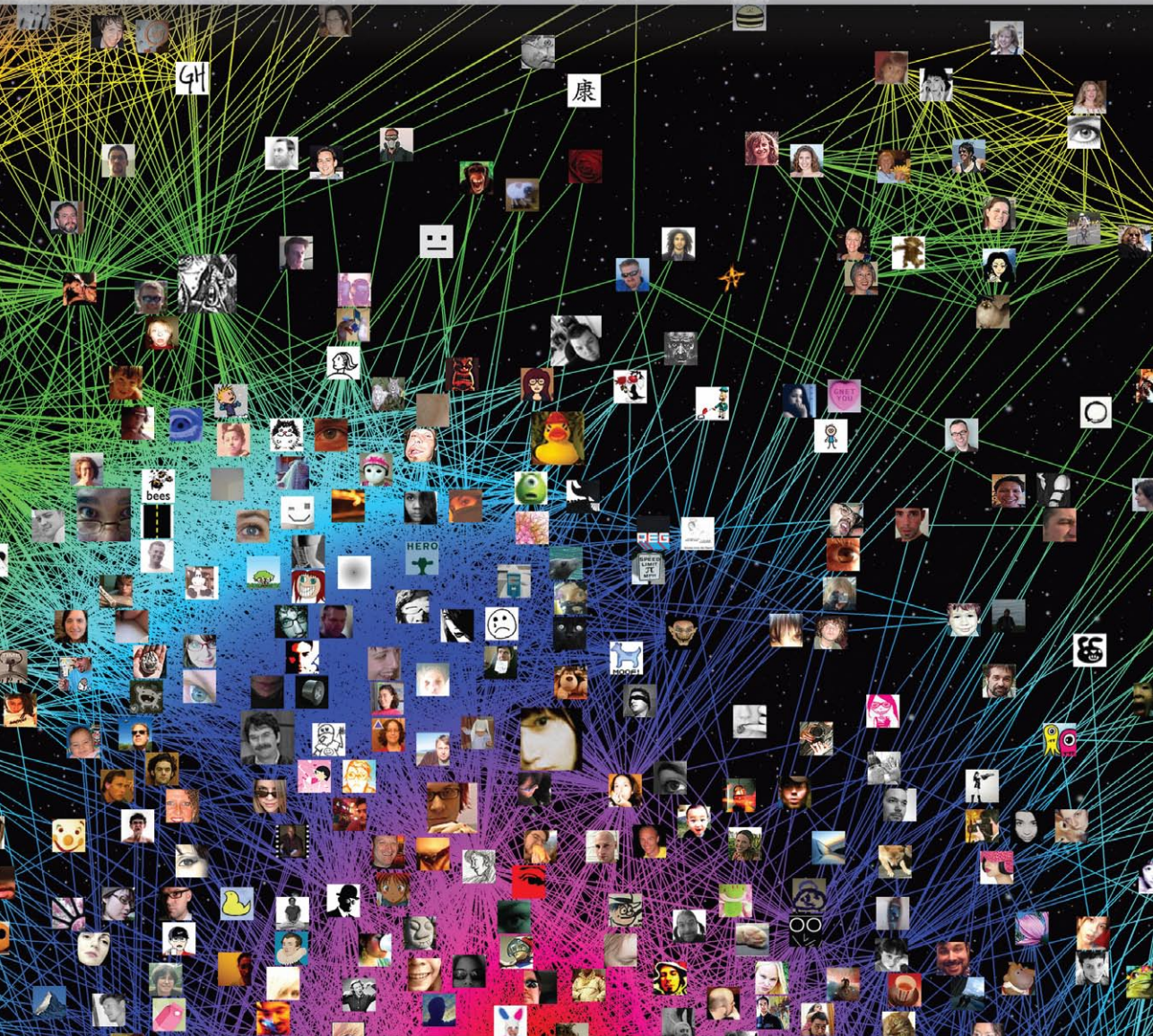
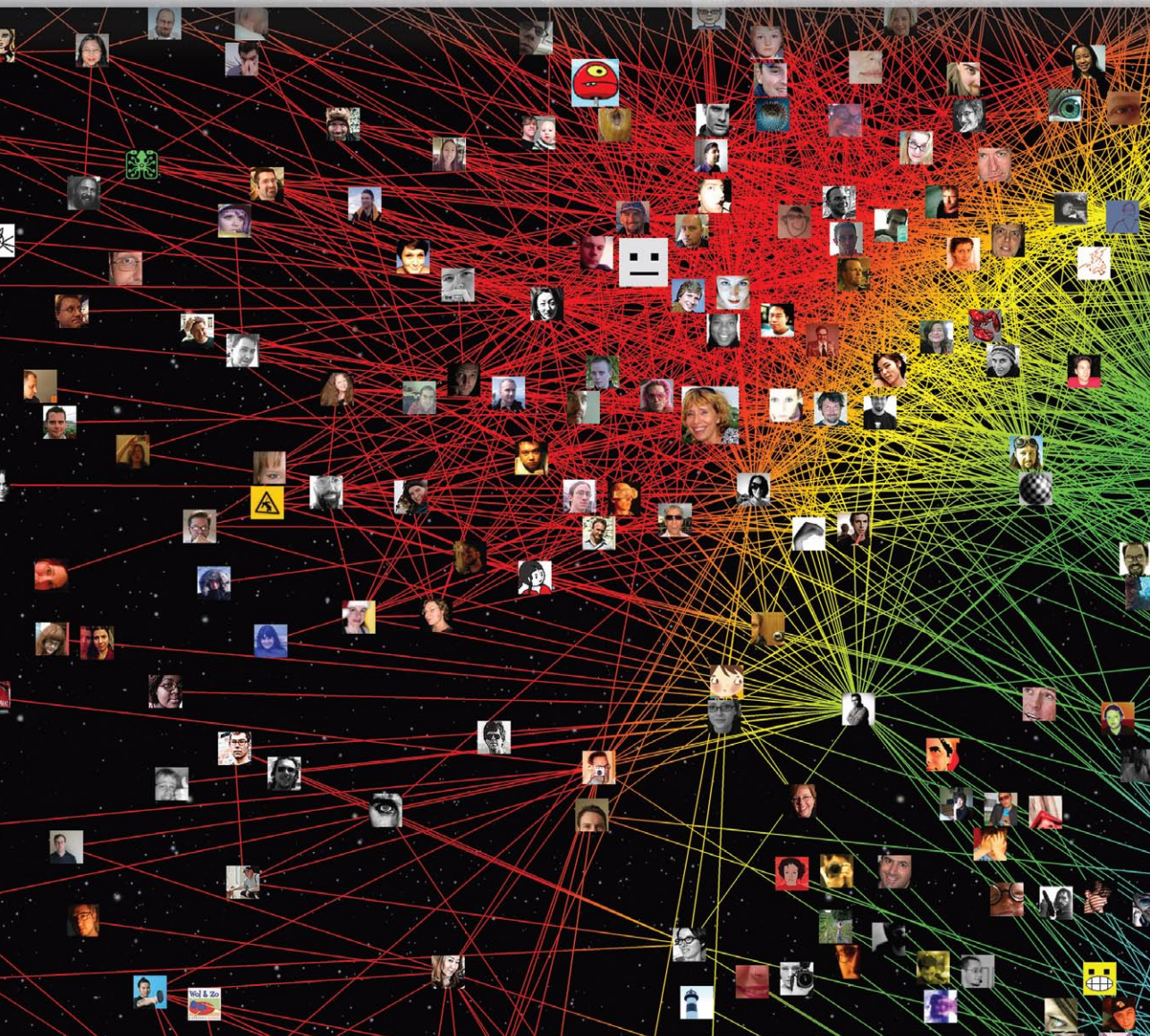


Curbing Problem Drinking in the Digital Galaxy



Heleen Riper

Many adults in our society drink too much alcohol, but few of them seek professional help for their problem drinking. Low-threshold self-help programmes could meet some of their therapeutic needs. This book examines whether digital self-help interventions could reduce problem drinking in the adult general population. The research shows that many problem drinkers are motivated to use self-help websites, and that such interventions can be cost-effective. Digital self-help hence deserves a place in a public health approach. Ten guidelines are provided for future research on the web-based prevention and treatment of problem drinking, focusing on the development, implementation, evaluation and dissemination of self-help programmes.



Curbing Problem Drinking in the Digital Galaxy

Terugdringen van Probleemdrinken
in het Digitale Universum

Heleen Riper

gal·ax·y | ˈgaləksē |

noun (pl. **-ax·ies**)

a system of millions or billions of stars, together with gas and dust, held together by gravitational attraction.

- **(the Galaxy)** the galaxy of which the solar system is a part; the Milky Way.
- **figurative** a large or impressive group of people or things : *a galaxy of boundless young talent.*

New Oxford American Dictionary

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Curbing Problem Drinking in the Digital Galaxy

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General Introduction

I

1.1 GENERAL INTRODUCTION

Why this book?

Problem drinking is multi-faceted in nature, and so is the problem-drinking population. A wide range of behavioural interventions is therefore needed to combat excessive alcohol consumption and ease the related burden of disease and social problems. This study focuses on people who drink in excess of the guidelines for low-risk drinking and experience alcohol-related problems, but who are not in touch with health services, even though they do have an interest in moderating their alcohol consumption (Posma & Koeten, 1998; Van Dijck & Knibbe, 2005).

The central question of this series of studies is whether this problem drinking can be curbed by using a new generation of digital, motivational and cognitive-behavioural self-help interventions. Together with my co-authors, I investigate this question in empirical studies focused on several aspects of digital self-help interventions for problem drinking:

- 1) Is web-based self-help effective from a clinical point of view?
- 2) Is web-based self-help cost-effective in terms of health and economic gains and losses?
- 3) Do certain groups of problem drinkers benefit more from web-based interventions than others?
- 4) Is effective web-based self-help translatable from a research context into routine practice in terms of reach, positive treatment response and acceptability to problem drinkers?
- 5) Is television-based self-help an effective additional intervention for curbing problem drinking?
- 6) How minimal and non-intrusive can self-help interventions be for problem drinkers while still being effective?

I start this chapter by providing a heuristic framework for the rationale underlying these questions, and I end it by outlining the subsequent chapters which address these questions.

1.2 PROBLEM DRINKING

The vast majority (81%) of the Dutch population aged 12 or older drinks alcohol, but the group varies greatly in the amount and frequency of alcohol consumption (CBS, 2007; Rodenburg, Spijkerman, Van den Eijnden, & Van de Mheen, 2007; Van den Brink, 1999). An estimated 10% of people between 16 and 69 years of age qualify as problem drinkers year by year, with a male/female ratio of about four to one (Van Dijck et al., 2005). This adult problem drinking prevalence rate is substantial and fairly stable, with an incidence rate of around two per cent annually (Van Dijck & Knibbe, 2006). Alcohol dependency – the most severe form of problem drinking – ranks in the Netherlands among the ten diseases with the highest burdens of illness (De Hollander, Hoeymans, Melse, Van Oers, & Polder, 2006). Worldwide has it been identified as the third leading cause of morbidity and mortality – on a par with tobacco, and accountable for nearly 3% of the total number of disability-adjusted life years (DALYs, see table 1.1; (Rehm et al., 2004; Room, Babor, & Rehm, 2005). In Europe, high-risk alcohol use is accountable for more than 8% the total number of disability-adjusted life years.

Table 1.1 DALYs attributable to high-risk alcohol use, by disease category and selected regions (in thousands of DALYs)

Disease category	Europe & Central Asia	Latin America & Caribbean	Sub-Saharan Africa	East Asia & Pacific	South Asia	High-income countries	World
Total chronic disease	6,510	5,283	2,270	10,296	3,167	4,526	33,634
Total injury	3,149	1,500	1,693	1,532	514	1,092	9,207
High-risk alcohol use	9,659	6,783	4,463	11,828	3,681	5,618	42,841
Total DALYs from all diseases	116,502	104,287	344,754	346,225	408,655	149,161	1,525,871
Proportion of DALYs attributable to high-risk alcohol use	8.3%	6.5%	1.3%	3.4%	0.9%	3.8%	2.8%

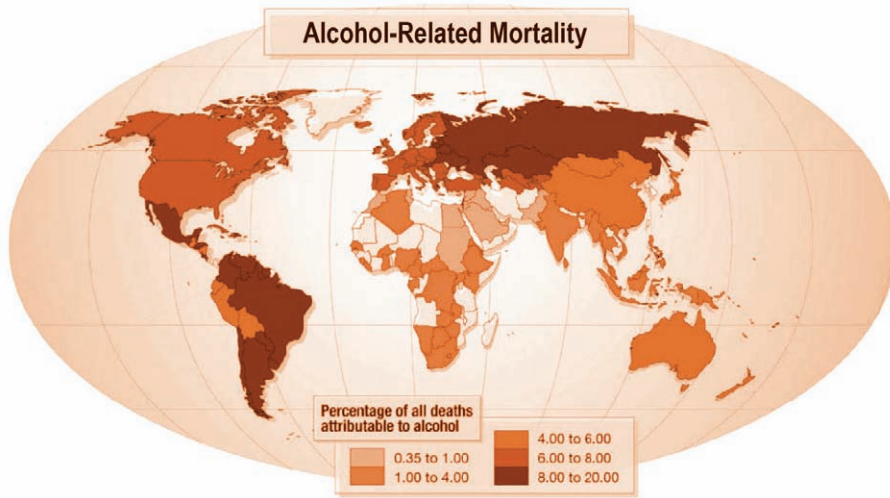
Source: Rehm et al. 2004

Contrasting with this high prevalence rate is the low uptake of addiction treatment services (3%) and general health services (10%) by problem drinkers (Ouweland, Kuijpers, Wisselink, & Van Delden, 2007; Van Laar, Cruts, Verdurmen, Van Ooyen-Houben, & Meijer, 2008). The uptake is almost non-existent among less severe problem drinkers (Van Laar et al., 2008). This may not come as a surprise, as addiction services predominantly focus on severely alcohol-dependent people. The low problem-drinking population experiences a high threshold to enter these services, attributable to fears of stigmatisation, loss of privacy or problems with work or family, as well as to low motivation for behavioural change (Cunningham, Sobell, Sobell, Agrawal, & Toneatto, 1993; Humphreys & Tucker, 2002; Sobell et al., 2002). The differences between the untreated problem drinkers in the general population – the largest share of the problem-drinking population – and the clinical treatment populations are illustrated by epidemiological studies. Clinical populations are more often severely dependent, have longer problem-drinking careers (over seven years)

and higher rates of relapse (De Bruijn, van den, de Graaf, & Vollebergh, 2006; Van Laar et al., 2008).

The question arises as to whether this low uptake is problematic and whether an increased uptake of conventional services would lead to health and socioeconomic gains. The first answer might be that it is not a problem at all, as the remission rates for less severe and even highly dependent drinkers appear high, despite the low uptake of services (De Bruijn et al., 2006; Sobell et al., 2002). This indicates that many in this group are able to overcome their excessive alcohol consumption without professional involvement. However, the high remission rates may reduce the prevalence of unmet needs, but not the importance of acknowledging these needs. One could argue moreover that, notwithstanding the high remission rates, drinking in excess of recommended guidelines is still known to have many detrimental health effects and associated elevated morbidity and mortality levels worldwide (see figure 1.1 and (Rehm, Gmel, Sempos, & Trevisan, 2003; World Health Organization, 2007). It can also give rise to family and social problems and to reduced economic productivity due to absenteeism and poor work performance (Alonso et al., 2004). Excessive drinking thus has substantial social and economic ramifications (Smit et al., 2006), estimated for the Netherlands at over €2.5 billion per annum (KPMG, 2001). And partly because of the high threshold attached to traditional addiction services, the complex needs of this problem-drinking population remain largely unaddressed (Cunningham et al., 1993; Humphreys et al., 2002).

Figure 1. 1 Alcohol-related mortality



Source: Rehm et al. 2003

Can natural recovery and public health approaches be reconciled in any way? We believe they can. We are interested in the possibilities to curb problem drinking by harnessing the potential of natural remission, but at a faster pace – thus strengthening the abilities of problem drinkers to help themselves. Our assumption is based on the results of numerous well-controlled studies and meta-analyses which have shown that (1) treatment of problem drinking is more effective than no treatment (McLellan et al., 1996); (2) some treatments are more effective than others (Miller & Wilbourne, 2002); (3) problem drinking cannot be tackled solely by treatment services, in view of the low number of problem drinkers reached (Van Laar et al., 2008); (4) brief self-help interventions in primary care and in the general population can be effective (Apodaca & Miller, 2003; Kaner et al., 2007; Moyer, Finney, Swearingen, & Vergun, 2002), especially for people with milder drinking problems (Heather, Robertson, MacPherson, Allsop, & Fulton, 1987; Moyer & Finney, 2002; Shand, Gates, Fawcett, & Mattick, 2003). Insights like these call for an evidence-based public health and prevention approach to problem drinking as espoused by the US Institute of Medicine (1990) and the World Health

Organization (2001). Such an approach has been actively endorsed over the past decade in the Netherlands (GGZ Nederland, 2001; Lemmers & Riper, 2007; Ministerie van Volksgezondheid, 2001; Ministerie van Volksgezondheid, 2006), and in many other Western countries such as United Kingdom (Department of Health, 2006), Australia (Ministerial Council on Drug Strategy, 2006) and the United States (Institute of Medicine 2001).

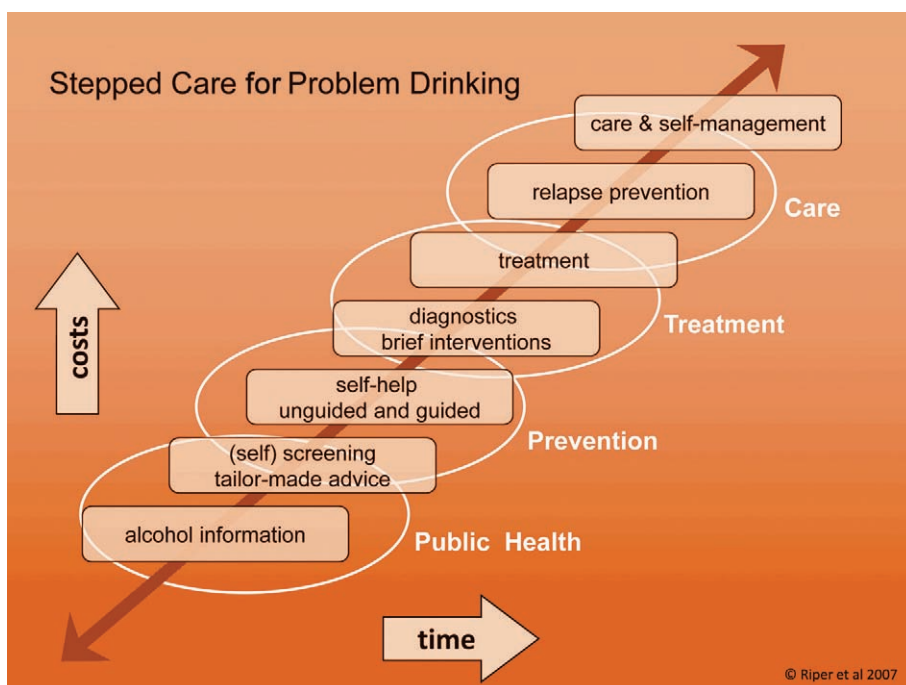
1.3 THE CHALLENGE OF ROSE'S THEOREM

A public health approach to problem drinking embraces Rose's theorem (1992), which states that 'a large number of people at small risk may give rise to more cases of disease than a small number who are at high risk'. If we reason along this line, the solution would be to approach a large number of problem drinkers with cost-effective brief interventions, along with treating the severely dependent clinical population of problem drinkers (Abrams et al., 1996). Self-help interventions could be highly suitable for this purpose, as a large proportion of problem drinking can be explained by behavioural factors and is amenable to self-change (Marlatt & Witkiewitz, 2002; Sobell & Sobell, 1993). Although self-help interventions are available in different formats, probably the best known example is the printed self-help manual. Alcoholics Anonymous is another example (Ferri, Amato, & Davoli, 2006), but that type of group intervention is not a focus of this book.

Problem drinkers can use individual self-help interventions on their own initiative or at the instigation of a professional therapist or prevention worker. The interventions can support and speed up intended behavioural change among problem drinkers who are unwilling, unlikely or not ready to seek conventional help (Institute of Medicine, 1990; Klingemann & Sobell, 2001; Sobell et al., 2002). They appear attractive for this population because of their non-confrontational and non-threatening approach (Koski-Janne & Cunningham,

2001; Long & Hollin, 1998). While the evidence base for effectiveness is less well established for self-help interventions in the general population than for brief interventions in primary care (Ballesteros, Duffy, Querejeta, Arino, & Gonzalez-Pinto, 2004), the dissemination of the latter in daily practice is very limited, thus reducing their potential public health impact (Beich, Thorsen, & Rollnick, 2003). In this light, self-help interventions could be offered as a first step in a stepped care approach, in addition to a treatment-based model for problem drinking (Breslin et al., 1998; Humphreys et al., 2002; Sobell & Sobell, 2000) see figure 1.2). The rationale is that problem drinkers first receive an intervention that is minimally intrusive into their lifestyle, yet has a reasonable chance of success. For those for whom the intervention does not work, the level of treatment can be stepped up in terms of more extensive or alternative treatments, with increasing levels of therapeutic involvement and cost.

Figure 1.2 Stepped Care for Problem Drinking



Riper et al. 2007

1.4 CURBING PROBLEM DRINKING IN THE DIGITAL GALAXY

If a public health approach to problem drinking is endorsed, and self-help interventions are acceptable to problem drinkers who do not easily cross the clinical threshold (Whitlock, Polen, Green, Orleans, & Klein, 2004), then the next question is whether such interventions are effective and can be made available on a large scale at an affordable cost. When Eltringham and Barber wondered in 1990 whether microcomputers might provide treatment alternatives to drink-driving offenders (Eltringham & Barber, 1990), they could not have imagined that computers could do just that within a decade by virtue of Internet accessibility for all. Today, 85% of the Dutch population uses the Internet regularly, the Netherlands having the highest percentage of Internet and broadband users in Europe (around 90 per 100 inhabitants), followed by Norway and Sweden (Eurostat, 2007). Undoubtedly, most Dutch problem drinkers are online, at least judging by a Canadian finding that current drinkers are more likely to have Internet access than abstainers (Cunningham, Selby, Kypril, & Humphreys, 2006). Digitally supported self-help entered the 21st century and took the professional addiction field by surprise at first, but this surprise was quickly replaced by the insight that the Internet could be used to reach out to problem drinkers on a broad scale. The well-known format of self-help interventions as printed manuals (Van Emst, 1997) was overtaken in unforeseen ways by new communication technologies such as software programs for PCs (Hester & Delaney, 1997), the Worldwide Web (Blankers, Kerssemakers, Schramade, & Schippers, 2007; Linke, Brown, & Wallace, 2004) or personal digital assistants (Sorbi, Mak, Houtveen, Kleiboer, & Van Doornen, 2007). Since then, the availability of self-help interventions for common mental health and substance use disorders has grown phenomenally (Marks, Cavanagh, & Gega, 2007), followed by more intensive online treatment (Lange et al., 2003; Postel, de Jong, & de Haan, 2005) and self-management tools for chronic

conditions (Riper et al., 2007). It is within this context that we have developed and evaluated a web-based self-help intervention known as Drinking Less (MinderDrinken) for adult problem drinkers in the Netherlands (Riper & Kramer 2002).

