sport consumption of the Swiss population)**. Basel, Bern, Zürich: Swiss Olympic, Sport Toto Association; 2000.
201. Nützi C: **Evaluation der Werbekampagne Allez Hop (Evaluation of the advertisement campaign Allez Hop)**. Dübendorf: IPSO Sozial-, Marketing- und Personalforschung; 1998.
202. Swiss Federal Office of Sport (FOSPO): **Konzept des Bundesrates für eine Sportpolitik in der Schweiz (The Swiss Federal Government's concept for a national sport policy)**. Magglingen, Switzerland; 2000.
203. Swiss Federal Office of Sport (FOSPO): **Konzept des Bundesrates für eine Sportpolitik in der Schweiz: Bericht zu den Umsetzungsmassnahmen 2003 bis 2006 (The Swiss Federal Government's concept for a national sport policy: Report of the implementation measures 2003 to 2006)**. Magglingen, Switzerland; 2006.
204. Hillsdon M, Cavill N, Nanchahal K, Diamond A, White IR: **National level promotion of physical activity: results from England's ACTIVE for LIFE campaign**. *J Epidemiol Community Health* 2001, **55**(10):755-761.

205. Wanner M, Wyss T, Schneider A, Martin B: **Evaluation der Seniorensportangebote in der Schweiz: Bericht zur Pilotphase (Evaluation of senior sport offers in Switzerland: Report of the pilot phase)**. Magglingen: Federal Office of Sport; 2005.
206. Hillsdon M, Foster C, Cavill N, Crombie H, Naidoo B: **The effectiveness of public health interventions for increasing physical activity among adults: a review of reviews: Evidence briefing**. London: Health Development Agency; 2005.
207. World Health Organization: **The Challenge of Obesity in the WHO European Region and the Strategies for Response**. Edited by Branca F, Nikogosian H, Lobstein T. Copenhagen: WHO; 2007.
208. Haskell WL, Lee IM, Pate RR, Powell KE, Blair SN, Franklin BA, Macera CA, Heath GW, Thompson PD, Bauman A: **Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association**. *Med Sci Sports Exerc* 2007, **39**(8):1423-1434.
209. Martin B, Mäder U, Calmonte R: **Einstellung, Wissen und Verhalten der Schweizer Bevölkerung bezüglich körperlicher Aktivität: Resultate aus dem Bewegungssurvey 1999 (Physical activity related attitudes, knowledge and behaviour in the Swiss population: Results of the HEPA Survey 1999)**. *Schweiz Z Sportmed Sporttraumatol* 1999, **47**(4):165-168.
210. Sjöström M, Oja P, Hagströmer M, Smith B, Bauman A: **Health-enhancing physical activity across European Union countries: the Eurobarometer study**. *Journal of Public Health* 2006, **14**(5):291-300.
211. Craig CL, Russell SJ, Cameron C, Bauman A: **Twenty-year trends in physical activity among Canadian adults**. *Can J Public Health* 2004, **95**(1):59-63.
212. Borodulin K, Laatikainen T, Juolevi A, Jousilahti P: **Thirty-year trends of physical activity in relation to age, calendar time and birth cohort in Finnish adults**. *Eur J Public Health* 2008, **18**(3):339-344.
213. Tammelin T: **A review of longitudinal studies on youth predictors of adulthood physical activity**. *Int J Adolesc Med Health* 2005, **17**(1):3-12.
214. Brodersen NH, Steptoe A, Boniface DR, Wardle J: **Trends in physical activity and sedentary behaviour in adolescence: ethnic and socioeconomic differences**. *Br J Sports Med* 2007, **41**(3):140-144.
215. Tammelin T, Ekelund U, Remes J, Nayha S: **Physical activity and sedentary behaviors among Finnish youth**. *Med Sci Sports Exerc* 2007, **39**(7):1067-1074.
216. Gordon-Larsen P, Nelson MC, Popkin BM: **Longitudinal physical activity and sedentary behavior trends: adolescence to adulthood**. *Am J Prev Med* 2004, **27**(4):277-283.
217. Martin B, Lamprecht M, Calmonte R, Raeber P-A, Marti B: **Taux d'activité physique de la population suisse: niveaux et effets sur l'état de santé (Physical activity in the Swiss population: Levels and effects on health state)**. *Schweiz Z Sportmed Sporttraumatol* 2000, **48**(4):161-162.
218. NICE Public Health Collaborating Centre – Physical Activity: **Physical Activity and Children: Review 2 - Correlates of phyiscal activity in children: A review of quantitative systematic reviews**. 2007.
219. Hamilton M, Healy G, Dunstan D, Zderic T, Owen N: **Too little exercise and too much sitting: Inactivity physiology and the need for new recommendations on sedentary behavior**. *Current Cardiovascular Risk Reports* 2008, **2**(4):292-298.
220. Sallis JF, Prochaska JJ, Taylor WC: **A review of correlates of physical activity of children and adolescents**. *Med Sci Sports Exerc* 2000, **32**(5):963-975.
221. Marshall SJ, Biddle SJ, Gorely T, Cameron N, Murdey I: **Relationships between media use, body fatness and physical activity in children and youth: a meta-analysis**. *Int J Obes Relat Metab Disord* 2004, **28**(10):1238-1246.
222. Wong BY, Cerin E, Ho SY, Mak KK, Lo WS, Lam TH: **Adolescents' physical activity: Competition between perceived neighborhood sport facilities and home media resources**. *Int J Pediatr Obes* 2009:1-8.
223. Feldman DE, Barnett T, Shrier I, Rossignol M, Abenhaim L: **Is physical activity differentially associated with different types of sedentary pursuits?** *Arch Pediatr Adolesc Med* 2003, **157**(8):797-802.
224. Santos MP, Gomes H, Mota J: **Physical activity and sedentary behaviors in adolescents**. *Ann Behav Med* 2005, **30**(1):21-24.
225. Utter J, Neumark-Sztainer D, Jeffery R, Story M: **Couch potatoes or french fries: are sedentary behaviors associated with body mass index, physical activity, and dietary behaviors among adolescents?** *J Am Diet Assoc* 2003, **103**(10):1298-1305.