Drinking Less

Drinking Less is based on motivational, cognitive-behavioural and self-control training principles (Hester, 1995; Miller & Rollnick, 1991; Schippers & De Jonge, 2002; Van Emst, 1997). These principles have been shown effective when used in face-to-face behavioural self-help interventions (Apodaca et al., 2003; Miller et al., 2002; Moyer et al., 2002). Drinking Less contains a home page, alcohol-related information, addresses of services (should more or different help be needed), and a moderated peer-to-peer discussion forum. The Drinking Less self-help programme, the core element of our intervention, is structured into four steps: (1) preparing for action, (2) goal setting, (3) behavioural change and (4) maintenance. In the preparation stage (1), participants assess their own alcohol intake and their risk of alcohol-related problems and dependence symptoms with the Alcohol Use Disorders Identification Test (AUDIT, (Saunders, Aasland, Babor, Defuentes-Merillas, & Grant, 1993), their motivation to change using the Readiness to Change Questionnaire (RCQ-D, (Defuentes-Merillas, Dejong, & Schippers, 2002), and the positive and negative consequences of their alcohol consumption. In stage 2, participants are prompted to make decisions about their future alcohol use: either moderating the amount consumed or abstinence. These first two steps typically require 15 minutes. The third and fourth steps aim at achieving a new, moderated drinking behaviour, preferably within the limits of low-risk alcohol use, and subsequently maintaining it and preventing relapse over time. To this end, the self-help programme provides information, interactive exercises and an electronic drinking diary. Participants are encouraged to use the programme for

six weeks (Breslin et al. 1998), but given the self-help nature of the intervention, they are allowed to use it as long as they feel necessary.

1.5 OUTLINE OF THE BOOK

This book investigates the clinical effectiveness, cost-effectiveness and implementation potential of Drinking Less in the adult general population of problem drinkers. Studies on web-based interventions for problem drinking have begun to emerge since the start of our work (Kypri, Sitharthan, Cunningham, Kavanagh, & Dean, 2005; Linke, Murray, Butler, & Wallace, 2007; Riper et al., 2007). The majority of these studies deal with the feasibility of digital interventions (Bewick et al., 2008), but few have yet reported on the effectiveness of these interventions as assessed in well controlled designs (Bewick, Trusler, Mulhern, Barkham, & Hill, 2008). The available effectiveness efficiency studies mostly evaluate student or youth interventions and associated treatment outcomes such as reduced alcohol consumption or delayed age of onset (Kypri et al., 2004). In the chapters to follow, we present on a step-by-step basis the results of our studies of web-based self-help for adult problem drinkers. We conducted our trials online. Online surveying (although not a topic of this book as such) has expanded enormously within a period of five years, whereas it was an unexplored field when we began. As we will show, the Internet provides an excellent venue not only for online self-help interventions but also for online surveying, particularly in relation to low-threshold web-based interventions and hidden target groups (Linke et al., 2004; McAlindon, Formica, Kabbara, LaValley, & Lehmer, 2003). Both undertakings, though, are plagued by high participant dropout rates.

Chapter 2 presents the results of our pragmatic, randomised behavioural trial of Drinking Less. The economic evaluation of Drinking Less at 12-month follow-

up is discussed in chapter 3; few studies have given insight into the cost-effectiveness of self-help interventions (Gibson & Shanahan, 2007; Ludbrook et al., 2002). Not all problem drinkers benefit from the same interventions – as found in meta-analyses (Apodaca et al., 2003; Moyer et al., 2002) – and treatment response is influenced by more than treatment alone. We were therefore curious as to whether specific baseline characteristics could be identified as predictors of positive response to Drinking Less in terms of reduced alcohol consumption. To address this question, we conducted a secondary analysis of our Drinking Less trial data, the results of which are reported in chapter 4. Chapter 5 investigates whether Drinking Less is feasible, effective and acceptable for problem drinkers when applied outside the research setting in routine practice. The future possibilities of the digital galaxy appear unlimited and as yet unknown, but current trends indicate an intensified use of, and crossover between, various communication channels alongside the Internet. We investigated the effectiveness of a self-help television intervention that made use of printed and web-based support tools for curbing problem drinking (Teleac, 2006); the results of our randomised controlled trial of this intervention are given in chapter 6. The lessons learned during our study then led us to conduct a meta-analysis on the briefest possible form of self-help interventions for problem drinkers, and its results are reported in chapter 7. The book concludes with a general discussion of the key findings and of possible directions for future research and daily practice.

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Web-based self-help for problem drinkers: a pragmatic randomized trial

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ABSTRACT

Aims Self-help interventions for adult problem drinkers in the general population have proved effective. The question is whether this also holds for self-help interventions delivered over the internet.

Design We conducted a pragmatic randomized trial with two parallel groups, using block randomization stratified for gender and with follow-up at 6 months.

Setting The intervention and trial were conducted online in the Netherlands in 2003–2004.

Participants We selected 261 adult problem drinkers from the general population with a weekly alcohol consumption above 210 g of ethanol for men or 140 g for women, or consuming at least 60 g (men) or 40 g (women) at least 1 day a week over the past 3 months. Participants were randomized to either the experimental drinking less (DL) condition or to the control condition (PBA).

Intervention DL is a web-based, multi-component, interactive self-help intervention for problem drinkers without therapist guidance. The recommended treatment period is 6 weeks. The intervention is based on cognitive-behavioural and self-control principles. The control group received access to an online psychoeducational brochure on alcohol use (PBA).

Outcome measures We assessed the following outcome measures at 6-month follow-up: (1) the percentage of participants who had reduced their drinking levels to within the normative limits of the Dutch guideline for low-risk drinking; and (2) the reduction in mean weekly alcohol consumption.

Findings At follow-up, 17.2% of the intervention group participants had reduced their drinking successfully to within the guideline norms; in the control group this was 5.4% [odds ratio (OR) = 3.66; 95% confidence interval (CI) 1.3–10.8; $P = .006$; number needed to treat (NNT) = 8.5]. The intervention subjects decreased their mean weekly alcohol consumption significantly more than control subjects, with a difference of 12.0 standardized units (95% CI 5.9–18.1; $P < .001$; $d = 0.40$).

Conclusions To our knowledge this is one of the first randomized controlled trials on a web-based self-help intervention without therapist guidance for self-referred problem drinkers among the adult general population. The intervention showed itself to be effective in reducing problem drinking in the community.

2.1 INTRODUCTION

Problem drinking is a widely prevalent condition accompanied by high morbidity and mortality (Murray & Lopez, 1996; World Health Organization, 2007). It has formidable economic repercussions in the form of higher health care and criminal justice costs and reduced productivity (Anderson & Baumberg, 2006; Klingemann & Gmel, 2001; Smit et al., 2006).

Active screening and brief intervention in primary care have been proposed as a good way to improve the low service uptake by problem drinkers; several meta-analyses have shown that approach to be effective (Cuijpers, Riper, & Lemmers, 2004; Kaner et al., 2007; Moyer, Finney, Swearingen, & Vergun, 2002).

However, many problem drinkers do not even use primary care, or they are not recognized by primary care services as problem drinkers (Anderson, 2003; Andrews, Issakidis, Sanderson, Corry, & Lapsley, 2004; Cunningham & Breslin, 2004). Alternative ways of reaching out to problem drinkers in the general public are therefore needed to tackle this major public health problem (Institute of Medicine, 1990). Community-based self-help interventions are one such alternative. They appear to be effective, but they have been assessed less thoroughly than brief interventions in primary care (Apodaca & Miller, 2003; Sobell et al., 2002).

These types of structured, potentially effective and low-cost self-help interventions can also be provided online. The internet makes it feasible to increase tremendously the number of people reached by health-related interventions, thus delivering substantial health gains both among underserved populations and among the general public (American Psychological Association, 2000; Curry, 2007). Clients may apply these interventions in the privacy of their homes and at the times they find convenient. Randomized controlled trials and a meta-analysis have shown online interventions, mainly with therapeutic guidance, to be effective for common mental health disorders such as depression (Andersson et al., 2005; Christensen, Griffiths, & Jorm, 2004; Spek et al., 2007)

and anxiety (Andersson et al., 2005; Klein, Richards, & Austin, 2006; Lange et al., 2003). Such web-based self-help interventions have also been developed for problem drinkers (Cunningham, Humphreys, Koski-Jannes, & Cordingley, 2005; Linke, Brown, & Wallace, 2004), and although studies of an evaluative nature have shown promising results (Cunningham et al., 2005; Hester & Delaney, 1997; Linke, Murray, Butler, & Wallace, 2007) only a few randomized controlled trials of such interventions are now available. Most of these have involved student populations (Chiauzzi, Green, Lord, Thum, & Goldstein, 2005) (Kypri et al., 2004; Moore, Soderquist, & Werch, 2005; Walters, Vader, & Harris, 2007) or youth in the work-place (Doumas & Hannah, 2008), and they have supported the effectiveness of the web-based interventions in the targeted groups of problem drinkers. The effectiveness of online interventions without therapeutic guidance for self-referred adult problem drinkers in the community has not yet been examined (Cunningham et al., 2005; Saitz et al., 2004), and this paper is one of the first to report on a randomized controlled trial among adult problem drinkers in the general population. We hypothesized that an online self-help intervention without therapeutic guidance would be more effective than an online psychoeducational brochure in reducing drinking levels to below the normative limits set by the Dutch guideline for low-risk drinking (Posma & Koeten, 1998), and that it would also have a greater beneficial impact in terms of decreased weekly alcohol consumption.

2.2 METHOD

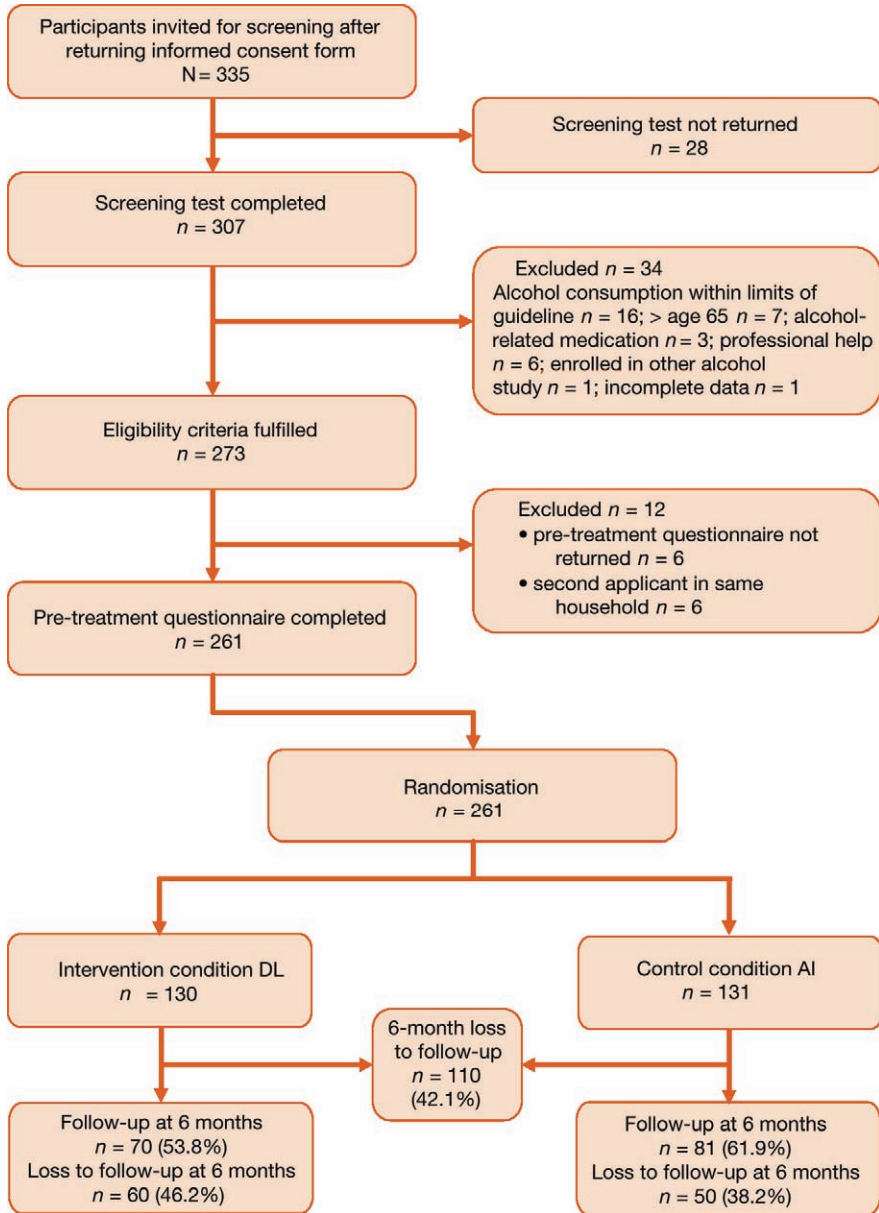
Participants and procedure

As our study was designed as a pragmatic randomized controlled trial focusing on problem drinkers in the general population rather than those in clinical settings (Hotopf, 2002), we recruited participants through advertisements in national

newspapers and health-related websites. Responders were referred to a research website for additional information about the study. The study and intervention were conducted entirely via the internet with the exception of the informed consent form, which had to be sent to us by post to ensure written and signed consent. Those who returned consent forms were invited to complete a brief web-based screening questionnaire. Participants were selected for the trial whose alcohol consumption exceeded the limits specified by the pertinent Dutch guideline for low-risk drinking (Posma et al., 1998). The online screening test was a measure of alcohol consumption patterns consisting of weekly recall and a quantity–frequency variability index of alcohol intake (Cahalan, Cisin, & Crossley, 1969; Lemmens, Knibbe, & Tan, 1988; Lemmens, Tan, & Knibbe, 1992).

Different cut-off points for problem drinking were applied for men and for women. Men were selected who were drinking either (1) more than 21 units per week (excessive drinking) or (2) 6 or more units at least 1 day per week for the past 3 months (hazardous drinking). Women were included if they drank (1) over 14 units a week or (2) 4 or more units at least 1 day a week for the past 3 months. One unit represents 10 g of ethanol. Additional inclusion criteria were: (3) age 18–65; (4) access to the internet; (5) not receiving professional help for problem drinking at the start of the study; and (6) informed consent. Participants satisfying all inclusion criteria were invited by e-mail to complete an online baseline questionnaire (t0). They were then randomized to either the web-based drinking less (DL) self-help intervention (the experimental condition) or to the six-page webbased psycho-educational brochure on alcohol (PBA, the control condition). Six months after the start of the intervention, participants received automated online follow-up questionnaires, and a reminder 2 weeks later if necessary. Figure 2.1 shows the flow of participants through the trial. Ethical approval was granted by an independent medical ethics committee (ref. no. 3.12.2002).

Figure 2.1 Flow of participants through the trial



Randomization

Randomization was stratified for gender, as the guideline for low-risk drinking differs for men and for women. It was performed in blocks of two to ensure equal numbers of participants in each condition.

Interventions

Participants in the experimental condition received access to the DL intervention (<http://www.minderdrinken.nl>). DL is a free-access web-based self-help intervention without therapist guidance for problem drinkers who want to reduce their alcohol consumption, preferably to within the recommended limits for low-risk drinking. The intervention is based on cognitive-behavioural and self-control principles (Hester, 1995; Miller & Munoz, 1982; Sanchez-Craig, 1993; Sobell, Sobell, Toneatto, & Leo, 1993; Van Emst, 1997), which are highly suitable for web-based implementation due to their standardized nature and systematic approach. DL consists of a home page giving information on alcohol and treatment services and offering access to the self-help programme via an automated sign-up procedure, with a description indicating for whom the intervention is suitable. The self-help programme proceeds in four successive stages: (1) preparing for action; (2) goal setting; (3) behavioural change; and (4) maintenance of gains and relapse prevention. These stages contain elements known to be effective, such as goal setting and analysis of drinking behaviour (Hester, 1995; Walitzer & Connors, 1999). The self-help programme also includes access to a moderated peer-to-peer discussion forum. The recommended treatment period is 6 weeks, which should give a reduction in alcohol consumption enough time to take hold (Sanchez-Craig, 1993); trial participants were allowed to use the intervention as long as they felt necessary. Control subjects received access to a web-based psychoeducational brochure on the effects of alcohol use (Nationaal Instituut voor Gezondheidsbevordering en Ziektepreventie (NIGZ), 2000), which described the impact of alcohol use on physical and social functioning in a factual manner. The brochure could be read in 10 minutes. Access to both interventions proceeded through a unique login and security identification code and was available on a 24-hour, 7-day basis.

Primary outcome

The primary outcome measure was problem drinking, defined as alcohol consumption exceeding the guideline—an average of more than 21 or 14 standard units [male/female (m/f)] per week or 6 or 4 units or more (m/f) at least 1 day per week over the previous 3 months. Mean weekly alcohol consumption was assessed with the Dutch version of weekly recall (WR (Cahalan et al., 1969; Lemmens et al., 1988)); it records the number of units consumed in the 7 days preceding the assessment. Units per day per week were assessed with the Dutch version of the Quantity–Frequency Variability Index (QFV (Lemmens et al., 1992)).

Secondary outcome

Mean weekly alcohol consumption as a continuous measure was assessed with WR (Cahalan et al., 1969; Lemmens et al., 1988).

Baseline measures

Alcohol-related problems were assessed using the validated six-item version of the Dutch 18-item alcohol problem questionnaire developed by Cornel and colleagues (Cornel, Knibbe, van Zutphen, & Drop, 1994). A score of 3 or more reflects alcohol-related problems. The scale has shown good psychometric properties (Candel, 2001). The extent to which participants were willing to alter their alcohol consumption was measured with the validated Dutch version of the Readiness to Change Questionnaire (RCQ-D (Defuentes-Merillas, Dejong, & Schippers, 2002; Rollnick, Heather, Gold, & Hall, 1992)). This 12-item questionnaire assesses the stage of change that respondents are currently experiencing. The three possible stages are precontemplation, contemplation or action.

Power

Originally the trial was powered to detect clinically significant health gains expressed as a standardized effect size ($d > 0.45$) in a one-sided test and at a power of $(1 - \beta) = 0.80$. The results reported in this paper, however, are based on two-tailed tests. From a clinical perspective, standardized effect sizes of 0.45 are considered to be of medium size (Lipsey & Wilson, 1993).

Analysis

We began by using t -tests, χ^2 tests and logistic regression to assess whether the randomization had resulted in two comparable groups at baseline (see Table 2.1) and whether any differential loss to follow-up had occurred. We then performed intention-to-treat (ITT) analysis, using multiple imputation (MI (Schafer, 1999)) to deal with loss to follow-up. Multiple imputation has the advantage that each missing observation at follow-up is replaced by a series of plausible values (we created 10 imputed data sets), rather than by a single value. This captures more effectively the stochastic uncertainty inherent, but often ignored, in other imputation techniques (Everitt, 2003). The following procedure was used. Missing values were replaced by values that were drawn randomly from ‘donor’ cases with complete data. This was performed on condition that the ‘donor’ cases were from the same gender and age group and had similar baseline scores on the WR and the QFV (i.e. falling in the same quartile). The hypotheses were then tested using regression analysis of the outcome in the treatment dummy within the multiple imputation framework.

Logistic regression was performed to derive odds ratios (OR). A linear risk model was used to obtain the risk difference (RD). The number needed to treat (NNT) was calculated as the inverse of the RD. Confidence intervals (CI) were based on multiple imputation. We report 95% CIs throughout, and tests were conducted at $\alpha = 0.05$ (two-sided). Additionally, we conducted completers-only analyses using logistic regression without imputation on the participants that completed the follow-up questionnaire at 6 months ($n = 151$). All analyses were

carried out independently by two researchers to cross-check outcomes. Data were analysed with Stata/SE versions 8.1 and 9.2 (StataCorp, 2001).

2.3 RESULTS

Sample

The demographic and clinical characteristics of the participants at baseline are shown in Table 2.1. No statistically significant differences emerged between groups on any of these variables at baseline (tested at $P < 0.10$).

Table 2.1 Baseline characteristics. Values are numbers (percentages) of participants, unless indicated otherwise.

	Condition*	
	Intervention (n = 130)	Control (n = 131)
Female gender	66 (50.8)	67 (51.1)
Age (mean, SD)	45.9 (8.9)	46.2 (9.2)
Education		
Unskilled	41 (31.5)	38 (29.0)
Vocational	52 (40.0)	55 (42.0)
Academic	37 (28.5)	38 (29.0)
Living with a partner	75 (57.7)	71 (54.2)
Paid employment	94 (72.3)	96 (73.3)
No prior alcohol treatment	116 (89.2)	115 (87.8)
Contemplation stage†	116 (89.2)	115 (87.8)
≥3 alcohol-related problems‡	114 (87.8)	118 (90.1)
Problem drinking§	130 (100)	131 (100)
Excessive drinking	125 (96.2)	128 (97.7)
Hazardous drinking	121 (93.1)	121 (93.1)
Weekly alcohol intake in standard units (mean, SD)¶	43.7 (21.0)	43.5 (22.3)

* All differences between conditions were non-significant (tested at $P < 0.10$).

† Assessed with the validated Dutch version (Defuentes-Merillas et al., 2002) of the Readiness to Change Questionnaire (Rollnick et al., 1992).

‡ Assessed with a validated Dutch questionnaire for problem drinking (Candel, 2001).

§ Drinking >21 or 14 units [male/female (m/f)] average per week over previous 3 months (excessive drinking) and/or drinking 6 or 4 units (m/f) at least 1 day per week over previous 3 months (hazardous drinking).

¶ Standard unit contains 10 g of ethanol.

At baseline, all 261 participants (100%) were exceeding one or both criteria for problem drinking. Mean weekly alcohol intake was 43.6 standard units [standard deviation (SD) = 21.6]. Most participants ($n = 231$; 88.5%) were in the contemplation stage of change, meaning that they wanted to decrease their alcohol consumption in the near future (Prochaska & Velicer, 1997; Rollnick et al., 1992). Most (243; 93%) aimed for moderation rather than abstinence. The large majority (228; 88%) had never received professional help for their problem drinking.

Loss to follow-up

Loss to follow-up at 6 months was 42.1% ($n = 110$) and was distributed evenly across the two conditions ($n = 60$ for the intervention and $n = 50$ for the control condition; $\chi^2_1 = 1.71$; $P = 0.19$). Participants who did not return the questionnaire 6 months after baseline did not differ from follow-up responders in terms of the characteristics assessed at baseline ($P > 0.10$; Table 2.1).

Effect of the intervention

Table 2.2 shows the effect of the intervention on the primary outcome—the percentage of problem drinkers now adhering to the guideline. Six months after the baseline assessment, significantly more participants in the intervention condition were drinking within the guideline than those in the control condition. Based on the ITT analysis, 17.2% of the experimental subjects were now drinking successfully within the limits of the guideline compared to 5.4% of the control subjects (OR = 3.66; CI 1.3–10.8; NNT 8.5; $P = 0.006$).

The significant difference was maintained in the completers-only (CO) analysis. The intervention was also effective in decreasing the mean weekly alcohol intake in the experimental condition relative to the control group.

Table 2.2 Success rates of adherence to the low-risk drinking guideline at 6-month follow up: intention-to-treat (multiple imputation) and completers-only analyses.

	Experimental condition (DL)		Control condition (PBA)		OR	95% CI	NNT	Test result	P
	n	% succes	n	% succes					
Intention-to-treat	130	17.2	131	5.4	3.66	1.3–10.8	8.5	$t_{2105.5} = 2.69$.006
Completers-only	70	18.5	81	4.9	4.39	1.4–13.4	7.3	$\chi^2_1 = 6.99$.008

DL = drinking less, web-based self-help intervention (experimental condition); PBA = web-based psychoeducational brochure on alcohol use (control condition); OR = odds ratio; CI = confidence interval; NNT = numbers needed to treat.

Table 2.3 shows that, based on the ITT analysis with multiple imputation, the experimental group decreased its mean weekly alcohol consumption by 15 units compared to 2.9 units in the control group, a difference in means of 12 units on a weekly basis (95% CI 5.86–18.10; $P < .001$). This corresponds to a medium standardized effect of $d = 0.40$. The significant difference was sustained in the CO analyses (see Table 2.3).

Table 2.3 Mean weekly alcohol consumption (WR) at 6-month follow-up: intention-to-treat (multiple imputation) and completers-only analysis.

	Experimental condition (DL)		Control condition (PBA)		dif	95% CI	SE dif	T(d.f.)	P	d
	n	M	n	M						
Intention-to-treat	130	28.7	131	40.6	12.0	5.86–18.10	2.72	T(570.5)=4.40	<.001	0.40
Completers-only	70	28.7	81	39.2	10.6	4.33–16.94	3.19	T(149)=3.33	.001	0.38

DL = drinking less, web-based self-help intervention (experimental condition); PBA = web-based psychoeducational brochure on alcohol use (control condition); WR = weekly recall; dif = difference in means; SE dif = standard error of difference in means; d = differential effect size.