226. Koezuka N, Koo M, Allison KR, Adlaf EM, Dwyer JJ, Faulkner G, Goodman J: **The relationship between sedentary activities and physical inactivity among adolescents: results from the Canadian Community Health Survey**. *J Adolesc Health* 2006, **39**(4):515-522.
227. Kerner MS, Kalinski M, Kurrant AB, Small E, Spatz E, Gropack S: **Leisure-time Internet use does not correlate with physical activity or physical fitness level of ninth grade African-American girls**. *Pediatric Exercise Science* 2001, **13**(4):402-412.
228. Kerner MS, Kurrant AB, Kalinski MI: **Leisure-Time Physical Activity, Sedentary Behavior, and Fitness of High School Girls**. *European Journal of Sport Science* 2004, **4**(2):1-17.
229. Lamprecht M, Fischer A, Stamm HP: **Sport Schweiz 2008: Kinder- und Jugendbericht (Sport in Switzerland 2008: report on children and adolescents**. Magglingen: Swiss Federal Office of Sport; 2008.
230. Zimmermann-Sloutskis D, Martin B, Marti B, Ken A, Zimmermann E: **Spontaneous changes in physical activity and its predictors in the Swiss Household Panel (SHP)**. In *8th Annual Congress of the European College of Sport Science: 2003; Salzburg, Austria*. Edited by E. Müller HS, G. Zallinger, V. Fastenbauer; 2003:24.
231. Kohatsu ND, Robinson JG, Torner JC: **Evidence-based public health: an evolving concept**. *Am J Prev Med* 2004, **27**(5):417-421.
232. Jenicek M: **Epidemiology, evidenced-based medicine, and evidence-based public health**. *J Epidemiol* 1997, **7**(4):187-197.
233. Blackwood B: **Methodological issues in evaluating complex healthcare interventions**. *J Adv Nurs* 2006, **54**(5):612-622.
234. Twinn S: **The evaluation of the effectiveness of health education interventions in clinical practice: a continuing methodological challenge**. *J Adv Nurs* 2001, **34**(2):230-237.
235. Schwartz D, Lellouch J: **Explanatory and pragmatic attitudes in therapeutical trials**. *J Chronic Dis* 1967, **20**(8):637-648.
236. Treweek S, Zwarenstein M: **Making trials matter: pragmatic and explanatory trials and the problem of applicability**. *Trials* 2009, **10**:37.
237. Schwartz D, Lellouch J: **Explanatory and pragmatic attitudes in therapeutical trials**. *J Clin Epidemiol* 2009, **62**(5):499-505.
238. Murray E, Khadjesari Z, White IR, Kalaitzaki E, Godfrey C, McCambridge J, Thompson SG, Wallace P: **Methodological challenges in online trials**. *J Med Internet Res* 2009, **11**(2):e9.
239. Eysenbach G: **Issues in evaluating health websites in an Internet-based randomized controlled trial**. *J Med Internet Res* 2002, **4**(3):E17.
240. Zahner L, Puder JJ, Roth R, Schmid M, Guldimann R, Puhse U, Knopfli M, Braun-Fahrlander C, Marti B, Kriemler S: **A school-based physical activity program to improve health and fitness in children aged 6-13 years ("Kinder-Sportstudie KISS"): study design of a randomized controlled trial [ISRCTN15360785]**. *BMC Public Health* 2006, **6**:147.
241. Singh AS, Chin APMJ, Kremers SP, Visscher TL, Brug J, van Mechelen W: **Design of the Dutch Obesity Intervention in Teenagers (NRG-DOiT): systematic development, implementation and evaluation of a school-based intervention aimed at the prevention of excessive weight gain in adolescents**. *BMC Public Health* 2006, **6**:304.
242. Drummond M, Weatherly H, Claxton K, Cookson R, Ferguson B, Godfrey C, Rice N, Sculpher M, Sowden A: **Assessing the challenges of applying the standard methods of economic evaluation to public health interventions (Short report)**. Public Health Research Consortium; 2007.
243. Drummond M, Weatherly H, Ferguson B: **Economic evaluation of health interventions**. *Bmj* 2008, **337**:a1204.
244. Weatherly H, Drummond M, Claxton K, Cookson R, Ferguson B, Godfrey C, Rice N, Sculpher M, Sowden A: **Methods for assessing the cost-effectiveness of public health interventions: Key challenges and recommendations**. *Health Policy* 2009.
245. Tate DF, Finkelstein EA, Khavjou O, Gustafson A: **Cost Effectiveness of Internet Interventions: Review and Recommendations**. *Ann Behav Med* 2009.
246. Brouwer W, Oenema A, Crutzen R, de Nooijer J, de Vries NK, Brug J: **An exploration of factors related to dissemination of and exposure to internet-delivered behavior change interventions aimed at adults: a Delphi study approach**. *J Med Internet Res* 2008, **10**(2):e10.
247. Estabrooks P: **Environmentally tailored interventions for physical activity: development, mediation, and outcomes**. In *Book of Abstracts of the Annual Conference of the International Society*