Intervention uptake

On the basis of the non-imputed data, 59 (45.4%) of the baseline participants in the experimental condition actually made use of the DL intervention. In the

control condition, 67 (51.1%) of the baseline participants actually used the psychoeducational brochure. Those who did use DL rated the self-help programme with a mean score of 7.2 (SD = 1.4) on a scale from 1 (very poor) to 10 (very good); the psychoeducational brochure users rated it at 6.3 (SD = 1.8).

2.4 DISCUSSION

Main findings

This study lends support to the hypothesis that the DL intervention is successful in curbing alcohol intake. Although both the experimental and control groups achieved a decrease in alcohol consumption, it was significantly stronger in the experimental DL condition in terms of both the outcome measures assessed here. Some 17.2% of the DL group and 5.4% of the controls succeeded in drinking within the normative Dutch guideline for low-risk drinking. DL subjects also reduced their mean weekly alcohol consumption by a significantly greater amount than the controls. The medium standardized effect size ($d = 0.40$) observed here is comparable to the effects found in the meta-analyses by Moyer et al. (2002) and Apodaca & Miller (2003) for brief and self-help interventions. This is an important finding from a clinical point of view, as drinking within the guidelines and lower weekly consumption imply lower risks for the morbidity and mortality associated with problem drinking (Anderson et al., 2006; Cuijpers et al., 2004; World Health Organization, 2007). Although our results also show that not all problem drinkers did succeed in reducing their alcohol intake or in adhering to the limits, a small-to-moderate effect size can nevertheless translate into considerable health and social gains at a population level (Martin & Copeland, 2003).

These results thus support the propositions that self-help interventions without therapeutic guidance can be effective in reducing problem drinking in self-referred adults from the general population (Apodaca et al., 2003; Moyer et al.,

2002) and that the internet offers an appealing and viable delivery format for this type of intervention (Cuijpers et al., 2004; Cunningham et al., 2005; Hester et al., 1997; Linke et al., 2004; Linke et al., 2007). This is underscored further by the estimated number needed to be treated (NNT) of 8.5 found in our study, which is comparable to the NNT figures of seven (National Health Committee, 1999) to eight (Anderson, 2003) obtained by delivering brief face-to-face advice in primary care for reducing problem drinking. Replication of our study is still necessary to establish the robustness of the results we have obtained and to assess how the observed effectiveness is maintained over time. In addition, research on the generalizability of the DL intervention in terms of implementation for routine, non-controlled public access is required, and is currently being conducted by our research group.

Limitations and strengths

These findings should be seen in light of the limitations and strengths of this study. The loss to follow-up was substantial (42.1%), although high dropout rates are characteristic for brief and self-help interventions for problem drinking (Miller & Wilbourne, 2002; Sobell et al., 2002). Attrition rates appear to be even higher for interventions delivered over the internet, as easy accessibility may also mean easy dropout (Eysenbach, 2005). In this study, we handled dropout data analytically as rigorously as possible by conducting ITT analyses that used multiple imputation to estimate missing end-points. Moreover, our findings are robust in that a re-analysis without any imputation produced near-identical outcomes. We kept our exclusion criteria to a minimum, in keeping with the nature of community-based self-help interventions. Consequently, we did not conduct diagnostic interviews, and it is therefore unknown what percentage of the sample would have met the diagnostic criteria for alcohol abuse or dependence. However, given the high level of mean weekly alcohol consumption at baseline (43.6 standard units, $SD = 21.6$) we appear to have reached a high-risk group, as the probability of abuse and dependence is known

to increase linearly with the average number of drinks consumed per day (Caetano & Cunradi, 2002; Caetano, Tam, Greenfield, Cherpitel, & Midanik, 1997; Dawson & Archer, 1993).

The few available evaluation studies of web-based interventions for problem drinking, most of which involved student populations, have reported promising results (Chiauzzi et al., 2005; Kypri et al., 2004; Moore et al., 2005; Walters et al., 2007). Adult problem drinkers differ from students, of course, in terms of age and other sociodemographic factors, but also in their drinking patterns, with students exhibiting mainly binge drinking (Miller, Naimi, Brewer, & Jones, 2007). The DL intervention proved to reach out effectively to these adult problem drinkers. The vast majority ($n = 231$; 88%) had never had any professional help for their alcohol use, yet they did show a willingness to take part in the self-help intervention. It is also worth noting that we recruited the required number of 261 participants in the rather short period of 3 months.

These observations thus indicate that internet-based self-help interventions may be suitable for problem drinkers who do not take up traditional alcohol treatment services. This is consistent with findings from other studies, which have reported the 50–80% of participants had never had professional help for their problem drinking before the study assessment (Cunningham et al., 2004; Cunningham, Humphreys, & Koski-Jannes, 2000; Humphreys & Klaw, 2001). Women also had a high, one-to-one level of representation in our study, which is in striking contrast with the reported male-to-female ratio of 4 : 1 among problem drinkers in the general population (Van Dijck & Knibbe, 2005). A similarly high gender ratio has been reported in other studies of internet interventions (Cunningham et al., 2005). Online self-help therefore appears well suited for adult female problem drinkers in the general population, and it may help to overcome the under-representation of women in many brief intervention trials (Kaner et al., 2007).

Conclusions

The high prevalence of adult problem drinkers in the general population, in combination with their low rate of health service utilization, underlines the need for low threshold self-help interventions. Such interventions need to be evidence-based and suitable for a broad range of users. Our findings point to a sizeable population of problem drinkers who are willing to seek self-help via the internet and who do so effectively. From a public health perspective, the challenge now is to make such self-help interventions widely available to the community. By virtue of its increasing level of penetration world-wide (National Health Committee, 1999), the internet has the potential to reach out to problem drinkers on a large scale. Significantly, searches for health information rate among the top 10 reasons for internet use (Internet World Stats, 2007; The Digital Future Report, 2004; Van Rijen & Ottes, 2006), and web-based self-help that is low threshold, anonymous and free of charge appears to hold some appeal to problem drinkers (Koski-Janne & Cunningham, 2001; Kypri, Sitharthan, Cunningham, Kavanagh, & Dean, 2005; Wild, Roberts, Cunningham, Schopflocher, & Pazderka-Robinson, 2004). Moreover, web-based interventions are economic to run and maintain.

We therefore recommend that online self-help for problem drinking be further explored. It has an apparent potential to reduce problem drinking in terms of different outcome measures, and it seems suitable for use in different settings. Given the heterogeneity of the problem-drinking population, it could, as part of a public health promotion strategy, help to increase the numbers of people in the community who adhere to the guidelines for low-risk drinking. It also has a potential for use in a stepped-care approach. Future research could identify which groups could benefit most from online self-help and which may not. What also remains to be investigated is whether minimal contact with a professional might improve online outcomes and whether that might serve as a second step in treatment delivery to those who do not succeed with the lowest-threshold

interventions. Other directions for research involve the potential of this type of intervention to give preliminary help to people who are currently wait-listed for more intensive treatments. It might also have possibilities for use as an adjunct to primary care or out-patient treatments. That would allow therapists to delegate some of their routine work to the computer by ‘prescribing’ certain modules of web-based self-help interventions to their patients. The efficiency gain thus achieved could also benefit patients who still clearly need face-to-face therapeutic contact. In this regard, the cost-effectiveness of this type of population-based interventions needs to be evaluated in terms of the population-level consequences and health gains in terms of disability adjusted life years and in terms of the maintenance of health gains over time.

There is ample evidence that brief interventions in primary care are effective in curbing problem drinking. The findings of this randomized controlled trial are among the first to be published on the effectiveness of web-based self-help interventions for self-referred adult problem drinkers in the general population. This study shows that drinking less, a low-threshold online self-help intervention without therapist guidance, can be effective in helping problem drinkers who want to reduce their alcohol consumption to within the guidelines for low-risk drinking. Our findings may also support the feasibility of online stepped care for adult problem drinkers.

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Cost-effectiveness of a
web-based self-help
intervention for problem
drinking: randomized trial

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ABSTRACT

Background Problem drinking is highly prevalent and associated with detrimental health effects. Brief interventions for problem drinking are known to be effective, but not always available and their uptake is limited. To have a real impact on population health, new interventions need to be offered that are acceptable, cost-effective and highly scalable. In this study we evaluate the cost-effectiveness of a web-based self-help intervention to curb problem drinking.

Methods The economic evaluation was conducted alongside a randomized trial with follow-ups at six and twelve months. The clinical endpoint was the percentage of participants successfully bringing down their alcohol intake to under recommended limits. The economic evaluation included health care provision costs, clients' out-of-pocket costs and productivity losses.

Results At 6 months, the intervention showed superior effectiveness relative to the control condition (OR = 3.66, 95% CI = 1.25~10.78; P < 0.01). At 12 months, the odds ratio for a more successful treatment outcome was no longer significant (OR = 1.74; 95% CI = 0.61~4.92; P = 0.30), largely due to further improvements in the control group. Yet the intervention still had a robust 73% probability of being acceptable from a cost-effectiveness point of view.

Conclusions This is the first study to pilot the hypothesis that a web-based self-help intervention is a cost-effective way to reduce alcohol consumption to low-risk levels. The outcomes are promising. It is recommended to expand the intervention to include a booster session to ensure that treatment effects survive beyond twelve months, and then to replicate this study.

3.1 INTRODUCTION

Alcohol use in excess of recommended levels is widely prevalent and has been linked both to higher morbidity and mortality (Rehm et al., 2003; White, Altmann, & Nanchahal, 2004; World Health Organization, 2002), lower economic productivity (Alonso et al., 2004), with all due economic consequences (Andlin-Sobocki, 2004; Smit et al., 2006).

Brief psychological interventions are known to be effective in reducing alcohol consumption (Apodaca & Miller, 2003; Ballesteros, Duffy, Querejeta, Arino, & Gonzalez-Pinto, 2004; Moyer, Finney, Swearingen, & Vergun, 2002; Poikolainen, 1999), alcohol-related accidents (Crawford et al., 2004), hospital stays (Fleming & Manwell, 1999) and alcohol-related excess mortality (Cuijpers, Riper, & Lemmers, 2004). Yet the limited availability of brief interventions and the poor uptake rates of available ones limit their public health relevance. According to one estimate, only 11% of alcohol use disorder cases receive treatment, and only 2% of the alcohol-related burden of illness is being averted under the current health care regime (Andrews, Issakidis, Sanderson, Corry, & Lapsley, 2004). Clearly, new interventions are needed, that are effective, acceptable, affordable and accessible on a large scale.

Such requirements might be met with an interactive self-help intervention based on cognitive-behavioral therapy that could be delivered over the Internet. Web-based interventions can be used by many people, because users can access them in the privacy of their homes, at their own convenience and, with little fear of stigma. That makes this form of treatment available to far more people than face-to-face therapies. Over 80% of Dutch private households now have Internet access (Centraal Bureau voor de Statistiek, 2008) number is increasing, as in most Western countries. Elsewhere we have shown that this web-based intervention is successful in reducing alcohol intake to below the recommended limits (Riper et al., 2008).

This study investigates whether the intervention called Drinking Less (in Dutch MinderDrinken) is cost-effective as compared to just providing online information on alcohol use and its health consequences. Several economic studies have evaluated the cost-effectiveness of brief face-to-face interventions for problem drinking (Fleming et al., 2000; Fleming et al., 2002; French, Salome, Sindelar, & McLellan, 2002; Mortimer & Segal, 2005). Most of these found favorable benefit-to-cost ratios, but no comparable studies have focused on web-based interventions. In the present study, we hypothesized that the costs of health care utilization would not be significantly reduced by a web-based intervention, as excessive drinkers currently do not make much use of specialized face-to-face services for alcohol-related problems. But we additionally hypothesized that such an intervention would help to reduce production losses due to absenteeism (work-loss days) and poor job performance (work-cutback days). Should that be the case, then a web-based intervention for problem drinking could be economically advantageous while also generating health benefits for large segments of the population.

3.2 METHODS

Participants and procedure

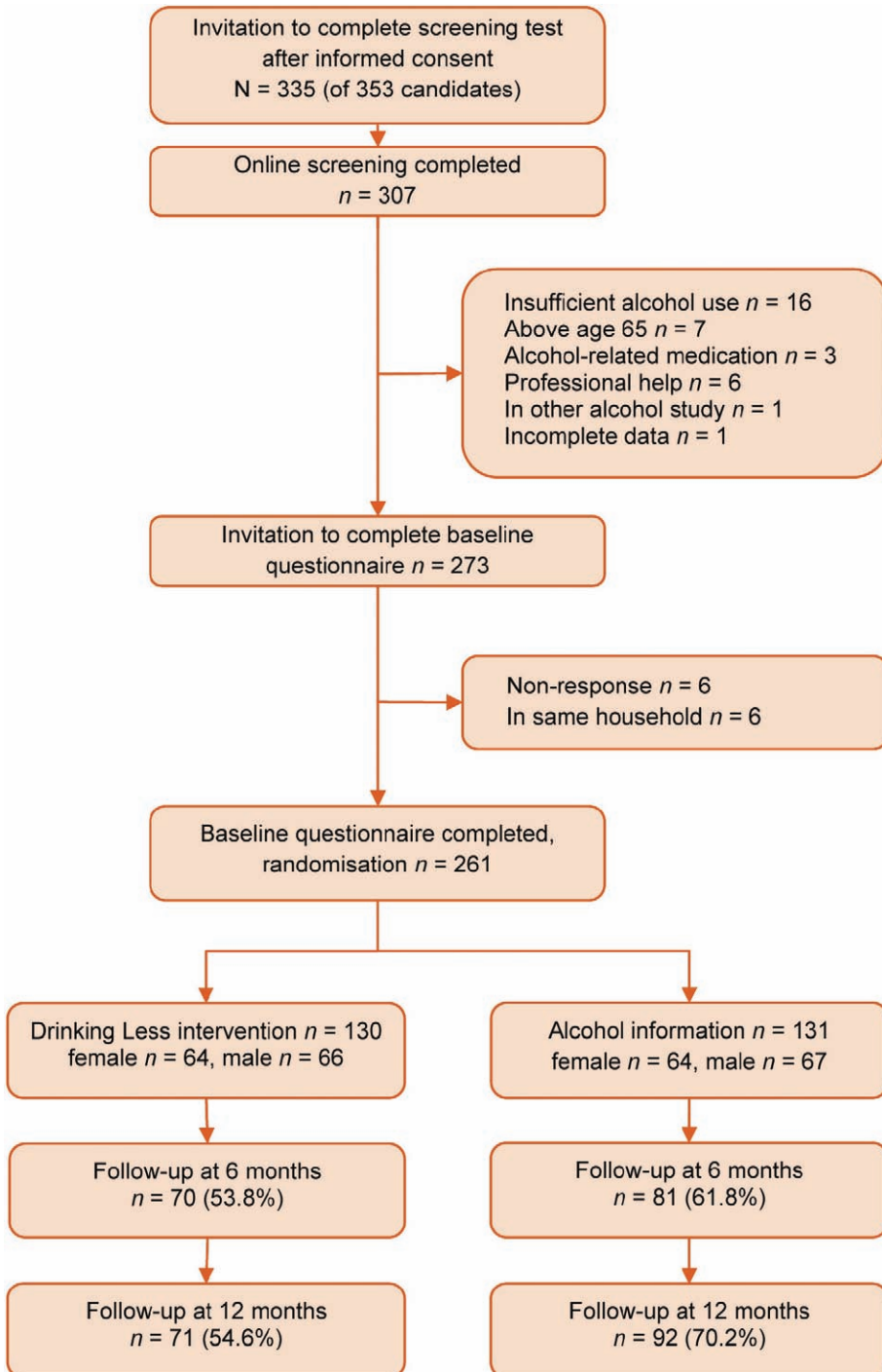
The target population consisted of problem drinking men and women aged 18 to 65 from the general population. To be included in the trial, men were to be currently drinking in excess of 21 units (of 10 grams of ethanol) per week, or 6 or more units in any one day every week over the past three months; women were to be drinking over 14 units a week or 4 or more units at least one day per week. Drinking above these limits is known to have detrimental health effects (Fleming et al., 2002; Rehm et al., 2003). Exclusion criteria were: current professional help for problem drinking, current use of prescription drugs for

alcohol-related problems, membership of self-help groups such as Alcoholics Anonymous, or current participation in a trial with an interfering objective. Participants were required to have Internet access. Participants were recruited through announcements in national newspapers and via health related websites. This strategy closely resembles the way Drinking Less users are to be recruited in future. Interested candidates were referred to a website explaining the aims of the study. An informed consent form was downloadable from the site, and the signed form had to be returned by post; this was the only part of the trial not conducted over the Internet.

Design and randomization

Blinding of the participants was not considered feasible given the psychological nature of the intervention. Eligible participants were randomized with equal probability to one of the two conditions. Randomization was stratified for gender (in blocks of two) to ensure equal distribution of men and women over both arms of the trial. Assessments were made prior to the trial at baseline (t_0) and at 6 and 12 months after baseline (t_1, t_2). Economic data were obtained at t_2 . The flow of the participants into and through the trial is depicted in Figure 3.1.

Figure 3.1 Flow of participants through the study



Interventions

Participants in the experimental condition were given access to an interactive online self-help intervention called Drinking Less. This intervention is based on motivational, cognitive-behavioral and self-control principles (Hester, 1995; Miller & Munoz, 1982; Miller, 1991). Participants work through the intervention without the aid of a therapist. The Drinking Less website contains a home page, the Drinking Less self help program and a users' forum.

The interactive, multi-component self-help program forms the core of the Drinking Less website. The program is structured in four steps: (1) preparing for action, (2) goal setting, (3) behavioral change and (4) maintenance. Preparations are made by assessing one's own alcohol intake and its consequences. Users are then prompted to make decisions about their future alcohol use: either reducing the amount consumed or abstinence. These first two steps typically require only 10 minutes. The third and fourth steps aim at achieving a new drinking behaviour, and subsequently to maintain it and prevent relapse over time. To this end, the self-help program provides information, interactive exercises, an electronic drinking diary, and automated and tailored feedback. Participants are encouraged to complete the program in six weeks (Breslin et al., 1998). The Drinking Less self-help program was developed by Riper and Kramer (2002) and funded by the Netherlands Health Research Council (ZonMw).

In the control condition, participants received access to an online information brochure on alcohol use and its health consequences. This brochure could be read in 10 minutes (Nationaal Instituut voor Gezondheidsbevordering en Ziektepreventie (NIGZ), 2000).

Clinical endpoint

The primary outcome was the percentage of people who successfully reverted to drinking habits below the low-risk drinking criteria outlined above. The first criterion concerned mean weekly intake (*excessive drinking*) and the second concerned intake per occasion (*hazardous drinking*). Both aspects are important

from a health perspective (Rehm et al., 1996; Rehm et al., 2003). Alcohol consumption patterns were recorded using the validated Dutch versions of Weekly Recall (Cahalan, Cisin, & Crossley, 1969; Lemmens, Knibbe, & Tan, 1988) and the Quality-Frequency Variability Index (QFV) (Lemmens, Tan, & Knibbe, 1992).

Perspective of the economic evaluation

The economic evaluation was conducted from a societal perspective, and it thus included utilization costs of any type of health care (direct medical costs), participants' out-of-pocket costs (direct non-medical costs), and costs due to production losses in both paid and unpaid work (indirect non-medical costs). As the time frame was one year, the costs were neither corrected for inflation nor discounted. All costs were originally in Euro (€) on an annual per capita basis for the reference year 2003, and were then converted into US Dollar (US\$) for the year 2007 using purchasing power parities that at once convert currency and equalize the buying powers of the US (in 2007) and the Netherlands (in 2003). The Organization for Economic Co-operation and Development (OECD) equates €1 (in the Netherlands, 2003) to \$ 1.22 (in the US, 2007).

Assessment of resource use

Cost data were obtained using the Dutch Cost Questionnaire for Psychiatry (TIC-P) (Hakkaart - Van Roijen, 2002), see Table 3.1. The TIC-P is a health service utilization interview that gathers data reflecting direct medical costs. It also has sections on direct non-medical costs (patients' out-of-pocket travel and parking costs plus time costs for travel, waiting and receiving treatment) and on indirect non-medical costs (production losses due to work absenteeism and inefficient job performance, as well as household production losses).

Table 3.1 Direct medical and direct non-medical costs by health service type

Type of health service	Direct medical costs (in \$, 2007)		Direct non-medical costs (in \$, 2007)	
	unit	unit cost ^a	km pkg hrs ^b	unit cost ^c
GP or company doctor	Contact	24.70	1.8km, 1h	13.60
Medical specialist	Consult	119.70	7km, 2h	24.70
Community mental health service	Contact	151.50	10km, 3h	35.40
Community addiction service ^d	Contact	151.50	10km, 3h	35.40
Psychiatric hospital – outpatient	Contact	107.50	12km, 4h	45.40
Psychiatric hospital – day care	Contact	152.70	12km, 4h	45.40
Psychiatric hospital – inpatient	Day	305.40	8h	81.10
General hospital – outpatient	Contact	68.40	7km, 3h	34.80
General hospital – day care	Contact	279.80	7km, 4h	45.00
General hospital – inpatient	Day	411.70	8h	81.10
Teaching hospital – outpatient	Contact	122.20	12km, 3h	35.80
Teaching hospital – day care	Contact	279.80	12km, 4h	45.90
Teaching hospital – inpatient	Day	581.50	8h	81.10
Private practice psychotherapist	Session	92.80	5km, 2h	24.30
Social worker ^e	Contact	58.60	7km, 3h	34.80
Physiotherapist	Contact	27.80	1.8km, 2h	23.70
Home care	Hour	37.50	0km, 0h	0.00
Informal care (family, friends) ^f	Hour	10.10	0km, 0h	0.00

^a full unit costs (Oostenbrink et al., 2004) in 2003 euro converted to US\$ in 2007

^b Average distances and travel, waiting and treatment times during receipt of treatment (cf. Oostenbrink et al., 2004)

^c Costs of travelling 1km = €0.16; parking = €2.50; 1 hour leisure-time = €8.30 (Oostenbrink et al., 2004)

^d Valued as outpatient mental health services

^e From J. Bosmans (2006) Cost-effectiveness of treatment of depression in primary care (PhD thesis). Amsterdam: VU Medical Centre, p.82.

^f Valued as domestic help (cf. Oostenbrink et al., 2004)

Costing

Unit costs of treatment were derived from the Dutch guideline for health economic evaluations (Oostenbrink, Bouwmans, Koopmanschap, & Rutten, 2004) and were multiplied by the numbers of units consumed (e.g., service contacts, hospital days). To this we added the costs of drug treatments, calculated as the unit cost per standard daily dose (obtained from the Dutch Pharmaceutical Compass, www.fk.cvz.nl), multiplied by the number of prescription days, plus pharmacy dispensing costs of \$7.90 per prescription.

Direct non-medical costs were calculated as the average distance to health services times \$0.20 per kilometer. Parking was costed at \$3.00 an hour (Oostenbrink et al., 2004).

To estimate the monetary value of a lost day in paid employment, we used age- and gender-specific economic productivity costs (Oostenbrink et al., 2004) (see Table 3.2). Production losses may also occur when people work less efficiently on the job while suffering the consequences of drinking. Inefficiency was measured using a self-rated inefficiency score (ranging from 0 = efficient as usual to 1 = totally inefficient) times the number of days worked while not feeling well. These production losses were also valued in terms of age- and gender-specific economic productivity.

Table 3.2 Average monetary value (US\$ per hour) of production losses in paid employment by gender and age ^a

Age	Men	Women
15-24	25.03	24.52
25-34	40.00	36.50
35-44	49.92	41.05
45-54	55.42	41.79
55-64	58.42	44.48
65 +	58.42	44.48

^a Cf. Oostenbrink et al., 2004

The amount of time spent by users on the experimental or control websites was monitored in order to accurately estimate both time costs and Internet costs. The intervention costs were set equal to the participants' time costs for working through the online self-help therapy (experimental condition) or for reading the online brochure (control condition). As participants were assumed to have visited the Internet sites outside work hours, their time costs were valued as leisure time at \$10.10 per hour. We added Internet use costs at \$12.20 per 1000 minutes (the Dutch Telecom tariff), assuming use of a modem (a likely

overestimate, as most users will have had cheaper broadband connections) and we added \$1.20 per user to account for the costs of hosting and maintaining the website. As a final step, we summed the direct medical, direct non-medical, indirect non-medical, and intervention costs to arrive at a total per capita cost estimate.

Statistical analysis

First, t-tests and chi-square tests were used to verify whether randomization had resulted in comparable groups in terms of prognostically relevant variables such as age, gender, marital status, educational attainment, employment status and weekly alcohol intake at baseline (Table 3.3).

Second, we ascertained whether loss to follow-up (Figure 3.1) was associated with any of the prognostic variables; an indicator for loss to follow-up was created and regressed on the baseline variables in a logistic model.

Third, we performed the regression imputation procedure as implemented in the Stata statistical package, version 8.2/SE (2003), in order to replace missing values at follow-up by the most likely values. Gender, age and baseline drinking levels (weekly number of units) were used as predictors in the imputation equation, as we assumed them to be key determinants of costs and effects.

Fourth, we carried out the main analysis according to the intention-to-treat principle. The percentages of participants who were successful in reducing their drinking to below the limits were compared across treatment conditions at the twelve-month follow-up. This dichotomous outcome was regressed on the treatment dummy in a logistic model to obtain the odds ratio (OR), and in a linear probability model to obtain the risk difference (RD), as measures of treatment effect; the latter was then converted into numbers needed to treat as $NNT = 1/RD$. Tests were performed at $\alpha < 0.05$, 2-sided.

Table 3.3 Baseline characteristics of the participants by condition

	Condition ^a	
	Intervention (n = 130)	Control (n = 131)
Female gender, N (%)	64 (49.2)	64 (48.9)
Age, mean (sd)	45.9 (8.9)	46.2 (9.2)
Education, N (%)		
unskilled	41 (31.5)	38 (29.0)
vocational	52 (40.0)	55 (42.0)
academic	37 (28.5)	38 (29.0)
Living with a partner, N (%)	75 (57.7)	71 (54.2)
Paid employment, N (%)	94 (72.3)	96 (73.3)
No prior alcohol treatment, N (%)	116 (89.2)	115 (87.8)
Contemplation stage ^b	116 (89.2)	115 (87.8)
≥ 3 alcohol-related problems ^c	114 (87.8)	118 (90.1)
Problem drinking, N (%) ^d	130 (100)	131 (100)
Excessive drinking N (%)	125 (96.2)	128 (97.7)
Hazardous drinking N (%)	121 (93.1)	121 (93.1)
Weekly alcohol intake in standard units, mean (sd) ^e	43.7 (21.0)	43.5 (22.3)

^a All differences between conditions were non-significant (tested at P < 0.10).

^b Assessed with the validated Dutch version (Defuentes-Merillas et al., 2002) of the Readiness to Change Questionnaire (Rollnick et al., 1992).

^c Assessed with a validated Dutch questionnaire for problem drinking (Candel, 2001).

^d Drinking > 21 or 14 units (m/f) average per week over previous three months (*excessive drinking*) and/or drinking ≥ 6 or 4 units (m/f) at least one day per week over previous three months (*hazardous drinking*)

^e One standard unit contains 10 g of ethanol.

Cost-effectiveness analysis

The incremental cost-effectiveness ratio (ICER) was determined using the bootstrap method. At each step, the ICER was calculated from a random sample from the trial data (with replacement) of same size of the complete sample (N = 261) and then plotted on a cost-effectiveness plane (C/E plane, Figure 3.2). This process was repeated 2,500 times, producing a scatter of 2,500 simulated ICERs consistent with the variance in both costs and effects (Figure 3.2). The distribution of the plotted ICERs over the C/E plane provides information on the likelihood that the experimental intervention would generate superior or inferior

health effects at higher or lower costs relative to the control condition. If an intervention generates inferior effects at higher costs, it is said to be dominated by its alternative; if it generates superior effects at lower costs, it is said to be dominant. In the remaining scenarios, the larger or smaller effects must be weighed against the higher or lower costs. If better health is generated at additional costs, then a decision to accept the new intervention would depend on the willingness to pay (WTP) for a unit effect. But the WTP is often an unknown quantity and might range from \$0 to, say, \$50,000 per successful treatment outcome. The likelihood that the intervention is more cost-effective than its alternative at different WTP ceilings is depicted graphically in an ‘acceptability curve’ (Figure 3.3). This graph can aid in reaching a conclusion that one intervention is more acceptable than another in view of the maximum that decision makers might pay for added treatment success.

Figure 3.2 Plot of simulated incremental cost-effectiveness ratios (ICERs, $N = 2500$) over the four quadrants of the cost-effectiveness plane

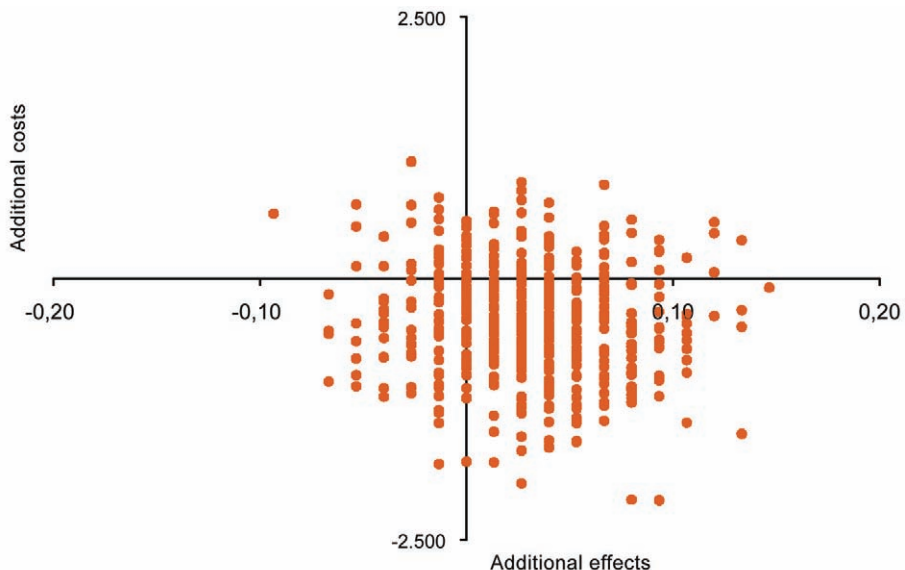
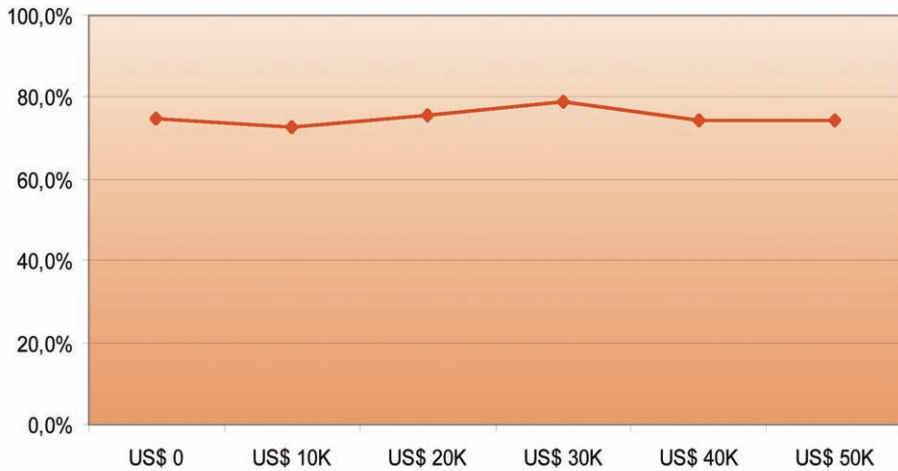


Figure 3.3 Cost-effectiveness acceptability curve: probability of cost-effectiveness (y-axis, in %) by willingness to pay ceilings (x-axis, in thousands of US\$)



Sensitivity analysis

The main cost driver in our study was production loss due to work cutback – less efficient performance while on the job due to after-effects of excessive drinking. Since people may make up for productivity losses by working longer hours or by working more efficiently another day, we repeated the cost-effectiveness analyses under the assumption that poorer performance does not uniformly translate into reduced productivity. In other words, rather than assuming a strict one-to-one ratio of efficiency to production, we allowed for a more elastic relationship by evaluating scenarios based on efficiency-to-productivity ratios of 1:0.9, 1:0.8 and 1:0.7, as well as those with a 1:1 ratio.

3.3 RESULTS

Sample at baseline

At baseline, 130 participants were randomized to the experimental intervention and 131 to the control condition. All 261 participants were classified as problem drinkers, consuming in excess of the recommended limits of the Dutch guideline for low-risk alcohol consumption. Mean weekly alcohol intake was 50 units (SD = 24.7) for men and 38 units (SD = 16.0) for women. A total of 231 baseline participants (89%) were contemplating decreasing their alcohol consumption in the near future, and 243 (93%) were aiming for moderation rather than abstinence. The mean age was 46 (SD = 9.0), 46% were women and 73% had paid employment. Table 3.3 illustrates the distribution of these and other baseline characteristics over the conditions. All these variables were evenly distributed over the two trial conditions at t_0 , indicating that randomization had been successful.

Incremental effects

The outcomes at six-month follow-up, which have been reported in detail elsewhere (Riper et al., 2008), were clinically substantial and statistically significant. We limit our focus here to the primary clinical outcome, drinking within the limits of the Dutch guideline. The intention-to-treat results at six months showed that 22 (17.2%) of the participants in the treatment condition and 7 (5.4%) of the participants in the control condition had successfully reduced their drinking to within the guidelines (OR = 3.66; 95%CI 1.25 ~ 10.78; $P < 0.01$; RD = 0.12; NNT = 8.5).

At the twelve-month follow-up, the findings were no longer statistically significant. In the control group, 6 subjects (4.6%) were now drinking below the recommended limits, compared to 10 (7.7%) in the treatment group, yielding a non-significant odds ratio for treatment success of 1.74 (SE = 0.92; $z = 1.04$; $P = 0.300$). The difference in success rates between the conditions was

$0.077 - 0.046 = 0.031$ (3.1%), which was not significant (SE = 0.030; $t = 1.05$; $P = 0.296$) and which corresponded to an NNT of 32.3. In an economic evaluation like this one, the difference in success rates between the conditions (the risk difference, RD) is the clinical parameter of interest; it is interpreted as representing the incremental effect of providing the experimental intervention rather than the alternative (the control condition).

Incremental costs

The mean per-user cost of the interventions was US\$ 52.50 in the experimental arm of the trial and US\$ 13.40 in the control arm, a cost difference of US\$ 39.10 that was statistically significant at $P < 0.001$ (Table 3.4). For all remaining cost items, the experimental intervention was associated with lower per capita costs. To illustrate, the annual per-user direct medical costs of utilizing any type of treatment was computed at US\$ 105.10 in the experimental group versus US\$ 155.20 in the control group – a negative cost difference of US\$ 50.10 in favor of the experimental intervention. In other words, €41 in direct medical costs would be saved per user per year if the experimental intervention were to be provided in preference to the control intervention, but this difference was not statistically significant. An additional US\$ 12.20 would be saved in direct non-medical costs and US\$ 33.00 due to fewer work-loss days in the experimental group. More substantial annual per capita savings of US\$ 376 would be achieved as a result of smaller production losses from work cutbacks. On balance, then, the intervention would be less costly than the comparison condition, because its slightly higher delivery costs would be more than offset by savings elsewhere in the health care system, lower out-of-pocket medical and non-medical costs and higher productivity – an overall cost saving of US\$ 432. However, this estimate is surrounded by stochastic uncertainty (95%CI = -1,175 ~ 308) and that the savings were not statistically significant ($P = 0.251$). The difference in total costs between the interventions is the economic parameter of interest and is interpreted as representing the incremental costs.

Table 3.4 Annual per capita costs (in US\$, rounded), by condition and their differences

Cost item	Intervention		Control		Cost differences (intervention minus control)			
	M in \$	(SD)	M in \$	(SD)	Diff. in \$	95%CI	t	P
Intervention	53	-44	13	-13	39	32 ~ 48	9.67	<0.001
Direct medical	105	-357	155	-535	-50	-161 ~ 61	0.90	0.372
Non-medical	33	-110	46	-159	-12	-46 ~ 21	0.77	0.441
Work loss	134	-1092	169	-1406	-33	-340 ~ 275	0.21	0.834
Work cutback	513	-1897	889	-2653	-376	-938 ~ 187	1.32	0.189
Total costs	840	-2,520	1,273	-3,484	-432	-1,175 ~ 308	1.15	0.251

Total costs and differences of costs may not add exactly due to rounding

Cost-effectiveness

In the next step, we computed the incremental cost-effectiveness ratio, ICER, as – US\$ 13,950, which was the incremental cost (–US\$ 432,45) divided by the incremental effect (RD, 0.031). This mean ICER may not be the best estimate, though, as cost data are known to have skewed distributions. We therefore also determined the median ICER, which was – US\$ 5,273 on the basis of the 2500 simulated ICERs generated by the bootstrap method. Figure 3.2 shows the scatter plot of the 2500 simulated ICERs on the cost-effectiveness plane. It emerged that 15.8% of the simulated ICERs fell in the north-east quadrant of the C/E plane, indicating a 15.8% probability that better outcomes would be gained at additional costs. The north-west quadrant showed a 3.6% probability that the intervention would be inferior in that less health would be generated for additional costs. A further 11.6% fell in the south-west quadrant, but the bulk of the simulated ICERs (69%) fell in the south-east quadrant, indicating that the intervention dominated the comparison condition in terms of cost-effectiveness – thus generating more successful therapeutic outcomes at lower costs.

Acceptability

Figure 3.3 depicts the likelihood that the experimental intervention would be acceptable from a cost-effectiveness point of view (vertical axis) at different ceilings of willingness to pay for a successful treatment outcome (WTP, horizontal axis). In the conservative scenario that the willingness to pay is US\$ 0, there is a 73.2% probability that we should regard the experimental intervention as more acceptable than the comparison condition. The acceptability curve varies only slightly between the different WTP ceilings, suggesting that the acceptability of the intervention would not be sensitive to WTP levels.

Sensitivity analyses

Production losses caused by less efficient work performance were the single most important cost driver (Table 3.4). This item accounted for 50% of the indirect non-medical costs and 44% of all costs. We conducted sensitivity analyses in which the elasticity of time and production losses due to inefficiency stood not in a 1 to 1 relationship, but in a 1 to 0.9, 0.8 and 0.7 relationships. We re-evaluated the effects of these different scenarios on the cost savings. Under the original scenario of unit elasticity (1.0), we had identified an average cost saving of US\$ 432 in the experimental group relative to the control group. At elasticities of 0.9, 0.8 and 0.7, these cost savings predictably became smaller at US\$ 396, 356 and 320, but this did not substantially alter the overall conclusions about the acceptability of the experimental intervention. At zero WTP, the probability that the intervention would be preferable from a cost-effectiveness point of view did not diverge much from the aforementioned 73.2%. The new values were 72.8%, 73.4% and 73.8% for the three alternative scenarios, and all other ICER-related outcomes remained virtually the same, indicating robustness of our findings even under varying scenarios for the main cost driver.

3.4 DISCUSSION

Main findings

This study evaluated the cost-effectiveness of the interactive web-based self-help intervention Drinking Less. This intervention proved to be effective in reducing alcohol use to below recommended limits at six-month follow-up (Riper et al., 2008). These significant clinical effects were not maintained at twelve-month follow-up, largely due to improvements in the control group. The intervention was nonetheless seen to be associated with favorable economic effects after twelve months, because the slight additional costs of the intervention were more than offset by lesser resource use elsewhere. Costs and cost offsets were subject to uncertainty, yet the conclusion stands that the intervention was worthwhile from a strict cost-effectiveness point of view. This was evidenced by the high ICER acceptability curve, which was virtually insensitive to willingness-to-pay levels and remained unaffected in a subsequent sensitivity analyses. It is important to note that the intervention failed to produce lasting clinical effects – an overriding issue that puts the economic benefits into a less favorable perspective.

Limitations and strengths

Before we draw our conclusions, we should place the findings in the context of the study's strengths and limitations. The analyzed costs were fairly comprehensive in that they included direct medical costs of health care uptake, patients' out-of-pocket and time costs, and costs from production losses in paid employment due to work loss and work cutback. Since additional costs like premature death, accidents, domestic violence and alcohol-related crime were not taken into account, our cost estimates are likely to be underestimates and do only reflect short-term costs. We should add that the costs were assessed only at follow-up, so it may be possible that there were some differences between the experimental conditions at pretest, which have had an influence on our

economic outcomes. On the other hand, all variables we examined at pretest did not differ significantly between the conditions ($p>0.1$) and we did not find any indications that our randomization was not successful. Another limitation is the relatively high dropout rate from the intervention, which may have biased our results. However, we have minimized this potential bias by conducting the analyses on the intention-to-treat principle, imputing the most likely values for missing endpoint data in appropriate regression models. A final limitation lies in our use of a clinical outcome based on self-report data, which, although capturing an important and relevant parameter in this research field, does not describe a diagnostic status.

Because of these limitations the results of our study have to be considered with caution. Despite these limitations, however, we must realize that this is the first economic evaluation of an interactive web-based self-help intervention for problem drinking. It was a strictly designed randomized trial, thus ensuring a considerable level of internal validity. It was also a pragmatic trial, in that it naturalistically mimicked the conditions under which web-based self-help interventions are delivered in the Netherlands, which enhances generalizability of the research findings. Finally, small or medium clinical effects may translate into substantial health gains at the population level if the number of recipients of an intervention is large. That may well be the case for a low-threshold provision like this one, as has also been concluded elsewhere (Linke, Murray, Butler, & Wallace, 2007).

Conclusions

Even though its clinical effects had waned after twelve months, the Drinking Less intervention still had favorable impacts on resource use and economic productivity. The intervention's effects diminished somewhat, but the control group subjects were increasingly successful in curbing their own alcohol use. Yet however cost-effective the intervention may be, measures are still needed to ensure that clinical effects will survive up to twelve months and beyond. We

therefore envisage a ‘next-step’ intervention that will situate the Drinking Less intervention in a stepped-care framework, allowing users to move on to booster sessions or more intensive treatments, such as maintenance therapy or relapse prevention, should these be required. These next-step interventions are needed, given the high prevalence of problem drinking in many Western countries. Novel, low-threshold interventions therefore need to be provided on a large scale. Interventions delivered over the Internet may well fulfill these requirements both from a clinical and economic perspective. The present study suggests that interventions like Drinking Less are cost-effective, but that more work is needed to ensure their therapeutic effectiveness over longer periods of time.

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Predicting successful treatment outcome of web-based self-help for problem drinkers

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ABSTRACT

Background Web-based self-help interventions for problem drinking are coming of age. They have shown promising results in terms of cost-effectiveness, and they offer opportunities to reach out on a broad scale to problem drinkers. The question now is whether certain groups of problem drinkers benefit more from such web-based interventions than others.

Objective We sought to identify baseline client-related predictors of the effectiveness of Drinking Less, a 24/7 free-access interactive web-based self-help intervention without therapist guidance for problem drinkers who want to reduce their alcohol consumption. The intervention is based on cognitive-behavioural and self-control principles.

Methods We conducted secondary analysis of data from a pragmatic randomised trial with follow-up at 6 and 12 months. Participants ($N = 261$) were adult problem drinkers in the Dutch general population with a weekly alcohol consumption above 210 g of ethanol for men or 140 g for women, or consuming at least 60 g (men) or 40 g (women) one or more days a week over the past three months. Six baseline participant characteristics were designated as putative predictors of treatment response: (1) gender (2) education, (3) Internet use competence (*sociodemographics*); (4) mean weekly alcohol consumption, (5) prior professional help for alcohol problems (*level of problem drinking*); and (6) participants' expectancies of web-based interventions for problem drinking. Intention-to-treat (ITT) analyses, using last-observation-carried-forward (LOCF) data and regression imputation (RI), were performed to deal with loss to follow-up. Statistical tests for interaction terms were conducted and linear regression analysis was performed to investigate whether the participants' characteristics as measured at baseline predicted positive treatment response at 6-month and 12-month follow-up.

Results At 6 months, prior help for alcohol problems interacted with Drinking Less to predict a small, marginally significant positive treatment outcome in the RI model only ($\beta = .18$, $P = .05$, $R^2 = .11$). At 12 months, female gender had modest predictive power in both imputation models (LOCF: $\beta = .22$, $P = .045$, $R^2 = .02$; regression: $\beta = .27$, $P = .01$, $R^2 = .03$). Higher level of education had modest predictive power in the LOCF model only ($\beta = .33$, $P = .01$, $R^2 = .03$).

Conclusions Although female and more highly educated users appeared slightly more likely to derive benefit from the Drinking Less intervention, none of the baseline characteristics we studied persuasively predicted a favourable treatment outcome. The web-based intervention therefore seems well suited for a heterogeneous group of problem drinkers and could hence be offered as a first-step treatment in a stepped care approach directed at problem drinkers in the general population.

4.1 INTRODUCTION

Problematic alcohol use is not only a pervasive individual problem; it also imposes serious health and social burdens at the population level (Murray & Lopez, 1996; Smit et al., 2006; World Health Organization, 2004). This makes it a major public health concern. Brief interventions hold a promise to ease these burdens, and their cost-effectiveness has been amply demonstrated in a number of studies and meta-analyses (Apodaca & Miller, 2003; Ballesteros, Duffy, Querejeta, Arino, & Gonzalez-Pinto, 2004; Cuijpers, Riper, & Lemmers, 2004; Kaner et al., 2007; Mortimer & Segal, 2005; Moyer, Finney, Swearingen, & Vergun, 2002). Yet in view of the small to medium treatment effects that have been reported by meta-analyses (Apodaca & Miller, 2003; Moyer et al., 2002), it appears that not every problem drinker benefits equally from brief interventions. Web-based self-help interventions for problem drinking are the youngest branch in the tree of brief interventions, making it possible to reach out to problem drinkers on a broad scale at relatively low cost. These web-based interventions are clearly coming of age for a number of psychological disorders (Marks, Cavanagh, & Gega, 2007; Spek et al., 2007) and increasingly for alcohol problems as well (Kypri et al., 2004; Linke, Murray, Butler, & Wallace, 2007). As of yet, however, the effect sizes found for brief web-based interventions for problem drinking have not differed much from those for offline brief interventions (Kypri et al., 2004; Riper et al., 2008). The question therefore arises whether such web-based interventions might work more effectively for some people than for others. The answer to this question could help to improve intervention development, treatment outcomes and the matching of clients to treatment modalities, and is therefore of potential clinical, social and economic interest (Ritterband, Andersson, Christensen, Carlbring, & Cuijpers, 2006; Smit et al., 2006).

It is well known that treatment response is not influenced by treatment alone (Bodin & Romelsjo, 2007); a number of effect moderators of alcohol treatment outcomes have been identified (Penberthy et al., 2007). These include clients' baseline sociodemographics, within-treatment variables such as treatment fidelity, and posttreatment factors like social support for curbing drinking activities (McKay & Weiss, 2001). Prediction studies have provided a limited number of consistently identified baseline predictors of treatment outcome, including readiness to change problematic alcohol use (Cox, Pothos, & Hosier, 2007; Project Match, 1997; Vielva & Iraurgi, 2001), self-efficacy (Bandura, 1997; Cox et al., 2007; Project Match, 1997) and severity of alcohol use (Bodin & Romelsjo, 2007; Moyer et al., 2002); the milestone study by Project MATCH (Project Match, 1997) is the best known example. Most prediction studies, however, have focused on severely alcohol-dependent clinical populations, and far fewer on brief interventions for clinical populations in primary care settings or on problem drinkers in the general population (Bodin & Romelsjo, 2007; Project Match, 1997). Research suggests that baseline characteristics are more likely to affect treatment outcomes for less severe problem drinkers than for more highly dependent clinical populations (Matzger, Delucchi, Weisner, & Ammon, 2004).