of Behavioral Nutrition and Physical Activity: 2009; Lisbon. Edited by Biddle SJ, Guldan G, Gans K, Ball K, Almeida MD, Teixeira P, French S; 2009:80.

248. Prins R, van Empelen P, Beenackers M, Brug J, Oenema A: **Development of YouR Action: a novel computer-tailored intervention that incorporates environmental information**. In *Book of Abstracts of the Annual Conference of the International Society of Behavioral Nutrition and Physical Activity: 2009; Lisbon*. Edited by Biddle SJ, Guldan G, Gans K, Ball K, Almeida MD, Teixeira P, French S; 2009:80-81.

249. Danaher BG, Seeley JR: **Methodological Issues in Research on Web-Based Behavioral Interventions**. *Ann Behav Med* 2009.

Abbreviations

95% CI	95% Confidence Intervals
BASPO	Bundesamt für Sport (Federal Office of Sport)
BMI	Body Mass Index
BMR	Basal Metabolic Rate
BRFSS	Behavioural Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
CG	Control Group
DALY	Disability-adjusted Life Year
DIT	Diet-induced Thermogenesis
e.g.	exempli gratia (Latin) meaning "for example"
FU	Follow-up
GPAQ	Global Physical Activity Questionnaire
HDL	High-density Lipoprotein
HEPA	Health-enhancing Physical Activity
i.e.	id est (Latin) meaning "that is"
IG	Intervention Group
IPAQ	International Physical Activity Questionnaire
IQR	Interquartile Range
IT	Information Technology
MET	Metabolic Equivalent
NHANES	National Health and Nutrition Examination Survey
OR	Odds Ratio
PAFQ	Physical Activity Frequency Questionnaire
RCT	Randomised Controlled Trial
RMR	Resting Metabolic Rate
SHP	Swiss Household Panel

SMS	Short Message Service
SU	Spontaneous Users
SUVA	Schweizerische Unfallversicherungssanstalt (Swiss National Accident Insurance Organisation)
TTM	Transtheoretical Model of Behaviour Change
UK	United Kingdom
URL	Uniform Resource Locator
US	United States
WHO	World Health Organisation

ANNEX

Online Questionnaire Used in the RCT (Chapter 5)

1. Wie haben Sie von dieser Studie erfahren
   - ❍ Hinweis im Care Magazin der Krankenkasse Wincare
   - ❍ Link auf www.sprechzimmer.ch
   - ❍ Hinweis in der Coop Zeitung
   - ❍ Hinweis in Gesundheit Sprechstunde
   - ❍ Inserat im Sonntagsblick
   - ❍ Inserat in der Sonntagszeitung
   - ❍ Webseite des Beobachters
   - ❍ Newsletter der Krankenkassen Helsana/Progrès
   - ❍ Newsletter von sprechzimmer.ch
   - ❍ Monatsmailing Netzwerk Gesundheit und Bewegung Schweiz
   - ❍ Hinweis im Bieler Tagblatt
   - ❍ Hinweis in der Berner Zeitung
   - ❍ Hinweis im Bund
   - ❍ Hinweis in der Basler Zeitung
   - ❍ Hinweis im Tagesanzeiger
   - ❍ andere, nämlich _____

2.Ihr Jahrgang ☐

3. Ihr Geschlecht
   - ❍ weiblich
   - ❍ männlich

4. Wie ist Ihre familiäre Situation?
   - ❍ mit Lebenspartner/in, keine Kinder
   - ❍ mit Lebenspartner/in, Kinder zu Hause
   - ❍ mit Lebenspartner/in, Kinder ausgezogen
   - ❍ alleinstehend, keine Kinder
   - ❍ alleinstehend, Kinder zu Hause
   - ❍ alleinstehend, Kinder ausgezogen
   - ❍ anderes

5. Welches ist die höchste Ausbildung, die Sie abgeschlossen haben?

- ❍ obligatorische Schule
- ❍ Berufsschule, Berufslehre
- ❍ Mittelschule, Matura
- ❍ höhere Berufsausbildung, höhere Fachschule
- ❍ Universität, Hochschule, Fachhochschule