We therefore investigate here whether specific baseline characteristics can be identified as predictors of positive treatment outcome for problem drinkers in the Dutch general population who completed a web-based self-help intervention called *Drinking Less*. On the basis of predictors already reported in the literature, we hypothesised that six putative baseline characteristics – (1) female gender, (2) high education, (3) Internet competence, (4) a moderate level of problem drinking, (5) prior professional help for problem drinking and (6) high expectancy of web-based intervention – would interact with *Drinking Less* to predict more favourable treatment outcome at follow-up. We conducted a secondary analysis of our *Drinking Less* trial data (Riper et al., 2008) to

examine attribute-treatment interaction (ATI) – the interplay between the baseline characteristics (attributes) of the problem drinkers and the intervention itself – and the influence such interaction might have on treatment response (Cronbach & Snow, 1977). Drinking Less has been shown effective for problem drinkers who want to reduce their alcohol intake, yielding a medium effect size at 6-month follow-up ($d = 0.40$, 95% CI 5.86–18.10; $P < 0.001$). At 12 months, the difference between the groups had faded ($d = 0.01$, 95% CI –2.63~9.20, $P = .21$), mainly due to a further decrease in alcohol consumption in the control group. Results of this pragmatic randomised trial have been reported elsewhere (Riper et al., 2008).

To the best of our knowledge, this is the first article that uses randomised trial data to assess predictors of short- and longer-term outcomes in web-based self-help for problem drinkers in the general population.

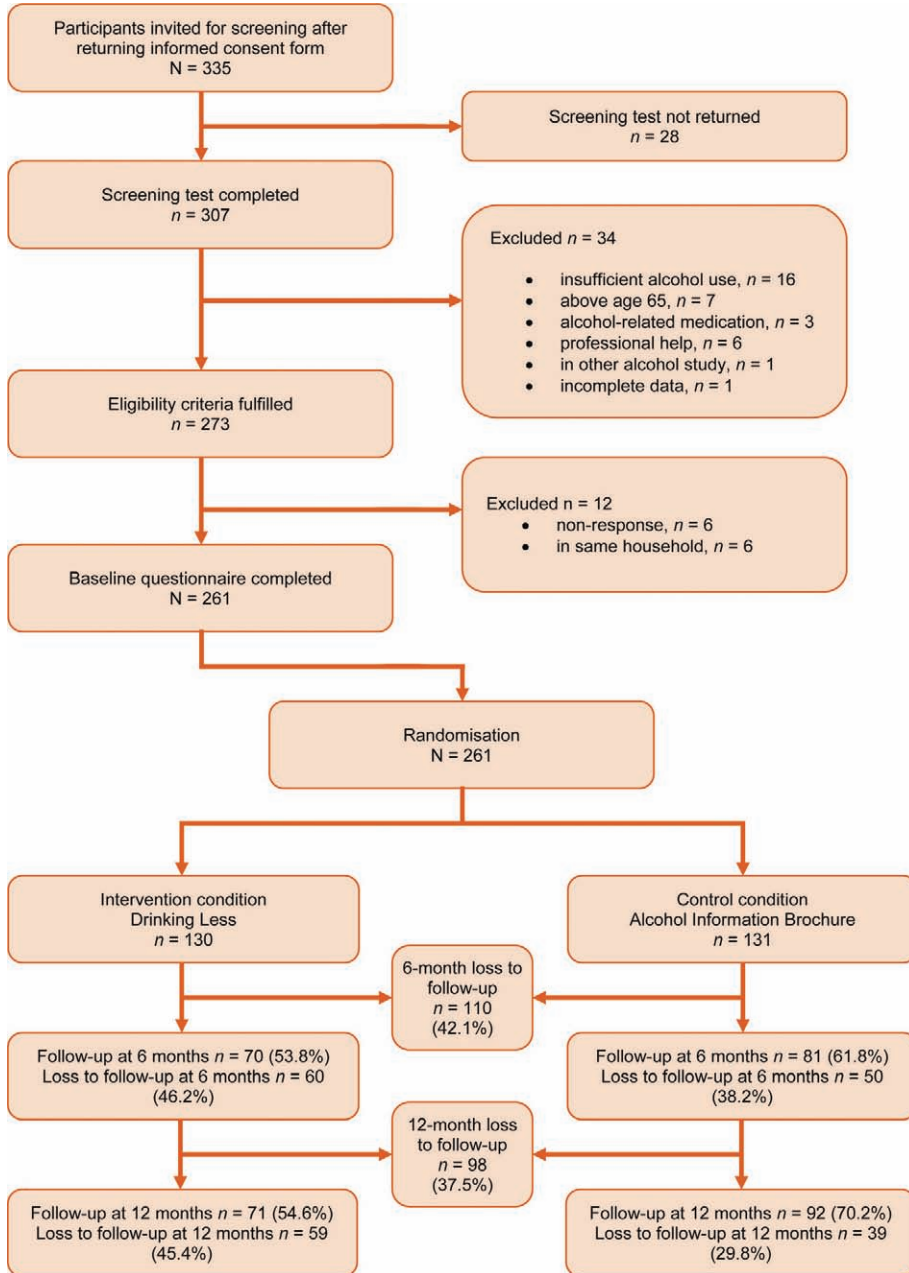
4.2 METHODS

Participants and procedure

Data were retrieved from a pragmatic randomised trial with two parallel groups, using block randomisation stratified for gender, with follow-up at 6 and 12 months (Riper et al., 2008). In brief, we recruited adult participants from the general population through advertisements in national newspapers and health-related websites. The study and intervention were conducted entirely via the Internet with the exception of the informed consent form, which had to be signed and returned by post. In the inclusion criteria, we applied different cut-off points for problem-drinking men and women. Men were selected who were drinking either more than 21 standard units per week (excessive drinking) or 6 or more units at least 1 day per week for the past 3 months (hazardous drinking). Women were included if they drank over 14 units a week or 4 or more units at least 1 day a week for the past 3 months. One standard unit represents 10 g of ethanol. Additional inclusion criteria were: age 18-65; access to the Internet; and not receiving professional help for problem drinking at the start of the study.

We kept our exclusion criteria to a minimum to facilitate a low-threshold inclusion strategy consistent with the nature of self-help interventions without therapeutic guidance. We therefore did not conduct diagnostic interviews. After screening and baseline assessment, participants were randomly assigned to the experimental condition (the Drinking Less intervention) or to the control condition (an online psychoeducational brochure on alcohol use that could be read in 10 minutes) (Nationaal Instituut voor Gezondheidsbevordering en Ziektepreventie (NIGZ), 2000). We selected a total of 261 adult problem drinkers. Figure 4.1 shows the flow of participants through the trial.

Figure 4.1. Flow of participants through the trial



Intervention

Participants in the experimental condition received access to the Drinking Less intervention (Riper & Kramer, 2002). Drinking Less is a free-access web-based self-help intervention without therapist guidance for problem drinkers who want to reduce their alcohol consumption, preferably to within the recommended Dutch limits for low-risk drinking (Posma & Koeten, 1998). The intervention is based on cognitive-behavioural and self-control principles (Hester, 1995; Miller & Munoz, 1982), which are suitable for web-based implementation due to their standardised nature and systematic approach. Drinking Less consists of a home page giving information on alcohol and treatment services and offering access to the self-help programme via an automated sign-up procedure, with a description indicating for whom the intervention is suitable (figure 4.2). The programme proceeds in four successive stages: (i) preparing for action; (ii) goal setting; (iii) behavioural change; and (iv) maintenance of gains and relapse prevention. These stages contain elements known to be effective, such as goal setting and analysis of drinking behaviour (Miller & Munoz, 1982; Walitzer & Connors, 1999). The self-help programme also includes access to a moderated peer-to-peer discussion forum. The recommended treatment period is 6 weeks, which should give a reduction in alcohol consumption enough time to take hold (Sanchez-Craig, 1993); trial participants were allowed to use the intervention as long as they felt necessary. Access to Drinking Less proceeded through a unique login and security identification code and was available on a 24-hour, 7-day basis.

Figure 4.2. Drinking Less home page (www.minderdrinken.nl)



Predictive variables

Our choice of baseline participant characteristics as putative predictors was based on theoretical assumptions and results from previous prediction studies (Bandura, 1997; Bodin & Romelsjo, 2007; Cox et al., 2007; McKay & Weiss, 2001; Penberthy et al., 2007; Project Match, 1997; Vielva & Iraurgi, 2001). We selected six characteristics: (1) gender, (2) education, (3) Internet use competence (*sociodemographic factors*); (4) mean weekly alcohol consumption, (5) prior professional help for alcohol problems (*level of problem drinking*); and (6) participants' expectancies of web-based intervention as helpful for overcoming problem drinking.

Outcome measure

The outcome measure was defined as the individual differences between baseline (T0) mean weekly alcohol consumption and the mean level of consumption at posttreatment (6 months, T1) and at follow-up (12 months, T2) in the total group. Alcohol consumption was assessed with the Dutch version of Weekly Recall (WR) (Cahalan, Cisin, & Crossley, 1969; Lemmens, Knibbe, & Tan, 1988); it records the number of units consumed in the 7 days preceding the assessment.

Statistical analyses

We first used *t*-tests, chi-square tests and logistic regression to assess whether the randomisation had resulted in two comparable groups at baseline and whether any differential loss to follow-up had occurred. We then performed intention-to-treat (ITT) analysis, using last-observation-carried-forward (LOCF) data and regression imputation (RI) to deal with loss to follow-up. Overall loss to follow-up was high (see figure 4.1), and we wanted to avoid overestimating the impact of the intervention (Engels & Diehr, 2003). ITT analysis enabled us to maintain sufficient power and the integrity of randomisation. The LOCF imputation procedure assumes that outcome assessments of participants not reached for follow-up would equal their last available assessment (Engels & Diehr, 2003). Missing WR data at 6 months and 12 months were also estimated by RI, using the significant predictors for the missing outcomes and for dropout (Engels & Diehr, 2003). At 6 months those predictors were condition, baseline partner status and baseline weekly alcohol units according to WR; at 12 months they were condition, gender, weekly alcohol units according to WR at 6 months (imputed), and baseline alcohol units as measured by the Dutch version of the Quantity-Frequency Variability Index (QFV) (Lemmens, Tan, & Knibbe, 1992).

In the third step, we created dichotomous measures for the continuous and categorical baseline variables, alongside the already dichotomous variable of

gender (female gender: yes/no). Values on the WR scale were transformed into a variable distinguishing moderate problem drinking (14-35 mean weekly alcohol units for women, 21-50 for men) from severe problem drinking (>35 or >50 units women/men). Categorical variables with more than two categories were recoded into two meaningful categories: (1) education: high/low (university and professional degrees versus the rest); (2) Internet competence: experienced/beginner; (3) prior professional help for alcohol problems: yes/no, (4) expectancies of web-based intervention: high/low. We then applied regression analyses to ascertain whether these particular groups benefited more from the intervention than others. We assessed the interactions between the above baseline attributes and the Drinking Less intervention modality, and then the effects of those interactions on treatment outcome. In this model, the standardised individual change scores (pre- to post-intervention effect sizes) served as the dependent or outcome variable; the interaction terms of each participant characteristic with the intervention dummy (Drinking Less experimental condition = 1, control condition = 0) served as independent predictor variables, along with their constituent main effects.

We next calculated the product of the intervention dummy and each of the dummy variables describing the participants' characteristics (Clayton & Hills, 1993; Rothman & Greenland, 1998). The interaction terms were entered together with the corresponding main effects into the linear regression model and tested at $P < .05$. Independent-samples t -tests were used to analyse differences between the conditions in terms of problem drinking outcome at T1 and T2. This technique permitted us to test for the differential effects of the predictors in interaction with the Drinking Less treatment; it also enhanced the power to detect effects. If neither of these interaction terms proved significant, then the effect of the predictor was deemed not to be modified by Drinking Less. That is, the effect of Drinking Less on drinking outcome could not be explained

by the predictor's modifying effect on the relationship between treatment and outcome.

We subsequently repeated this procedure in completers-only analyses on those participants who completed the follow-up questionnaire at 6 months ($n = 151$) or at 12 months ($n = 163$) to verify whether the results of the two ITT analyses would be sustained. Finally, we used descriptive statistics to illustrate the changes in alcohol consumption over time in terms of the identified predictors. The sample size provided 24 participants per variable at 6 months and 26 per variable at 12 months (Tabachnick & Fidell, 2006). All analyses were conducted with SPSS version 15 (SPSS Inc., 2006) and were carried out independently by two researchers to cross-check outcomes.

4.3 RESULTS

Sample characteristics

The demographic and clinical characteristics of participants at baseline are shown in table 4.1. No differences were found between the experimental and control groups on any of these variables at baseline (even when tested conservatively at $P < .10$ to ensure against marginal differences that could affect results); this indicated that the randomisation was successful. At baseline, all 261 participants (100%) were exceeding the mean number of weekly alcohol units set by the Dutch guideline for sensible drinking for healthy adults. Mean weekly alcohol intake was 43.6 standard units ($SD = 21.6$). More than half the sample belonged to the category of moderate, as opposed to severe, problem drinkers ($n = 148, 57.7\%$). The female-to-male ratio was almost 1:1. Two thirds of participants had high educational backgrounds ($n = 182, 69.7\%$). Most participants considered themselves experienced Internet users ($n = 204, 78.1\%$). Almost half had positive expectations of the intervention ($n = 127, 48.2\%$). The large majority of participants ($n = 231, 88.5\%$) were in the contemplation stage

of change, meaning that they wanted to reduce their alcohol consumption in the near future (Defuentes-Merillas, Dejong, & Schippers, 2002; Rollnick, Heather, Gold, & Hall, 1992). Most ($n = 243$, 93.1%) aimed for moderation rather than abstinence. Few ($n = 33$, 12.6%) had ever received professional help for their problem drinking.

Table 4.1. Baseline characteristics of the 261 participants. Values are numbers (and percentages) of participants, unless otherwise indicated.

	Condition*	
	Experimental $n = 130$	Control $n = 131$
<i>Female gender</i>	64 (49.2)	64 (48.9)
<i>Education</i>		
Low	41 (31.5)	38 (29.0)
High (academic/professional)	89 (68.5)	93 (71.0)
<i>High Internet competence</i>	104 (80.0)	100 (76.3)
<i>High treatment expectancy</i>	61 (46.9)	66 (49.6)
Weekly alcohol intake in standard units [†] (mean, SD)	43.7 (21.0)	43.5 (22.3)
<i>Moderate problem drinking</i> 14-35 units per week (women) 21-50 units per week (men)	74 (56.9)	74 (56.5)
<i>Severe problem drinking</i> >35 (women) and >50 (men) units [†] per week	56 (43.1)	57 (43.5)
<i>Prior professional help for problem drinking</i>	18 (13.8)	15 (11.5)
<i>Contemplation stage[‡]</i>	116 (89.2)	115 (87.8)
<i>Alcohol moderation as goal</i>	120 (92.3)	123 (93.9)
<i>Age (mean, SD)</i>	45.9 (8.9)	46.2 (9.2)
<i>Living with a partner</i>	75 (57.7)	71 (54.2)
<i>Paid employment</i>	94 (72.3)	96 (73.3)

Italics indicate putative predictors of favorable treatment response.

* All differences between conditions were non-significant (tested at $P < .10$).

† A standard unit contains 10 g of ethanol.

‡ Assessed with the validated Dutch version (Defuentes-Merillas et al., 2002) of the Readiness to Change Questionnaire (Rollnick et al., 1992).

Predictors of loss to follow-up

Participants who did not return the questionnaire 6 months after baseline did not differ from posttreatment responders in terms of the characteristics assessed at baseline ($P > .10$; see table 4.1 for characteristics). Loss to follow-up at 6 months was 42.1% ($n = 110$) and was distributed rather evenly across the two conditions ($n = 60$ in the experimental and $n = 50$ in the control condition; $\chi^2(1) = 1.71, P = .19$). At 12 months, loss to follow-up was 37% ($n = 98$) and was greater in the experimental condition ($n = 59, 45\%$) than in the control condition ($n = 39, 30\%$; $\chi^2(1) = 5.56, P = .02$). Non-responders at 12 months had a higher baseline mean weekly alcohol intake as measured by WR (46.9 units, $SD = 24.3$) than non-responders (41.7 units, $SD = 19.7$; $t(259) = 1.91, P = .06$).

Predictors of successful outcome: mean weekly alcohol consumption at 6 and 12 months

Analyses of predictor-by-treatment interaction effects in terms of a successful reduction of mean weekly alcohol use at 6 and 12 months showed similar results for the last-observation-carried-forward (LOCF) and the completers-only model. We therefore present here only the intention-to-treat models. Results of the completers-only analysis are available from the first author.

Analyses of predictor-by-treatment interaction effects in terms of a successful reduction of mean weekly alcohol use found no significant effects for the putative predictors at 6 months (tables 4.2 and 4.3), with the exception of prior professional help for problem drinking, which emerged only after regression imputation (RI; table 4.3). Its predictive power with regard to treatment response was only marginally significant and the explained variance was small ($N = 261$, $\beta = .18, P = .05, R^2 = .11$). At 12 months, female gender predicted successful alcohol reduction in both analysis models (tables 2 and 3). RI indicated a significant but small impact and explained variance ($N = 261$, $\beta = .27, P = .01, R^2 = .03$), while the LOCF model showed a less strongly significant

impact and a lesser amount of explained variance ($N = 261$, $\beta = .22$, $P = .045$, $R^2 = .02$). High education level was identified as an additional predictor of successful outcome at 12 months; the LOCF analysis ($N = 261$, $\beta = .33$, $P = .01$, $R^2 = .03$) showed a significant modest effect and accounted for a small fraction of the variance in treatment outcome, but the effects in the RI model were not significant.

Table 4.2. Predictor-by-treatment interaction regressed individually using last-observation-carried-forward (LOCF) imputation at 6- and 12-month follow-up

Interaction term: participant characteristic by condition (Drinking Less = 1)	Effect on mean weekly alcohol consumption* at 6 months (N = 261)			Effect on mean weekly alcohol consumption* at 12 months (N = 261)		
	beta†	P	R2‡	beta†	P	R2‡
Female	.003	.98	.03	.22	.045	.02
High educational level	.17	.17	.03	.33	.01	.03
High Internet competence	.13	.39	.03	.11	.44	.00
High treatment expectancy	.09	.37	.03	.09	.37	.00
Moderate problem drinking (female/male 14-35 or 21-50 units a week*)	-.02	.86	.03	.04	.70	.06
Prior help for drinking	.07	.48	.03	-.05	.60	.00

* measured in standard units containing 10 g of ethanol

† beta: standardized regression coefficient

‡ R^2 : amount of variance in treatment response explained by the model

We compared the mean weekly alcohol consumption at 6 and 12 months for the two conditions as shown by the intention-to-treat and completers-only analyses. The last-observation-carried-forward (LOCF) model appeared to be the most conservative estimation method for the total group, as it returned the highest alcohol intake in both conditions – thus suggesting less improvement. We therefore chose these more cautious LOCF results to report outcomes for the two main predictors identified in our analysis. Detailed information about the other two models can be obtained from the first author.

Table 4.3. *Predictor-by-treatment interaction regressed individually using regression imputation (RI) at 6- and 12-month follow-up*

Interaction term: participant characteristic by condition (Drinking Less = 1)	Effect on mean weekly alcohol consumption* at 6 months (N = 261)			Effect on mean weekly alcohol consumption* at 12 months (N = 261)		
	beta [†]	P	R ^{2‡}	beta [†]	P	R ^{2‡}
Female	.06	.53	.12	.27	.01	.03
High educational level	.11	.37	.10	.21	.10	.03
High Internet competence	.002	.99	.10	.06	.97	.01
High treatment expectancy	.15	.14	.11	.04	.74	.00
Moderate problem drinking (female/male 14-35 or 21-50 units a week*)	-.08	.46	.16	-.09	.39	.17
Prior help for drinking	.18	.05	.11	.02	.79	.01

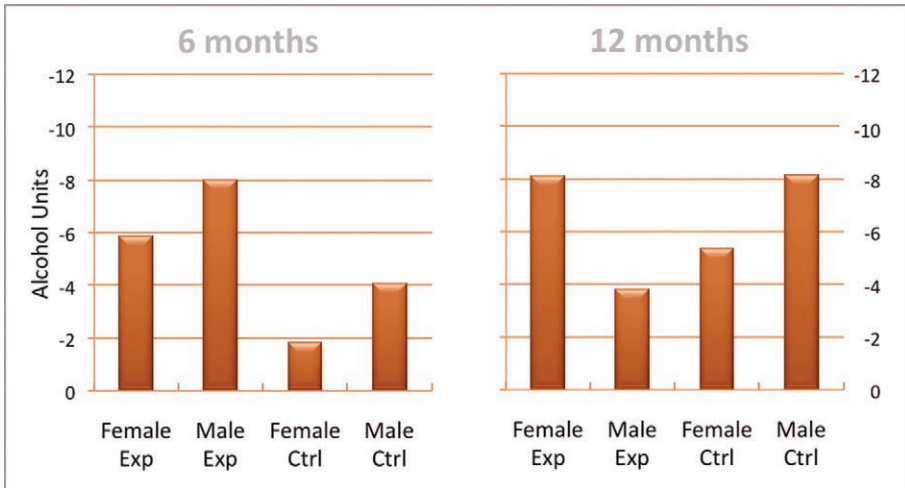
* measured in standard units containing 10 g of ethanol

† beta: standardized regression coefficient

‡ R²: amount of variance in treatment response explained by the model

Figure 4.3 shows that women in the Drinking Less condition had not reduced their mean weekly alcohol consumption at 6 months to a greater degree than their male counterparts either in absolute terms (−5.86 vs −8.01 units) or in relative terms (−14.6% vs −16.9%). At 12 months, in contrast, women in the Drinking Less condition had reduced their intake (−8.13 units, −20.3% as compared to baseline) substantially more in both absolute and relative terms than female controls (−5.36 units, −15.3%) or than males in the experimental condition (−3.8 units, −8.0%). Interestingly, men in the control condition had decreased their intake at 12 months by a larger amount in absolute and relative terms (−8.16 units, −15.5%) than men who had completed the Drinking Less intervention (−3.8 units, −8.0%).

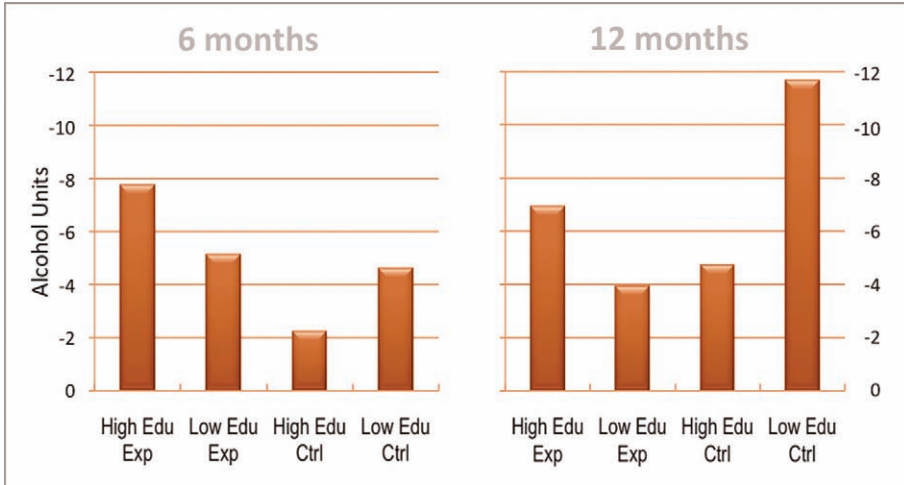
Figure 4.3. Reductions in mean weekly alcohol consumption* in experimental and control groups 6 and 12 months after baseline, by gender (LOCF)



* in mean weekly units containing 10 g of ethanol

At 6 months, the more highly educated Drinking Less (experimental) participants had achieved the greatest reduction in both absolute and relative terms (-7.74 units, -19.0%) as compared to other categories (figure 4.4). Although at 12 months their reduction had diminished by nearly one unit (0.80), they were still drinking less (-6.94 units, -17.1%) than at baseline, and their reduction remained greater than that of the lesser educated experimental participants (-3.93 units, -7.8%) and the more highly educated controls (-4.73, -11.6%). Interestingly, though, the lesser educated controls achieved the greatest reduction of all (-11.65 units, -23.1%) at 12 months.

Figure 4.4. Reductions in mean weekly alcohol consumption* in experimental and control groups 6 and 12 months after baseline, by high and low education (LOCF)



* in mean weekly units containing 10 g of ethanol

4.4 DISCUSSION

The aim of this study was to determine whether some groups would benefit more than other groups from Drinking Less, a web-based self-help intervention for problem drinkers, when assessed at 6 and 12 months. We investigated six characteristics of the participants at baseline as putative predictors of treatment response: (1) female gender, (2) high level of education, (3) high Internet experience, (4) moderate as opposed to severe level of problem drinking, (5) prior professional help for alcohol-related problems, and (6) high expectancies of web-based intervention.

At six-month follow-up, we could not convincingly establish predictive value for any of these putative predictors, with the possible exception of prior help for alcohol problems, which was only marginally significant under the regression imputation model. Some other studies have likewise identified prior professional

help as a predictor of positive client-by-treatment interaction leading to successful outcomes (Matzger et al., 2004); an explanation might be that reducing problem drinking requires multiple efforts over time (perhaps with a cumulative facilitating effect), and that help seeking is one such effort.

At twelve months, we found a modest prognostic value for female gender and for higher education; both variables were associated with better treatment response to the Drinking Less self-help intervention. Women who completed the intervention were found to have reduced their alcohol consumption to a significantly greater extent than men or than control group participants. Comparable results for female gender as a predictor of a successful brief intervention outcome in general population samples were reported by Sanchez-Craig and colleagues (Sanchez-Craig, 1993) and to a lesser extent for general practice patients by Reinhardt (Reinhardt et al., 2008). By contrast, several meta-analyses have found similar effectiveness of brief interventions for men and women in primary care populations (Ballesteros, Gonzalez-Pinto, Querejeta, & Arino, 2004; Bertholet, Daeppen, Wietlisbach, Fleming, & Burnand, 2005) or even far stronger effects for men in general practice populations (Kahan, Wilson, & Becker, 1995; Kaner et al., 2007). Women's favourable results in our web-based course for problem drinking are, however, in line with findings that e-health in general is of particular interest to women [(Lieberman & Huang, 2008).

Higher levels of education also had modest predictive power and explained a small amount of variance at twelve months in combination with Drinking Less. This finding is consistent with results from other studies that identified high education as interacting with treatment interventions to produce favourable outcomes (Greenfield et al., 2003; McKay & Weiss, 2001). Like female gender, high education is also reportedly associated with a greater use of the Internet for health-related issues (Mead, Varnam, Rogers, & Roland, 2003). Interestingly,

the added benefit of high education in the Drinking Less treatment outcome at twelve months coincided with a remarkable decrease in alcohol consumption by lesser educated male control group participants. On the basis of our data we can only hint at possible explanations, such as that our online psychoeducational information may have had a delayed but more effective long-term impact on men with lower levels of education. This issue needs further research.

The other characteristics investigated were not found to act as predictors in our study. A moderate baseline level of problem drinking (in terms of mean weekly alcohol consumption) did not predict better outcomes than a severe level. This contrasts with the many studies that assume brief interventions to be better suited to moderate problem drinkers (Moyer et al., 2002). One explanation could be the high level of motivation and readiness to change that we found in both moderate and severe drinkers in our self-referred study sample (see table 4.1). Another explanation could be that baseline severity of drinking is less relevant to treatment outcome for problem drinkers in the general population than for the more severely alcohol-dependent clinical samples that form the basis of many studies. The former group may be experiencing a range of incipient problems, such that their treatment response may be influenced by a wider range of factors, whereas the health and social problems of severely dependent drinkers may have already crystallised into more specific forms (Matzger et al., 2004).

We did not find any predictive value for the two remaining putative predictors, Internet experience and positive expectancies of treatment efficacy, in contrast to some other studies that did (Greenberg, Constantino, & Bruce, 2006; Long, Williams, Midgley, & Hollin, 2000). Explanations might be that Drinking Less is equally suitable for both experienced and beginning Internet users, and that positive expectations were what prompted both the experimental and control participants in our self-referred sample to take part in the first place.

Limitations and strengths

This study has several limitations that are important to acknowledge. We conducted secondary analysis of data from our pragmatic randomised trial (Riper et al., 2008). The overall loss to follow-up in that trial was substantial at both follow-up assessments (see figure 4.1). High dropout rates are common in self-help interventions for problem drinking without therapist guidance, whether web-based or otherwise (Miller & Wilbourne, 2002)(Fewtrell et al., 2008). However, attrition rates appear to be especially high for those delivered over the Internet, as easy accessibility may also mean easy dropout. High loss to follow-up is therefore a potential concern in all web-based self-help interventions (Couper, Peytchev, Strecher, Rothert, & Anderson, 2007; Eysenbach, 2005). In the present study, we dealt with attrition data analytically as rigorously as possible by conducting intention-to-treat analyses, using last-observation-carried-forward and regression imputation. Nevertheless, the high loss to follow-up may still have biased our results by obscuring meaningful predictors.

Secondly, we conducted a prespecified subgroup analysis and hence cannot rule out false-positive or false-negative predictors resulting from multiple testing (Brookes et al., 2004; Wang, Lagakos, Ware, Hunter, & Drazen, 2007). Given that we found only a marginally significant predictor (prior help) at six months and two further predictors (female gender and high educational level) at twelve months, this might well have been the case. On the other hand, we kept the number of putative predictors to a minimum and also appropriate in relation to our sample size (Tabachnick & Fidell, 2006). The fact that we detected different predictors at 6- and 12-month follow-up could also mean that different factors operate at different points during the post-intervention period (Bodin & Romelsjo, 2007).

We were also limited by the data in the number of predictors we could investigate. That prevented us from studying self-efficacy, a potentially

important predictor (Vielva & Iraurgi, 2001). Nor could we investigate another key predictor, readiness to change (Prochaska & Velicer, 1997), as most participants by far ($n = 231$, 88.5%; see table 4.1) were at the contemplation stage (Defuentes-Merillas et al., 2002; Rollnick et al., 1992). A final limitation is that our findings are generalisable only to self-referred problem drinkers in the general population who are motivated to take part in a web-based self-help intervention.

Our study has a number of strengths as well. The study on which the analysis is based was one of the first pragmatic randomised trials on the effectiveness of web-based self-help interventions without therapeutic guidance for problem drinkers in the general population. The data also enabled us to examine short- and longer-term relationships. Because we had anticipated a high overall loss to follow-up when we first selected the trial sample, we included enough participants to ensure the statistical power to detect differences between the experimental and control conditions and between subgroups (Riper et al., 2008).

Conclusion

Female gender and a high level of education were found to have interacted with the Drinking Less self-help intervention to predict a somewhat better treatment response one year after the start of the intervention. This suggests that web-based self-help without therapeutic guidance may hold a special attraction for problem drinkers with greater fears of stigmatisation, including women or more highly educated people – population segments that might otherwise be difficult to reach with face-to-face brief interventions (Cunningham & Breslin, 2004). The non-stigmatising approach to problem drinking in web-based self-help and the lack of a need to interact with a therapist may form part of the appeal to these groups (Knaevelsrud & Maercker, 2006; Lieberman & Huang, 2008). At the same time, the effects of the predictors identified here offer only a very partial explanation for how client characteristics interact with treatment to affect

outcome. Other baseline attributes such as self-efficacy may also play a role (Vielva & Iraurgi, 2001). In addition, non-baseline predictors, including treatment progress factors (such as dose-response interaction stemming from variable treatment compliance) and posttreatment factors (such as social support), may prove to have stronger influences on client-by-treatment interaction and therapeutic outcomes, as has indeed been reported in clinical treatment samples (Babor, 2008; Bodin & Romelsjo, 2007).

Implications for public health strategies

Our findings could enhance public health strategies that use stepped care approaches to curb problem drinking in the general population. Since none of the groups we identified stood out conspicuously against others as deriving benefit from Drinking Less, we would argue that web-based self-help is well suited to a broad, heterogeneous group of problem drinkers. It may therefore serve well as an initial intervention in a stepped care model, suitable for matching to a large and varied group of problem drinkers in the general population and not just at more individual levels (Babor, 2008; Buhringer, 2006). The 24/7 free access to Drinking Less guarantees swift entry to the help programme, and such ready access is known to facilitate positive outcomes as well as additional help-seeking behaviour, if needed (Babor & Caetano, 2008; Moos & Moos, 2006). To sustain treatment progress, booster sessions might be needed six months after the intervention, in particular to support male participants.

Future studies

Our results add to the knowledge already gained from prediction studies in that we tested the role played by individual baseline attributes in the effectiveness of web-based self-help for problem drinkers in the general population. The scope of future prediction research now needs to be extended to include the contributions of within-treatment progress variables, such as dose-response

relationships and the time required to initiate positive behavioural change, and of posttreatment variables like social support. Replication of our study is needed in view of the novelty of web-based interventions for problem drinkers and the related prediction research.

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Translating effective
web-based self-help for
problem drinking into
routine practice

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ABSTRACT

Background Drinking Less (DL) is a 24/7 free-access anonymous interactive web-based self-help intervention without therapeutic guidance for adult problem drinkers in the community. In a randomized controlled trial (referred to here as DL-RCT), DL has been shown effective in reducing risky alcohol consumption.

Objective To assess whether the findings of DL-RCT are generalizable to routine practice (DL-RP) in terms of ability to reach the target group and alcohol treatment response.

Methods Pretest-posttest study with 6-month follow-up. An online survey was conducted of 378 of the 1,625 people who used DL-RP from May to November 2007. Primary outcome measures were (1) problem drinking, defined as alcohol consumption in the previous 4 weeks averaging >21 or >14 standard units (male/female) per week or ≥ 6 or ≥ 4 units (m/f) on one or more days per week; and (2) mean weekly alcohol consumption. DL-RP and DL-RCT data were pooled and intention-to-treat (ITT) analysis was performed to analyze and compare changes in drinking from baseline to follow-up.

Results In the DL-RP group, 18.8% ($n = 71$) were drinking successfully within the limits of the Dutch guideline for low risk drinking ($P < .001$) six months after baseline (ITT). The DL-RP group also decreased its mean weekly alcohol intake by 7.4 units, $t(377) = 6.67$, $P < .001$, $d = 0.29$. Drinking reduction in DL-RP was of a similar magnitude to that in the DL-RCT condition in terms of drinking within the guideline ($\chi^2(1) = 1.83$, CI 0.82-3.00, $P = .18$, $RD = .05$, OR = 1.55) and mean weekly consumption (a negligible difference of $d = 0.03$ in favor of DL-RP group).

Conclusion The results from DL-RCT and DL-RP were quite similar, and they demonstrate that web-based self-help without therapeutic guidance is feasible, accepted and effective for curbing adult problem drinking in the community.

5.1 INTRODUCTION

A major challenge in a public health approach to problem drinking is the effective implementation of evidence-based self-help interventions in the community (Glasgow & Emmons, 2007; Moyer, Finney, Swearingen, & Vergun, 2002). The need for such interventions is clear. The prevalence of problematic alcohol use in Western societies is as high as ten per cent of the adult population; problem drinking has been identified as the third leading cause of morbidity and mortality on a par with tobacco (Room, Babor, & Rehm, 2005) and it brings high social and economic costs in its train (Smit et al., 2006; World Health Organization, 2007). Yet only 10 to 20 per cent of people with alcohol problems ever seek and engage in treatment (Harris & McKellar, 2001; Kohn, Saxena, Levav, & Saraceno, 2004). This means there are substantial unmet needs among the problem drinking population (Grant, 1997; Lieberman & Huang, 2008). Moreover, while brief interventions with some form of professional guidance in primary care have been shown to be effective beyond doubt, there are barriers to implementing them on any large scale, and their potential for a real public health impact remains unrealized (Beich, Gannik, & Malterud, 2002; Beich, Thorsen, & Rollnick, 2003). Web-based self-help interventions for problem drinking could be a promising complement that could help overcome some of the implementation problems. These can be provided on a broad scale at reasonable cost. They hold some appeal to problem drinkers (Cunningham, Humphreys, & Koski-Jannes, 2000; Koski-Jannes, Cunningham, Tolonen, & Bothas, 2007) and they fit well into an era in which self-help in good and ill health are becoming essential components of our health care system.

As yet, little is known about how to translate problem drinking interventions tested in randomized trials into daily practice, and that applies even more so to the new generation of web-based interventions. Some feasibility studies do

provide insights into the effectiveness of web-based self-help interventions for problem drinkers (Hester, Squires, & Delaney, 2005; Kypri et al., 2004; Riper et al., 2008) or into how these operate in daily practice (Cunningham, Humphreys, Koski-Jannes, & Cordingley, 2005; Linke, Murray, Butler, & Wallace, 2007; Saitz et al., 2004). All studies conclude nonetheless that further research is needed to (1) test such interventions more thoroughly in clinical trials and (2) assess the effectiveness of web-based self-help when delivered under conditions of routine daily practice (Kypri, Langley, Saunders, Cashell-Smith, & Herbison, 2008). To the best of our knowledge, no studies have yet been published that address this question. Some initial positive answers have, however, been provided for web-based self-help for other disorders such as depression (Christensen, Griffiths, Korten, Brittliffe, & Groves, 2004). Effectiveness of implementation is a critical issue, as the potential public health impact of an evidence-based intervention depends to a large degree on its fit in daily practice (Glasgow, 2008).

In this article, we investigate whether the impact of an effective interactive web-based self-help intervention without therapeutic guidance is sustained in terms of improved drinking outcomes when the intervention is implemented into daily practice. The Drinking Less (DL) intervention has been tested in a randomized controlled trial and shown effective six months later (Riper et al., 2008). To investigate implementation in daily practice, we gave the general public access to Drinking Less and then conducted a pretest-posttest study, to determine (1) whether participating DL users showed improved drinking outcomes and (2) whether improved outcomes in routine practice were comparable to the improvements realized in the earlier randomized controlled trial of DL.

5.2 METHOD

The Drinking Less intervention

Drinking Less (DL) is an evidenced-based online interactive self-help intervention without therapeutic guidance designed to curb problem drinking among the adult general population. The intervention is based on motivational, cognitive-behavioral and self-control training principles (Hester, 1995; Miller & Rollnick, 1991; Schippers & De Jonge, 2002). The DL home page gives access to alcohol-related information, addresses of health services if more or different help is needed, a moderated peer-to-peer discussion forum, and the Drinking Less self-help program, which is the core element of the intervention. The program is structured into four steps: (1) preparing for action, (2) goal setting, (3) behavioral change and (4) maintenance. During the preparation phase (1), participants assess their own alcohol intake and their risk in terms of alcohol-related problems and dependence symptoms (using the Alcohol Use Disorders Identification Test, AUDIT, (Saunders, Aasland, Babor, Defuentes-Merillas, & Grant, 1993) their motivation to change (RCQ-D, (Defuentes-Merillas, Dejong, & Schippers, 2002)); and the positive and negative consequences of their alcohol consumption. Participants are prompted at step 2 to make decisions about their future alcohol use: either moderating the amount consumed or abstinence. These first two steps typically require 15 minutes. The third and fourth steps help participants to achieve a new drinking behavior, preferably within the limits of low-risk drinking guidelines, and subsequently to maintain it and to avoid relapse over time. To this end, the program provides information, interactive exercises and an electronic drinking diary. Participants are encouraged to complete the course in six weeks (Breslin et al., 1998) but, given the self-help nature of the intervention, they may use it for as long as they feel is necessary.

Drinking Less in routine daily practice

In the period from May 2007 to February 2008, we placed advertisements in national newspapers and on alcohol- and health-related websites to promote awareness of DL. People who were interested in using a web-based self-help intervention to moderate their alcohol use were invited to visit the DL website. An average of 2,750 unique visitors accessed the website per month (with the notable exception of January 2008, when nearly 6,000 visited the site, probably as a result of New Year's resolutions). The site was accessed an average of 3.84 times per unique visitor. The vast majority (91.5%) lived in the Netherlands. The overall mean time spent per visit ($N = 103,746$ visits) ranged from 0-5 minutes ($n = 48,025$), to 5-30 minutes ($n = 31,394$) to 30 minutes or more ($n = 24,427$), with about one quarter of the visits lasting over half an hour. A poll we took of the visitors received 2,984 responses. The reason most often given for not utilizing the self-help program ($n = 2598$, 87%) was an intended postponement of participation by a month or more; about 1 in 8 did not intend to use the program at all ($n = 376$, 12.6%), most of whom indicated that they were not planning to change their drinking patterns ($n = 241$, 8.1%).

During the 10-month study period, 1,625 of the visitors signed up to utilize the DL self-help program via the website. Registration is anonymous. More males ($n = 1097$, 67.5%) registered than females ($n = 528$, 32.5%). The mean age was 45.30 ($SD = 10.84$). More than two thirds were highly educated ($n = 1117$, 68.7%), four fifths were in paid employment ($n = 1304$, 80.3%), and almost all were prepared to change their alcohol consumption (RCQ-D contemplation and action stages, $n = 1614$, 99.3%). Mean weekly alcohol consumption at baseline was 39.60 standard units (one standard unit representing 10 g of ethanol). We obtained AUDIT scores for 1,421 participants, 97.7% ($n = 1389$) of whom scored ≥ 8 , possibly indicating alcohol abuse or dependence (Conigrave et al. 1995); their mean score was 20.27 ($SD = 6.30$). The main referral channels were search engines ($n = 492$, 30.3%), newspapers ($n = 490$, 30.2%), and another

alcohol-related website ($n = 267$, 16.4%). Virtually all users completed step 1 ($n = 1604$, 98.7%) and step 2 ($n = 1595$, 98.2%). The maintenance and relapse exercises were used by only 5% of the users ($n = 81$). The mean self-help program visit rate was 23.23 times ($n = 1625$, SD 56.28) and the mean visit rate of the forum was 8.98 ($n = 1625$, SD 49.50).

Recruitment, participants and procedure for the online survey

We conducted an online pragmatic cohort study following the TREND (DesJarlais, Lyles, & Crepaz, 2004) and CHERRIES (Eysenbach, 2004) checklists for reporting on non-randomized and online evaluations. Survey participants were recruited from the users of Drinking Less who registered in the period May-November 2007. Users willing to take part in the study returned a consent e-mail and completed an online baseline questionnaire. To obtain data from a purposely heterogeneous population of DL participants and to preserve a low threshold for participation, we required an e-mail address only and did not apply exclusion criteria, except that no users under age 18 were accepted. To address our main research question in this paper, we report here the results of the 6-month follow-up; results from the 8-week and 12-month follow-ups will be analyzed in a future publication. Participants received an automated e-mail reminder if they had yet not returned questionnaires two weeks after the return date. As a token of appreciation, we drew lots amongst participants who returned the 6-month questionnaire; the prizes were one iPod nano and five 50-euro gift vouchers.

Primary outcome measures

Primary outcome measures were (1) problem drinking, defined as alcohol consumption exceeding the pertinent Dutch guideline for low-risk drinking (Posma 1998) – an average over the previous four weeks of more than 21 or 14 standard units (male/female) per week, or 6 or 4 units or more (m/f) on one or more days per week; and (2) mean weekly alcohol consumption. Mean weekly

consumption was assessed with the Dutch version of Weekly Recall (WR; (Cahalan, Cisin, & Crossley, 1969; Lemmens, Knibbe, & Tan, 1988)), which records the number of units consumed in the 7 days preceding the assessment point. Units per day per week were assessed with the Dutch version of the Quantity-Frequency Variability Index (QFV; (Lemmens, Tan, & Knibbe, 1992)).

Participants' uptake and rating of the intervention

At the post-intervention assessment at 8 weeks, participants were asked whether and to what extent they had used the Drinking Less program and, if so, what their opinion was on a scale from 1 (very bad) to 10 (very good).

Power

Originally the survey was powered to detect clinically significant health gains expressed as a standardized effect size ($d > 0.45$) in a one-sided test with a power of 80% ($1 - \beta$). The results reported in this paper are based on more conventional two-tailed tests. From a clinical perspective, standardized effect sizes of 0.45 are considered to be of medium size (Lipsey & Wilson, 1993).

Analyses

We analyzed the DL-RP data and the DL-RCT data on an intention-to-treat- (ITT) basis, imputing missing values by last observation carried forward (LOCF) and regression imputation. LOCF imputation was the more conservative procedure here, as baseline values were used to impute missing data at 6 months, meaning that most imputed outcomes indicated at-risk drinking. We therefore chose LOCF for the further analyses to minimize the risk of overestimating results. ITT analysis enabled us to maintain sufficient power and integrity of baseline conditions. We verified the results by conducting completers-only analyses on the data from participants who returned the 6-month questionnaires.

We first assessed baseline-to-follow-up changes in alcohol use patterns in the routine practice group (DL-RP) by itself using the McNemar test for problem drinking and paired samples *t*-tests for units of alcohol consumed. We calculated the effect size *d* for the latter data using the formula $d = (M_{pre} - M_{post}) / SD_{pre}$ (Cohen 1997). To compare the effectiveness of Drinking Less in routine practice (DL-RP) with that found in the randomized controlled trial (DL-RCT, experimental condition only, data sampled in 2003-2004), we then pooled the data of these two studies, excluding 18 DL-RP participants who had low-risk drinking profiles at baseline (since that was also an exclusion criterion for the RCT). We used *t*-tests, chi-square tests and logistic regression to assess differences between groups at baseline (at $P < .10$). The DL-RP group differed significantly from the DL-RCT group in having higher rates of (a) parental alcohol abuse, $\chi^2(1) = 2.89, P = .089$; (b) paid employment, $\chi^2(1) = 5.42, P = .02$; (c) substantial alcohol-related problems, $\chi^2(1) = 3.76, P = .052$; and (d) low education, $\chi^2(1) = 6.85, P = .009$. Only educational level is a potential confounder, as it is a predictor of one of the outcome measures: the mean weekly alcohol intake at six months ($t(403.9)=2.7, P=.007$, LOCF-imputed). Therefore, the mean weekly alcohol intake at six months was analyzed using ANCOVA, with educational level entered as a covariate to adjust for group differences at baseline. Subsequently, effect sizes *d* were calculated (Cohen 1997), and between-group effect size differences were assessed using independent samples *t*-tests (education was not significant as a covariate here and was omitted). Differences between the DL-RP and DL-RCT groups in terms of problem drinking were determined using χ^2 tests. We report 95% confidence intervals throughout, as tests were conducted at $\alpha < .05$ (two-sided). SPSS version 15.0 was used for all analyses.

5.3 RESULTS

Participants baseline characteristics

The baseline sociodemographics and clinical characteristics of the DL-RP group ($N = 378$) are shown in table 5.1, alongside those of the DL-RCT experimental group ($N = 130$). Almost all DL-RP participants ($n = 360$, 95.2%) were exceeding one or both problem drinking criteria at baseline. Mean weekly alcohol intake was 40.9 ($SD = 25.2$) units.