6. Jetzt geht es um Ihre (hauptberufliche) Erwerbstätigkeit. Sind Sie

- ❍ in Ausbildung
- ❍ Angestellt als Lehrling / Lehrtochter (mit Lehrvertrag oder Anlehrvertrag)
- ❍ Angestellt , z.B. als Angestellte/r, Arbeiter/in, Praktikant/in
- ❍ Angestellt im mittleren und unteren Kader, z.B. als Bürochef/in, Dienstchef/in, Filialleiter/in, Gruppenchef/in, Werkstättenchef/in, Werkmeister/in, Vorarbeiter/in, Polier/in
- ❍ Angestellt als Direktor/in, Prokurist/in, Chefbeamter/in
- ❍ selbständig erwerbend
- ❍ Hausfrau / Hausmann
- ❍ in Pension
- ❍ arbeitslos
- ❍ sonstiges

7. Welche Nationalität haben Sie?

- ❍ Schweiz
- ❍ andere Nationalität, nämlich: _____ (*Drop down Menu*)
- ❍ Doppelbürger, nämlich:_____ und _____ (*Drop down Menu)*

8. Rauchen Sie (auch selten)?

- ❍ ja
- ❍ nein

9. Falls Sie rauchen, was und wie viel rauchen Sie im Durchschnitt pro Tag?

- ❍ Zigaretten ____ Stück pro Tag
- ❍ Zigarren ____ Stück pro Tag
- ❍ Zigarillos ____ Stück pro Tag
- ❍ Pfeife ____ Stück pro Tag

10. Wie gross sind Sie? _____cm

11. Wie schwer sind Sie? _____kg

12. Jetzt geht es um körperliche Aktivitäten, bei denen Sie ***zumindest ein bisschen ausser Atem*** kommen, zum Beispiel zügiges Gehen, Velofahren, Wandern, Tanzen, viele Gartenarbeiten oder viele Sportarten.

An wie **vielen Tagen pro Woche** machen Sie körperliche Aktivitäten dieser Art? Bitte kreuzen Sie diejenige Zahl an, die am ehesten für Sie zutrifft:*)*

0	1	2	3	4	5	6	7
❍	❍	❍	❍	❍	❍	❍	❍

13. Wie lange sind Sie durchschnittlich an jedem dieser Tage aktiv?

_____ Minuten

14. Jetzt geht es um sportliche oder körperliche Aktivitäten, bei denen Sie ***ziemlich ins Schwitzen*** kommen, zum Beispiel Joggen, Aerobics, Tennis, schnelles Rad fahren, Spielsportarten, Schwimmen, Lasten tragen, Graben, Schaufeln.

An wie **vielen Tagen pro Woche** machen Sie sportliche Aktivitäten dieser Art? Bitte kreuzen Sie diejenige Zahl an, die am ehesten für Sie zutrifft:

0	1	2	3	4	5	6	7
❍	❍	❍	❍	❍	❍	❍	❍

15. Wie lange sind Sie durchschnittlich an jedem dieser Tage aktiv?

_____ Minuten

16. Welche der folgenden 4 Beschreibungen trifft am besten auf Ihre körperliche Betätigung im Beruf zu?

- ❍ Ich arbeite meist im Sitzen und brauche nur selten hin- und herzugehen (z.B. Uhrmacher, Telefonistin).
- ❍ Bei meiner Arbeit muss ich viel umhergehen, doch habe ich keine schweren Dinge zu tragen oder zu verschieben (z.B. Coiffeur, Schuhverkäuferin).
- ❍ Bei meiner Arbeit muss ich oft Treppensteigen oder relativ schwere Dinge transportieren (z.B. Briefträger, Flächenmaler, Serviertochter).
- ❍ Meine Arbeit ist mit schwerer körperlicher Anstrengung verbunden, so muss ich Lasten tragen oder schwere Gegenstände bewegen (z.B. Zügelmann, Bauhandlanger).
- ❍ Ich übe keine berufliche Tätigkeit aus.