Table 5.1 *Baseline characteristics in DL-RP and DL-RCT(Exp), in numbers (percentages) of participants, unless otherwise indicated*

	DL-RP total group ($n = 378$)	DL-RCT experimental group ($n = 130$)	DL-RP, at-risk group** ($n = 360$)	Total*** ($N = 490$)
Female gender	199 (52.6)	66 (50.8)	191 (53.3)	258 (52.7)
Age (mean, SD)	44.3 (10.5)	45.9 (8.9)	44.5 (10.5)	44.9 (10.1)
High education (academic/professional) *	207 (54.7)	89 (68.5)	199 (55.3)	288 (58.8)
Living with a partner	232 (61.4)	75 (57.7)	222 (61.7)	297 (60.6)
Paid employment	311 (82.3)	94 (72.3)	295 (81.9)	389 (79.4)
Parental drinking problems	148 (39.2)	40 (30.8)	141 (39.2)	181 (36.9)
No prior help for problem drinking	316 (83.6)	116 (89.2)	305 (84.7)	417 (85.1)
RCQ-D Contemplation stage † ‡	255 (81.5)	116 (89.2)	250 (82.5)	366 (84.5)
Problem drinking §	360 (95.2)	130 (100)	360 (100)	490 (100.0)
Weekly alcohol intake in standard units (mean, SD)	40.9 (25.2)	43.7 (21.0)	42.5 (24.7)	42.8 (23.8)
Alcohol-related problems ≥ 3 ¶	352 (93.1)	114 (87.8)	340 (94.4)	454 (92.7)

* Significant difference between DL-RP at-risk group and DL-RCT experimental group

† Assessed with the validated Dutch version (Defuentes-Merillas et al. 2002) of the Readiness to Change Questionnaire (Rollnick et al. 1992)

‡ $n = 65$ in the practice group did not complete RCQ-D.

§ Drinking >21 or >14 units (m/f) in the last week (*excessive drinking*) and/or drinking ≥ 6 or ≥ 4 units (m/f) an average of one or more days per week over previous three months (*hazardous drinking*)|| A standard unit contains 10 g of ethanol.

¶ Assessed with a validated Dutch questionnaire for problem drinking (Lemmens et al. 1988; Lemmens et al. 1992).

** For purposes of comparison with the DL-RCT group, $n = 18$ were excluded from the daily practice group because they did not exceed the guideline for low-risk drinking at baseline.

*** DL-RCT experimental group and DL-RP at risk group

Large majorities were experiencing alcohol-related problems ($n = 352$, 93.1%) and had never received professional help for their problem drinking ($n = 316$, 83.6%). This suggests that the DL intervention was successful in contacting groups of problem drinkers that had not been reached by other health services for their problematic alcohol consumption. More than one third ($n = 148$, 39.2%) had experienced parental problem drinking.

Predictors of loss to follow-up

Loss to follow-up at 6 months was high in the DL-RP group: 59.5% ($n = 225$) failed to respond to our questionnaire. These were less likely than responders to have been living with a partner at baseline, $b = -0.73$, Wald(1) = 10.29, $P = .001$, and more likely to be above the median age of 47, $b = -.63$, Wald(1) = 8.35, $P = .004$.

Treatment response in DL-RP at 6 months

Six months after baseline, LOCF analysis showed that 18.8% ($n = 71$) of the participants in the DL-RP group ($N = 378$) were successfully drinking within the guidelines (McNemar $P < .001$), as compared to 4.8% ($n = 18$) at baseline. In completers-only (CO) analysis ($N = 153$), 38.6% ($n = 59$) were drinking within the guidelines, compared to 3.9% ($n = 6$) at baseline (McNemar $P < .001$). As table 5.2 shows, the DL-RP group was also effective in reducing its mean alcohol intake by 7.4 units a week, $t(377) = 6.67$, $P < .001$, corresponding to a small standardized effect of $d = 0.29$ (LOCF). In the CO analysis, the decrease was 18.2 units, $t(152) = 7.31$, $P < .001$, with an accompanying medium-sized effect of $d = 0.72$.

Table 5.2 Mean weekly alcohol consumption by DL-RP participants at baseline and 6-month follow-up: intention-to-treat (LOCF) and completers-only analyses.

	N	baseline		6 months				P	a
		M	SD	M	SD	t	df		
WR, LOCF	378	40.9	25.2	33.5	25.5	6.67	377	<.001	0.29
WR, completers only	153	40.0	26.5	21.8	22.7	7.31	152	<.001	0.72

WR = mean weekly consumption in standard units of 10 g ethanol according to Weekly Recall

Uptake and rating of the intervention in the DL-RP group

At 8 weeks post-intervention, 196 (51.9%) of the DL-RP participants ($N = 378$) provided information on intervention uptake; 12.2% ($n = 24$) of them had never used the program, 59.7% ($n = 117$) had used it once or a few times and 28.1% ($n = 55$) more than a few times. Those who had used the program rated it favorably at 7.3 ($SD = 1.2$). At the 6-month follow-up, 117 participants (31%) returned uptake information; the number of visits to the program in the past 6 months had ranged from 0 to 400 with a median of 6.

Comparisons between DL-RP and DL-RCT

We next assessed whether the treatment responses in the DL-RP at-risk group (with the 18 baseline low-risk drinkers excluded) differed from those in the DL-RCT experimental group. Table 5.1 shows the baseline characteristics of these two groups; they did not differ significantly at baseline in terms of either problem drinking or mean units of alcohol consumed weekly, suggesting that both groups were comparable. At six months, no significant differences emerged between the groups in the LOCF analysis in terms of success rates at drinking within the guidelines, $\chi^2(1) = 1.83, P = .18; OR = 1.55, 95\% CI 0.82 - 3.00, RD = .05$. The CO analysis found better results for the RP-DL group, $\chi^2(1) = 2.47, P = .01; OR = 2.47, 95\% CI = 1.24 - 4.93, RD = 0.18$.

Table 5.3 Differences between Routine Practice (DL-RP at risk) and RCT (DL-RCT): percentages drinking according to low-risk drinking guidelines at 6 months post-intervention: Intention-to-Treat (LOCF) and Completers-Only (CO) analyses

6 months	DL-RP (at-risk)		DL-RCT (exp)		Comparison of conditions				
	total <i>n</i>	low-risk <i>n</i> (%)	total <i>n</i>	low-risk <i>n</i> (%)	<i>OR</i>	95% <i>CI</i>	<i>RD</i>	χ^2 (<i>df</i> 1)	<i>P</i>
Intention to Treat (LOCF)	360	51 (14.7)	130	13 (10.0)	1.55	0.82-3.00	.05	1.83	.18
Completers Only (CO)	147	53 (36.1)	70	13 (18.6)	2.47	1.24-4.93	.18	6.57	.01

DL-RP (at-risk) = routine practice group excluding 18 baseline low-risk drinkers
 DL-RCT (exp) = experimental group in randomised controlled trial

In terms of mean weekly alcohol consumption, the LOCF analysis also found no difference between the groups at six months, $F(1, 487) = 1.20, P = .27$. The mean standardized pre-post effect size d in DL-RP was 0.30 ($SD = 0.87$) and in DL-RCT 0.33 ($SD = 0.62$), yielding a negligible between-group difference of $d = 0.03$ in favor of the DL-RP group. The CO analysis again found a more favorable outcome for the DL-RP group, $t(215) = 1.99, P = .048$, with a between-group difference of $d = 0.14$).

Table 5.4 Differences between DL-RP at risk and DL-RCT: reductions in mean weekly alcohol consumption at 6 months post-intervention: intention-to-treat (LOCF) and completers-only (CO) analyses

6 months	DL-RP (at-risk)		DL-RCT (exp)		Comparison of conditions				
	<i>n</i>	<i>M</i> (<i>SD</i>)	<i>n</i>	<i>M</i> (<i>SD</i>)	<i>dif</i>	95% <i>CI</i>	<i>Test</i>	<i>P</i>	<i>a</i>
Intention to treat	360	34.8 (25.4)	130	36.7 (24.8)	2.78	-2.21 - 7.76	$F(1, 487) = 1.20$.27	0.03
Completers only	147	22.5 (22.9)	70	28.6 (16.8)	6.09	0.04 - 12.15	$t(215) = 1.99$.048	0.14

Results of ANCOVA with educational level as covariate (unadjusted means). Estimated marginal means after adjustment for educational level (evaluated at .59): DL-RP = 34.6; DL-RCT = 37.4.

5.4 DISCUSSION

The Dutch web-based self-help program Drinking Less appears to be a feasible and acceptable intervention for problem drinkers in the community. It welcomes around 2,750 unique visitors a month. Almost all registered course participants ($n = 1458$, 89.7%) were problem drinkers with an AUDIT score of 8 or higher. A total of 378 of them consented to take part in our online pretest-posttest survey (DL-RP). The large majority (83.6%) of these had never had professional help for their alcohol problems. At the six-month follow-up assessment, 18.8% ($n = 71$) of the DL-RP group were drinking successfully within the limits set by the Dutch guideline for low-risk drinking (as compared to 4.8%, $n = 18$, at baseline) and the group as a whole had significantly curbed its mean alcohol consumption by 7.4 units a week.

Although there were some baseline differences between the characteristics of the DL-RP and DL-RCT groups, their drinking patterns were very similar. The 6-month impact of DL in terms of improved drinking outcomes was also similar for both groups. This indicates that our randomized controlled trial had high external validity and that DL can be used effectively to help adult problem drinkers in the broad community.

The participant groups reached by a number of feasibility studies (Blankers, Kerssemakers, Schramade, & Schippers, 2007; Cunningham et al., 2005; Koski-Jannes et al., 2007; Linke et al., 2007; Saitz et al., 2004) had similar profiles to those of the DL-RP and DL-RCT groups in terms of (1) main age cohort (35-55); (2) high representations of female, employed and highly educated participants in relation to the general problem-drinking population; (3) proportions of severe problem drinkers at baseline and (4) low rates of prior professional help for alcohol-related problems. Such profiles may be attributable to the reactive self-referral recruitment strategies applied by these and our studies, in contrast to the proactive or opportunistic strategies pursued in primary care studies (Prochaska, Velicer, Fava, Rossi, & Tsoh, 2001; Saitz et

al., 2004). Reactive recruitment strategies appear more likely than proactive strategies to reach female and more educated participants who are at the ready-for-action stage, whereas the latter strategies reach groups that more closely reflect the population of problem drinkers in terms of educational background and gender, but which have lower levels of readiness to change (Glasgow, Magid, Beck, Ritzwoller, & Estabrooks, 2005). This may be a possible explanation for why women are reached so well by reactive web-based self-help interventions (Humphreys & Klaw, 2001; Riper et al., 2008), but less so by proactive brief interventions in primary care or in traditional addiction services (Copeland & Hall, 1992; Kaner et al., 2007). Feasibility studies measuring treatment response in web-based self-help programs show improved drinking outcomes on a number of alcohol-related variables (Cunningham et al., 2005; Koski-Jannes et al., 2007; Linke et al., 2007).

Limitations

We recognize several limitations to this study. Only a small portion of the registered users of DL in daily practice ($N = 1625$) took part in our online survey (DL-RP, $n = 378$), which may reflect selection between those who were only seeking information on the website and those who proceeded with the intervention proper. We also experienced high loss to follow-up in both the DL-RP and DL-RCT groups. High attrition, as well as low intervention adherence, are well known features of many studies of web-based self-help interventions without therapeutic guidance (Christensen, Griffiths, & Jorm, 2004; Eysenbach, 2005; Miller & Wilbourne, 2002). We dealt with our high loss to follow-up analytically as rigorously as possible by conducting intention-to-treat analyses, using a conservative last-observation-carried-forward imputation strategy for both groups. A further limitation is that our DL-RP study was uncontrolled, so that the data can only show an association between the use of DL and improved drinking outcomes and not whether the association was causal. Our comparison

of DL-RP with the randomized controlled trial DL-RCT did, however, suggest evidence for causality.

Conclusion

The central question was whether the positive findings of our randomized controlled trial were representative for the routine use of Drinking Less in terms of the intended target group and the alcohol-related drinking outcomes (Riper et al., 2008). Our results point to an affirmative answer. The next question is what this generalizability might imply for the potential to reach the target group. As (Glasgow, 2008) has argued, the impact of interventions stems not only from their effectiveness, but also from their ability to reach sizeable segments of the intended target group. Around 10.3% (1.3 million) of the Dutch adult population are problem drinkers, 90% of whom have never received any professional help for their alcohol problems (Van Dijck & Knibbe, 2005) and 75% of whom have Internet access (Centraal Bureau voor de Statistiek, 2008). We estimate that at least 70% of these drinkers, or 614,250 people, now have sufficient e-skills to work with DL. We expect 3,000 participants to begin the DL self-help program annually, meaning that 0.5% of the entire target group, and nearly 2.5% of the 122,850 problem drinkers in the 35-55 age cohort (Van Dijck et al., 2005), would be reached per year with a single self-help intervention. In itself this is a conservative estimate if we take into account that other similar interventions are also on offer in the Netherlands (Blankers et al., 2007). In view of these numbers, web-based self-help could function well within a public health approach, particularly as a first step in a stepped care approach to problem drinking. This is important in view of the large-scale availability of DL at reasonable cost, as the cost per additional user is negligible.

While this potential public health impact is inspiring, our results also show that not all problem drinkers benefit from DL. Formidable challenges remain to ensure that additional interventions and recruitment strategies are in place for

groups not reached by web-based self-help, including individuals with lower educational backgrounds, problem drinkers who are not motivated to change, and those for whom web-based self-help proves not the answer to their problem drinking. There are also other factors that are essential to effectively translating evidence-based interventions into routine practice. These include the maintenance of service delivery, broad-scale acceptance and adoption by health care professionals, and the issue of who will provide the interventions and who will pay for them (Glasgow et al., 2005; Hester & Miller, 2006; World Health Organization, 2007). We have not focused on any of these factors. Other crucial questions also remain, such as how to interpret the low rates of intervention compliance for web-based self-help interventions in both trial and routine practice settings. Although our study found high motivation levels for participants and high uptake in routine practice, many participants used the intervention only in part and for a short duration. It would therefore be useful to better understand the underlying reasons for this and to evaluate whether treatment response could be improved by shortening DL to its active components or by somehow improving compliance rates. Replication of our study is also needed, in view of the limited availability of similar studies on translating effective interventions for problem drinking for use in the broader community.

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Television-supported
self-help for problem
drinkers: a randomized
pragmatic trial

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ABSTRACT

Aims To test the effectiveness of a television-supported self-help intervention for problem drinking.

Methods. Dutch television viewers (N = 181) drinking in excess of the guidelines for low-risk alcohol use were randomly assigned either to the Drinking Less self-help course (consisting of five television sessions, a self-help manual, and an associated self-help website) or to a waitlisted control group. To ensure trial integrity, intervention delivery was mimicked beforehand by sending intervention participants weekly DVDs in advance of the actual telecasts in 2006.

Pre-post assessments were carried out on both groups, as well as a 3-month follow-up assessment on the intervention group to study effect maintenance. The primary outcome measure was low-risk drinking.

Results The intervention group was more successful than the waitlist group in achieving low-risk drinking at post-intervention (OR = 9.4); the effects were maintained in the intervention group at 3-month follow-up.

Conclusions The low-threshold television-based course Drinking Less appears effective in reducing alcohol consumption.

6.1 INTRODUCTION

Numerous publications in recent decades have highlighted the need for brief, low-threshold interventions to reach out to problem drinkers (Anderson & Baumberg, 2006; Institute of Medicine, 1990; Kaner et al., 2007). This concern is indeed warranted, given the wide prevalence of problem drinking, its consequences in terms of morbidity and mortality (Murray & Lopez, 1996; World Health Organization, 2004), and the associated economic costs (Klingemann & Gmel, 2001; Smit et al., 2006).

Brief interventions have meanwhile been thoroughly investigated and shown effective in both primary care settings (Anderson, Laurant, Kaner, Wensing, & Grol, 2004; Ballesteros, Duffy, Querejeta, Arino, & Gonzalez-Pinto, 2004) and the general population (Apodaca & Miller, 2003; Moyer, Finney, Swearingen, & Vergun, 2002). Most brief interventions in primary care are delivered with some form of therapeutic guidance, whereas those aimed at the public are often without personal therapeutic support (Cuijpers & Riper, 2007). In primary care settings, the dissemination of brief interventions is still hampered by factors like the limited number of professionals who administer them, the difficulty of reaching problem drinkers, and the high costs of implementation (Kaner, Lock, McAvoy, Heather, & Gilvarry, 1999; Moyer & Finney, 2005; Raistrick, Heather, & Godfrey, 2006). This has prompted a search for broad-scale dissemination channels for brief interventions outside primary care.

Television and the Internet are media that could potentially enable low-threshold, low-cost dissemination. The applicability of the Internet for providing mental health interventions has developed strongly since the turn of the millennium, and a corresponding evidence base has been built (Kypri et al., 2004; Riper et al., 2008). Radio and television, by contrast, have largely evolved along different lines. Approaches were often limited to brief, stand-alone mass communication strategies to warn about social and health risks of problem drinking, and these had little success in effecting behavioral change (Austin &

Husted, 1998; Bennett, Smith, Nugent, & Panter, 1991). Although a few successful television-based intervention series were developed, including ones for problem drinking (Barker, Pistrang, Shapiro, Davies, & Shaw, 1993; Bennett et al., 1991), they were not consistently implemented or systematically evaluated in terms of treatment response.

Gradually, though, the digital revolution has facilitated the use of more traditional media, including television, to promote healthy lifestyles and behavioral change, such as smoking cessation (Jason, Salina, McMahon, Hedeker, & Stockton, 1997) or physical exercise (Hopman-Rock, Borghouts, & Leurs, 2005). Awareness has also been raised of the impact of alcohol use in non-alcohol-related TV series (Blair, Yue, Singh, & Bernhardt, 2005), particularly soap operas (Breen, 2007). Multi-media interventions using combinations of broadcasts and self-help manuals have been found more effective than single strategies used alone (Jason et al., 1997).

Television therefore has a potential for health promotion interventions extending far beyond the genre of brief mass media campaigns. It can be used to deliver more in-depth programs on overcoming psychological or behavioral problems and targeting specific groups (Austin & Husted, 1998; Park, Yi, Joo, & You, 2001). It could be a powerful medium to bring self-help interventions to large audiences.

This article reports the results of a randomized controlled trial of a five-week television self-help intervention entitled *Drinking Less? Do It Yourself!* designed to reduce problem drinking in adults (Teleac, 2006). We hypothesized a beneficial posttreatment effect in terms of reduced alcohol consumption as compared to the waitlisted control condition. To our knowledge this is one of the first randomized controlled trials of a television-based self-help intervention to reduce problem drinking in the general population.

6.2 METHOD

Recruitment

Study participants were recruited through advertisements in national newspapers referring interested people to a trial-related website containing additional information. After giving informed consent, candidates were invited by e-mail to respond to web-based questionnaires. Inclusion criteria were (1) alcohol consumption exceeding the limits specified by the pertinent Dutch guideline for low-risk drinking (Posma & Koeten, 1998); (2) age 18 or older, (3) access to a DVD or video player and Internet, and (4) an e-mail address. Exclusion criteria were (1) current professional help for alcohol problems, (2) current participation in a self-help group such as Alcoholics Anonymous, (3) current intake of alcohol medication, and (4) current involvement in another study on problem drinking. In accordance with the low-risk guideline, men were selected who were drinking more than 21 units per week or 6 units or more at least one day a week over the past month. Women were selected who were drinking either more than 14 units per week or 4 units or more at least one day a week. One unit represents 10 g of ethanol.

Intervention

The *Drinking Less? Do It Yourself!* intervention is a cognitive-behavioral self-help intervention to reduce alcohol consumption. The core component consists of five 25-minute televised sessions (Teleac, 2006) featuring a coach giving advice and feedback to both the general public and to two real-life problem drinkers, whose progress is followed as the course proceeds. Participants are encouraged to make use of supportive materials consisting of a self-help manual (Lemmers, Kramer, Conijn, Riper, & Van Emst, 2006) and a related self-help website called Drinking Less (www.MinderDrinken.nl). The course takes the participants through 4 stages: 1) review of current alcohol consumption and assessment of the benefits, drawbacks, and health and social hazards of that

level of drinking, 2) goal setting for future alcohol moderation, 3) behavioral change toward achieving these goals, 4) consolidation and relapse prevention.

Procedure

The trial was conducted before the actual broadcasting started on Dutch nationwide television, to ensure that the control group had no access to the intervention during the trial. We mimicked the television series beforehand by sending one session per week to the intervention group on DVD. The self-help manual (Lemmers et al., 2006) and the web address of the interactive Drinking Less website (www.minderdrinken.nl) were enclosed with the first installment. The waitlisted group received all course materials after the T1 assessment, as the nationwide telecast began. Both groups were allowed access to other forms of treatment during the study.

Primary outcome measure

The primary outcome measure was problem drinking, defined as alcohol consumption exceeding the guideline—an average of more than 21 or 14 standard units [male/female (m/f)] per week or 6 or 4 units or more (m/f) at least 1 day per week over the previous month. Mean weekly consumption at baseline, posttest, and follow-up was assessed in standard units using the Dutch version of Weekly Recall (WR) (Cahalan, Cisin, & Crossley, 1969; Lemmens, Knibbe, & Tan, 1988); units per day were assessed with the Dutch version of the Quantity-Frequency Variability Index (Lemmens, Tan, & Knibbe, 1992) (QFV).

Secondary outcome measures

Secondary outcome measures obtained at baseline, posttest, and follow-up were mean weekly alcohol consumption assessed with WR and alcohol-related problems assessed with the 6-item version of Problem Index, a validated Dutch questionnaire for problem drinking (Candel, 2001; Cornel, Knibbe, van

Zutphen, & Drop, 1994), with a score of 3 or higher reflecting significant problems related to alcohol use.

Other baseline data

Sociodemographic data on participants were obtained at baseline, and the validated Dutch version of the Readiness to Change Questionnaire was used to assess their willingness to change their alcohol consumption (RCQ-D, (Defuentes-Merillas, De Jong, & Schippers, 2002; Rollnick, Heather, Gold, & Hall, 1992).

Evaluation of the intervention

In the posttest at T1 in the intervention group, the intervention was evaluated with several questions about use of the materials and satisfaction with the intervention, on a scale from 1 (very bad) to 10 (very good).

Assessments

Baseline assessment (T0) took place two weeks or less before the start of the intervention. Five weeks after the start of the intervention (T1), all participants received automated online posttest questionnaires, with subsequent e-mail reminders 3 and 6 days later if necessary. The follow-up questionnaire was sent to the intervention group 3 months later (T2) to determine effect maintenance. No between-group comparisons were made at T2, as the control group had meanwhile had access to the course.

Power

The trial was powered to detect clinically significant health gains expressed as a standardized effect size ($d > 0.35$) in a one-sided test with a power of 80% ($1 - \beta$). The power calculation resulted in an n of 101 participants needed for each arm of the trial. The results reported here are based on more conventional

two-tailed tests. From a clinical perspective, standardized effect sizes above 0.35 standard deviations are considered of medium size (Lipsey & Wilson, 1993).

Randomization

Random allocation sequences were generated automatically by computer after the baseline assessment. Randomization was stratified by gender and heavy drinking in blocks of two. The cut-off point for heavy drinking was >35 units weekly for women and >50 units for men (Verdurmen, Monshouwer, & Van Dorsselaer, 2003).

Analysis

T-tests and chi-square tests were used to assess whether the randomization had resulted in two comparable groups at baseline (see Table 6.1) and whether any differential loss to follow-up had occurred. We then performed intention-to-treat (ITT) analysis, whereby all randomized participants were included in the analyses whether or not they had used course materials. Missing data were imputed with regression imputation, using the smallest set of significant predictors for the missing outcomes.

Logistic regression was performed to derive odds ratios (OR). A linear risk model was used to obtain the risk difference (RD). The number needed to treat (NNT) was calculated as the inverse of the RD. We report 95% confidence intervals throughout, as tests were conducted at $\alpha < .05$ (two-sided). The secondary outcomes of a continuous nature were analyzed with t-tests. Effect sizes were calculated as the differences between the standardized pre-post differences of each group (Cohen, 1997). An effect size of 0.5 thus indicated that the average standardized pre-post difference score was half a standard deviation larger in the intervention group than in the waitlisted group.