17. Wie lange sind Sie schon in der Art aktiv, wie Sie es heute sind?

- ❍ Weniger als 3 Monate
- ❍ 3 bis 6 Monate
- ❍ 6 Monate bis zu einem Jahr
- ❍ Mehr als ein Jahr

18. Haben Sie vor, in den nächsten 6 Monaten das Ausmass Ihrer körperlichen Aktivitäten zu erhöhen?

- ❍ ja
- ❍ nein

19. Haben Sie vor, im nächsten Monat das Ausmass Ihrer körperlichen Aktivitäten zu erhöhen?

- ❍ ja
- ❍ nein

20. Denken Sie, dass Sie sich für Ihre Gesundheit genug bewegen?

- ❍ ja
- ❍ nein

21. Was haben Sie ganz allgemein das Gefühl: Wie anstrengend muss Bewegung sein, damit Ihre Gesundheit davon profitiert?

- ❍ Jede Bewegung tut der Gesundheit gut.
- ❍ Die Bewegung muss mindestens so sein, dass man dabei ein bisschen ausser Atem kommt.
- ❍ Die Bewegung muss mindestens so sein, dass man dabei ins Schwitzen kommt.
- ❍ Die Bewegung muss so sein, dass man ausser Atem kommt und nicht mehr reden kann.
- ❍ Ich weiss nicht.

22. Und wie viel und wie lange müssen Sie sich bewegen, damit Ihre Gesundheit davon profitiert?
- ❍ Jede Bewegung tut der Gesundheit gut.
- ❍ Man muss sich mindestens 10 Minuten täglich bewegen.
- ❍ Man muss sich mindestens eine halbe Stunde täglich bewegen.
- ❍ Man muss sich mindestens 2-mal pro Woche eine Stunde bewegen.
- ❍ Man muss sich mindestens 5 Stunden pro Woche bewegen.
- ❍ Ich weiss nicht.

23. Trauen Sie sich zu, auch in den folgenden Situationen aktiv zu sein?

	traue ich mir gar nicht zu	traue ich mir wenig zu	traue ich mir einiger-massen zu	traue ich mir weit-gehend zu	traue ich mir sehr zu
…. wenn Sie müde sind.	❍	❍	❍	❍	❍
…. wenn Sie schlechte Laune haben.	❍	❍	❍	❍	❍
…. wenn Sie denken, dass Sie keine Zeit haben.	❍	❍	❍	❍	❍
…. wenn Sie Ferien haben.	❍	❍	❍	❍	❍
…. wenn es schneit oder regnet.	❍	❍	❍	❍	❍

24. Wie geht es Ihnen zurzeit gesundheitlich?
- ❍ sehr gut
- ❍ gut
- ❍ mittelmässig
- ❍ schlecht
- ❍ sehr schlecht

25. Wenn Sie an letzte Woche denken, an wie vielen Tagen etwa waren Sie niedergeschlagen oder verstimmt?
- ❍ praktisch jeden Tag
- ❍ an 3-4 Tagen
- ❍ an 1-2 Tagen
- ❍ nie

26. An wie vielen Tagen in der letzten Woche waren Sie ruhig, ausgeglichen und gelassen?
- ❍ praktisch jeden Tag
- ❍ an 3-4 Tagen
- ❍ an 1-2 Tagen
- ❍ nie

27. An wie vielen Tagen in der letzten Woche waren Sie angespannt, gereizt oder nervös?
- ❍ praktisch jeden Tag
- ❍ an 3-4 Tagen
- ❍ an 1-2 Tagen
- ❍ nie

28. An wie vielen Tagen in der letzten Woche waren Sie voller Kraft, Energie und Optimismus?
- ❍ praktisch jeden Tag
- ❍ an 3-4 Tagen
- ❍ an 1-2 Tagen
- ❍ nie

29. Während wie vielen Tagen waren Sie aus gesundheitlichen Gründen in den letzten 4 Wochen nur mit Einschränkungen einsatz- und leistungsfähig, so dass Sie nicht alles wie gewohnt machen konnten?

- ❍ Anzahl Tage _____
- ❍ nie

30. Aus welchem Grund?

- ❍ Krankheit
- ❍ Unfall
- ❍ beides
- ❍ anderes