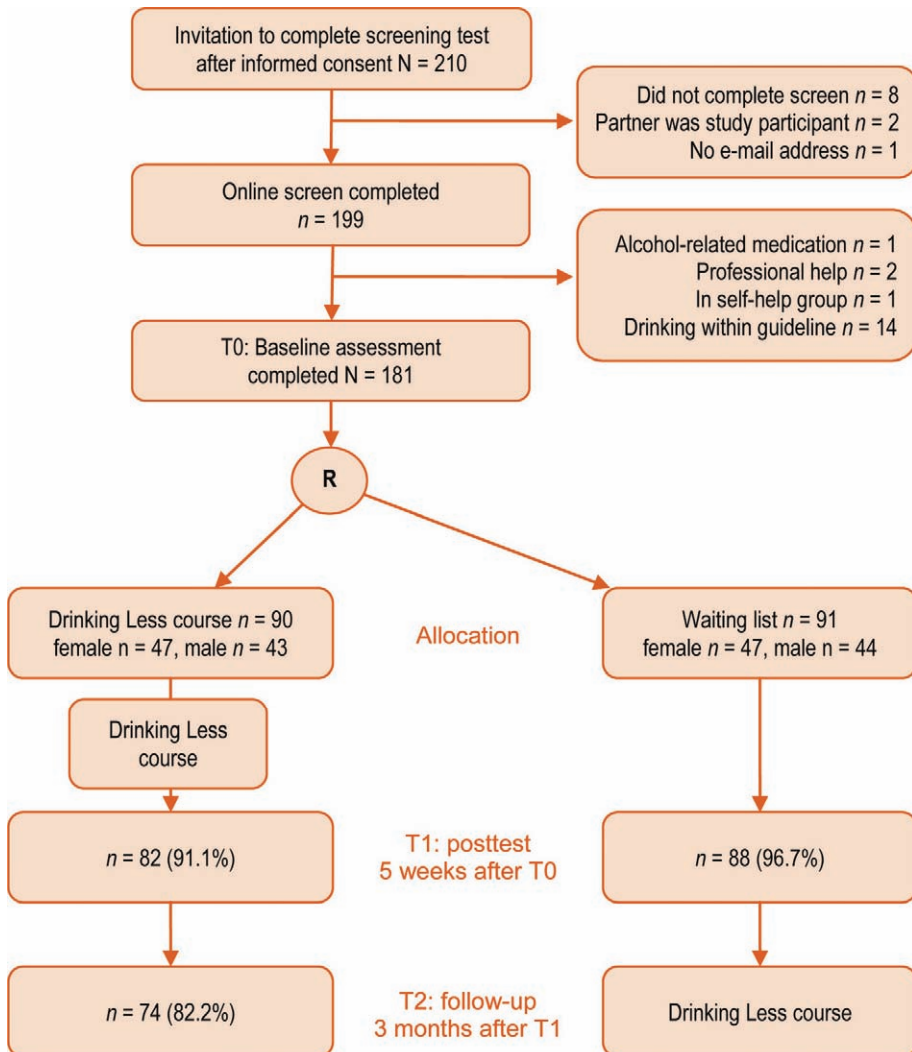
Effect maintenance was tested using the McNemar test for the distributions of problem drinking at T1 with T2. Data were analyzed with SPSS for Windows, version 15.0.

6.3 RESULTS

Sample characteristics

Of the 210 participants that gave informed consent, 181 (86.2%) were selected for the study. Figure 6.1 shows the flow of participants through the trial.

Figure 6.1. Flow of participants through the trial



The baseline demographic and clinical characteristics of participants are shown in Table 6.1. No statistically significant differences emerged between groups on any of these variables at baseline (tested at $P < .05$ and subsequently at $P < .10$).

Table 6.1 Baseline characteristics in numbers (and percentages) of participants, unless otherwise noted

	Condition*	
	Intervention (n = 90)	Waitlist (n = 91)
Female gender	47 (52.2)	47 (51.6)
Age (mean, SD)	49.1 (8.5)	48.5 (9.8)
Education		
Low	34 (37.8)	40 (44.0)
High (academic / professional)	56 (62.2)	51 (56.0)
Living with a partner	57 (63.3)	59 (64.8)
Paid employment	65 (72.2)	69 (75.8)
Readiness to change †		
Contemplation stage	79 (87.8)	83 (91.2)
Action stage	11 (12.2)	8 (8.8)
High-risk drinking §	90 (100)	91 (100)
Weekly alcohol intake in standard units (mean, SD) ¶	37.5 (17.0)	39.1 (16.4)
Problem Index (mean, SD) ‡	8.3 (3.5)	8.3 (4.1)
Alcohol-related problems ≥ 3 ‡	83 (93.3)	84 (92.3)

* All differences between conditions were non-significant at $P < .10$.

† Tested with Dutch version of the Readiness to Change Questionnaire (Rollnick et al. 1992, Defuentes-Merillas et al. 2002).

‡ Tested with Problem Index, a Dutch scale for problem drinking (Cornel et al. 1994, Candel 2001)

§ Drinking > 21 or > 14 units (male/female) per week and / or ≥ 6 or ≥ 4 units (m/f) one or more days a week in preceding month.

|| Tested with Weekly Recall (Cahalan et al. 1969, Lemmens et al. 1988); one standard unit contains 10 g of ethanol.

At baseline, all 181 participants (100%) were exceeding the limits for low-risk alcohol use. Mean weekly alcohol intake was 38.3 units (SD = 16.7). In terms of the guideline, 176 (97.2%) participants were drinking too many units per week (>14 or >21 units f/m) and 166 (91.7%) were drinking too much at least one day per week (≥ 4 or ≥ 6 units f/m). Most participants were in the contemplation stage of change (n = 162, 89.5%), meaning they were ready to change their alcohol

consumption in the near future (34;35). The vast majority (n = 177, 97.8%) were aiming for moderation rather than abstinence.

Loss to follow-up

Posttests at T1 were completed by 170 participants (93.9%), a low attrition rate equivalent across the two conditions (n = 8 intervention and n = 3 control, $\chi^2(1) = 2.50, P = .13$). At the three-month follow-up (T2), attrition in the intervention group was 17.8% (n = 16). Participants not returning the questionnaires at T1 and T2 did not differ from those who did on any characteristics assessed at baseline (tested at $P < .10$).

Effects of the intervention

Primary outcome

At posttest (T1), participants in the intervention were significantly more likely to have reverted to low-risk drinking than those in the waitlist group: 36 (40%) intervention participants versus 6 (6.6%) controls; $\chi^2(1) = 28.3, P < .001$, OR = 9.4, 95% CI = 3.7 – 23.9. The risk difference was 0.33, corresponding to a number needed to treat of 3.

Secondary outcomes

Table 6.2 shows the results for mean weekly alcohol consumption (WR) and alcohol-related problems (Problem Index) at posttest (T1).

Table 6.2 Posttest differences between conditions on secondary outcome measures: intention-to-treat analysis using regression imputation

	Intervention group (DL)		Waitlist control group		Comparisons between conditions					
	<i>n</i>	<i>M</i>	<i>n</i>	<i>M</i>	<i>dif</i>	<i>SE dif</i>	95% CI	<i>t(df)</i>	<i>P</i>	<i>d</i>
Mean weekly alcohol consumption*	90	19.4	91	36.0	16.6	2.29	12.1-21.1	t(152.6)=7.3	< .001	0.90
Alcohol-related problems †	90	6.0	91	7.5	1.5	0.65	1.9-2.8	t(179)=2.3	.025	0.38

* Tested with Weekly Recall (Cahalan et al. 1969, Lemmens et al. 1988)

† Tested with Problem Index, Dutch scale for problem drinking (Cornel et al. 1994, Candel 2001)

DL = Drinking Less television course

dif = difference in means

SE dif = standard error of difference in means

df = degrees of freedom

d = differential effect size

Intervention participants reduced their mean weekly alcohol consumption by a significantly greater amount than controls. The between-group difference was 16.6 units (166 grams of ethanol per week), representing a large, clinically important standardized differential effect size ($d = 0.90$, 95% CI = 0.63 – 1.17) (Lipsey & Wilson 1993). The intervention group also reported significantly fewer alcohol-related problems at T1; the difference of 1.5 scale points corresponded to a differential effect of a medium size ($d = 0.38$, CI = 0.13 – 0.64). Although more intervention participants than controls also remained below the cut-off score of 3 for substantial alcohol-related problems ($n = 25$, 27.8%, versus $n = 18$, 19.8%), that difference was not significant, $\chi^2(1) = 1.60$, $P = .21$.

Effect maintenance by the intervention group at three-month follow-up

Based on intention-to-treat-analysis, the numbers of intervention participants drinking within the low-risk limits were 36 (40%) at T1 and 35 (38.9%) at T2 (McNemar, $P=1.0$). The results for mean weekly alcohol consumption and

alcohol-related problems are shown in Table 6.3. Intervention group participants were drinking 18.2 (SD = 18.1) units less at T1 and 18.2 (SD = 17.7) units less at T2. Their mean reductions in the Problem Index score were 2.2 (SD = 3.5) from T0 to T1 and 2.0 (SD = 3.3) from T0 to T2. Differences from T1 to T2 were not significant on either outcome measure, indicating that the gain was sustained three months after the intervention.

Table 6.3 *Changes in alcohol consumption and related problems in the intervention group at post-intervention and 3-month follow-up (n = 90): intention-to-treat analysis using regression imputation*

	T0, baseline mean (SD)	T1, post- intervention mean (SD)	T2, follow-up mean (SD)	T0-T1 P	T0-T2 P	T1-T2 P	T0-T1 effect size d †	T0-T2 effect size d †
Weekly alcohol intake *	37.5 (17.0)	19.4 (11.6)	19.4 (12.0)	< .001	< .001	.57	1.07	1.07
Alcohol-related problems †	8.3 (3.5)	6.0 (4.3)	6.3 (4.0)	< .001	< .001	.53	0.64	0.56

* Weekly Recall (Cahalan et al. 1969, Lemmens et al. 1988)

† Problem Index, Dutch scale for problem drinking (Cornel et al. 1994, Candel 2001)

‡ Standardized effect size: mean of the absolute individual differences between pretest and posttest divided by pretest SD

Intervention uptake and acceptability

Of the intervention group participants who returned the questionnaire at T1 (n = 82), 52 (63.4%) had viewed 4 or 5 of the five sessions. The self-help manual was used by 72 participants (90.2%); 58 (60.7%) read at least half the book and 41 (50%) more than three quarters. The Drinking Less website was visited by 15 participants (18.3%), but only 3 (1.7%) visited it more than once or twice. Almost all responding intervention participants (n = 76, 92.7%) used at least one course component. On a 1-to-10 scale, the television sessions received a mean score of 7.6 (SD = 1.1), the manual 7.3 (SD = 1.1), and the website 6.8 (SD = 1.1), indicating satisfaction with the various components of the multi-media package.

6.4 DISCUSSION

The television-based self-help intervention *Drinking Less? Do It Yourself!* proved effective at posttreatment in reducing alcohol intake to within the low-risk drinking guidelines as compared to the no-intervention waitlisted control group. One in three problem drinkers exposed to the course was successful in cutting back to low-risk levels at posttreatment, as opposed to one in fifteen controls. This reduction in alcohol consumption was also accompanied by a significant decrease in alcohol-related problems in the intervention condition. Intervention participants were also maintaining their improved drinking outcomes at the three-month follow-up. The large differential effect size ($d = 0.90$) found in this study at posttreatment is comparable to the pooled effect size ($d = 0.67$) reported for follow-up assessments within three months in a meta-analysis on brief alcohol interventions (Moyer et al., 2002). It is much larger than the small effect size ($d = 0.31$) reported by Apodaca and Miller (2003) in a meta-analysis of bibliotherapy and control conditions for drinkers responding to advertisements (albeit after a 15-month posttreatment period). We cannot compare our results to other randomized trials of television-based interventions, as apparently none have yet been conducted, Bennett et al. (1991) in a matched control study, did not find different drinking outcomes for viewers and non-viewers of a televised self-help program similar to *Drinking Less*. Our findings seem important from a clinical point of view, as drinking within low-risk guidelines implies a lower probability of alcohol-related morbidity and mortality (Caetano & Cunradi, 2002; Cuijpers, Riper, & Lemmers, 2004), while drinking above these limits has detrimental health effects (Fleming et al., 2002; Rehm, Gmel, Sempos, & Trevisan, 2003). Our results support the proposition that a television-based self-help intervention, supported by self-help tools such as manuals and web-based interventions, can be effective in reducing problem drinking in self-referred adults from the general population (Apodaca & Miller, 2003; Moyer et al., 2002). It is also

important to note that about 40 percent of our study participants had lower vocational educational backgrounds. The television intervention thus reached a higher proportion of low-skilled people than has so far been the case for web-based alcohol interventions (Kypri et al., 2005; Riper et al., 2008). Television may hence be an important potential channel for reaching out to groups with low education.

Strengths and weaknesses

Several limitations should be considered in interpreting the results. The first is practical, in that a mere seven weeks were available from the start of the trial to the telecast. That only allowed us to assess a short-term, 5-week posttreatment outcome in our randomized controlled design, and we cannot draw any conclusions about long-term effects. Second, the waitlist control design we applied may have methodological limitations of its own, although there is no firm agreement on this (Mercer, DeVinney, Fine, Green, & Dougherty, 2007; Tunis, Stryer, & Clancy, 2003). In our trial, we mimicked the television course beforehand by sending participants one DVD per week. This allowed them to view the sessions at their leisure, possibly increasing their ease of participation and boosting their results as compared to ordinary course participants, who must tune in at a specified time each week. The weekly “placebo attention” from the researchers could also have worked in favor of a positive outcome in the intervention condition. Another potential bias in a waitlist design derives from the control group’s awareness of receiving treatment soon. Controls might postpone their behavioral change and drink more pending receipt of treatment, thus artificially inflating between-group differences in favor of the intervention condition. A final limitation is that the findings may only be generalized to self-referred problem drinkers who are motivated to take part in a television-supported intervention to achieve change.

Our study was sufficiently powered, and the overall attrition at posttest was low (6%) in contrast to the 30%-40% dropout rates often seen in trials of brief and

self-help alcohol interventions (Eysenbach, 2005; Miller & Wilbourne, 2002). The self-help course also achieved high viewing rates and favorable participant ratings in the trial, indicating that it is an acceptable intervention for this group of problem drinkers.

Conclusion

Our results show that television can be used effectively to target problem drinkers and curb their alcohol consumption. Moreover, a blend of new technologies and old media such as television and printed self-help manuals could be developed into a multimedia public health approach for the heterogeneous group of adult problem drinkers in the general population. The low-threshold *Drinking Less* course has shown a potential to reach a large group of problem drinkers and their significant others. This was further reflected in the viewing rates the course received when broadcast on nationwide television after our trial. An average of 1.5% of the Dutch population, or 202,000 viewers per installment, tuned in to each of the five televised sessions (Stichting Kijkonderzoek, 2006). In view of this wide audience, the course has a strong potential for curbing problem drinking at the population level. From a public health perspective, it could serve as a first step in a stepped care approach to problem drinking. The potential reach seems far greater than that of interventions in primary care settings; even when comprehensive screening is carried out in primary care contexts and effective brief interventions are offered, studies have shown that a high percentage of problem drinkers are not in touch with such services at early stages of their drinking problem or avoid discussing their alcohol use when they do have contacts (Andrews, Issakidis, Sanderson, Corry, & Lapsley, 2004; Kypri et al., 2005).

An additional finding of our study was that not all drinkers were successful in reverting to low-risk drinking patterns and that the intervention group still reported substantial alcohol-related problems posttreatment. A large proportion

(65%) were still drinking above the recommended guidelines three months after the intervention. Effectively curbing problem drinking in over one third of problem drinkers may be too much to expect from a single low-threshold intervention, as the intervention may not “fit all” (Mattson, 2003). Nonetheless, such a widely viewed course could have a spin-off effect in encouraging participants and other viewers to overcome feelings of shame and to seek professional or other help. It is also known that curbing problem drinking at the population level requires a multifunctional individual and environmental approach; in other words, even a multimedia intervention needs to be embedded in a wider intervention strategy (Abrams et al., 1996).

Our results could enhance the knowledge already gained about self-help interventions for problem drinking in the general population. The scope of future multimedia research could be extended to focus on problem drinking at the population level. Future research would benefit from investigating cost-effectiveness, dose-response relations, and long-term effects of television-supported interventions, as well as the influence that participants’ choice of treatment might have on outcome. Replication of our study is also needed, given the current lack of evaluation studies on television-based self-help for problem drinkers.


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Meta-analysis: Curbing problem drinking with personalized feedback interventions

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ABSTRACT

Background The effectiveness of personalized feedback interventions (PF) to reduce problem drinking has been evaluated in several randomized controlled trials and systematic reviews. We performed a meta-analysis to examine the overall effectiveness of brief single-session PF without therapeutic guidance. Selection and analyses of studies were conducted in 2008.

Methods 14 randomized controlled trials of single-session PF without therapeutic guidance were identified and their combined effectiveness on reduction of problematic alcohol consumption was evaluated in a meta-analysis.

Outcome measure Alcohol consumption was the primary outcome measure.

Results The pooled standardized effect size (14 studies, 15 comparisons) for reduced alcohol consumption at post-intervention was $d = 0.22$ (95% CI: 0.16-0.29; NNT 8.06, AUC = 0.562). No heterogeneity existed among the studies ($Q = 10.962$; $p = 0.69$; $I^2 = 0$).

Conclusion Single-session PF without therapeutic guidance appears a viable and probably cost-effective option for reducing problem drinking in student and general populations. The internet offers ample opportunities to deliver PF on a broad scale, and problem drinkers are known to be amenable to internet-based interventions. More research is needed on the long-term effectiveness of PF for problem drinking, on its potential as a first step in a stepped care approach, and on its effectiveness in other groups (such as mandated youth) and other settings (such as primary care).

7.1 INTRODUCTION

Problem drinking is a major public health issue, particularly due to its high prevalence in adult (Murray & Lopez, 1996; World Health Organization, 2007) and student populations (Knight et al., 2002; Wechsler et al., 2002). It is these groups of problem drinkers – and not those with severe alcohol-dependence, as is often thought – who account for the bulk of the alcohol-related harm in the general population (Heather & Kaner, 2003; Kaner et al., 2007). Problem drinking causes a formidable array of serious health problems (Raskin White & Jackson, 2004) and a heavy social and economic burden (Anderson & Baumberg, 2006; Smit et al., 2006). Besides short-term and long-term morbidity (Murray et al., 1996; World Health Organization, 2007) and mortality (Holman, English, Milne, & Winter, 1996), the consequences include acute unintended injuries, sexual and physical assault, violence-related trauma, vandalism, and poor academic or work performance (Hingson, Heeren, Winter, & Wechsler, 2005; Whitlock, Polen, Green, Orleans, & Klein, 2004).

Early identification and brief intervention have been increasingly advocated as cost-effective strategies to curb problem drinking (Anderson et al., 2006; Freemantle et al., 1993; Institute of Medicine, 1990; U.S. Department of Health and Human Services, 2007). Evidence is strongest for brief interventions in primary and secondary care (Ballesteros, Duffy, Querejeta, Arino, & Gonzalez-Pinto, 2004; Burke, Arkowitz, & Menchola, 2003; Cuijpers, Riper, & Lemmers, 2004; Kaner et al., 2007), but effectiveness has also been shown in settings such as the general population (Apodaca & Miller, 2003; Moyer, Finney, Swearingen, & Vergun, 2002; Raistrick, Heather, & Godfrey, 2006) or student communities (Carey, Scott-Sheldon, Carey, & DeMartini, 2007; Ehrlich, Haque, Swisher-McClure, & Helmkamp, 2006; Larimer & Cronce, 2007; White, 2006). Less encouraging is the fact that the implementation of brief interventions is still hampered by constraints such as a limited number of professionals who administer them, the difficulty of contacting problem drinkers and the high costs

of implementation and delivery (Kaner, Lock, McAvoy, Heather, & Gilvarry, 1999; Moyer & Finney, 2005; Raistrick et al., 2006). As a consequence, as many as 80% of problem drinkers are not yet receiving help (Anderson, 2003; Andrews, Issakidis, Sanderson, Corry, & Lapsley, 2004; Cunningham & Breslin, 2004). Innovative ways of reaching out to them are needed.

Brief personalized feedback (PF) could be one such strategy (Walters & Neighbors, 2005). PF interventions provide personal feedback regarding an individual's alcohol consumption patterns. This feedback may consist of different components such as an overview of mean weekly alcohol consumption, blood alcohol concentration levels (BAC), associated health and social risks of problem drinking or self-help guidelines to change problematic alcohol consumption. Normative feedback is another important component of many PF interventions. This normative feedback enables problem drinkers to compare their own alcohol consumption (in terms of frequency, quantity or other measures) with the level of their own significant cohort, such as the average male or female in the general population or their student peer group (Chan, Neighbors, Gilson, Larimer, & Alan, 2007; Larimer et al., 2001; Marlatt et al., 1998), as well as with the recommended guidelines for sensible drinking. The rationale of normative feedback is that such comparisons trigger an awareness in problem drinkers of their own drinking patterns and the risks they are taking, thus motivating them to reduce their alcohol use (Larimer et al., 2001). One underlying explanation for such behavioral change is that many problem drinkers overestimate the alcohol consumption of others while underestimating their own (Borsari & Carey, 2001; Borsari & Carey, 2003; Miller, Toscova, Miller, & Sanchez, 2000). PF interventions may consist of normative feedback only (Lewis, Neighbors, Oster-Aaland, Kirkeby, & Larimer, 2007).

Personalized feedback began as a component of evidence-based, face-to-face individual or group motivational enhancement interventions (Burke et al., 2003; Miller & Rollnick, 2002). Today, PF interventions are being successfully

provided as autonomous, face-to-face self-help interventions in both individual and group formats. Technological advances also now enable the delivery of automated postal, computer and internet-based PF. This includes individual single-session interventions without therapeutic guidance, provided in various settings and to various populations (Carey et al., 2007; Cunningham, Humphreys, Koski-Jannes, & Cordingley, 2005; Larimer & Cronce, 2007; Walters & Neighbors, 2005). The systematic review by Raskin-White (2006) on PF for college students has shown that postal or web-based PF interventions without professional guidance were as effective in student populations as brief face-to-face interventions. Studies on needs assessment in problem-drinking populations also suggest that PF is a highly practicable method for the target groups concerned. Both adults and students often prefer to use self-help interventions without therapeutic involvement to address their problem drinking above more intensive individual or group treatments (Chiauzzi, Green, Lord, Thum, & Goldstein, 2005; Cunningham, Wild, Bondy, & Lin, 2001). Given these promising results of single-session stand-alone PF interventions, we decided to assess their effectiveness in a meta-analysis. To the best of our knowledge this is the first meta-analysis to focus on brief PF interventions without professional guidance for young and mature adult problem drinkers. Our expectation was that PF interventions for problem drinkers would be more effective than non-intervention in reducing problem drinking.

7.2 METHOD

Identification and selection of studies

The relevant studies were identified in 2008, using several systematic search strategies. (1) Systematic searches were carried out in the following bibliographical databases: Medline; PsycINFO (1985 to present); Social Science Index Expanded (SCI); Social Sciences Citation Index (SSCI); Arts &

Humanities Citation Index (A&HCI; 1988 to present); CINAHL; EMBASE; the Cochrane Drug and Alcohol Group Specialised Register; Cochrane Effective Practice and Organisation of Care Group; Alcohol and Alcohol Problems Science Database; and ETOH (<http://etoh.niaaa.nih.gov>, 1972 to 2003). Text and key words indicative of personalized feedback interventions for problem drinking ('personalized feedback' 'personalized normative feedback', 'self-help', 'brief intervention', 'brief psychotherapy', 'bibliotherapy') were combined with terms referring to the content of the problem ('problem drinking', 'binge drinking', 'hazardous drinking', 'alcohol abuse', 'alcoholism', both MeSH terms and free text words), the setting ('primary care', 'general population', 'community', 'internet', 'adults', 'students', 'mail', 'web-based') and the study design ('randomized controlled trials'). These search strategies were combined with the optimal search strategy for RCTs designed by the UK Cochrane Centre (2008). (2) References were examined relating to earlier meta-analyses and systematic reviews on brief interventions, self-help interventions and PF interventions for problem drinking (Apodaca et al., 2003; Ballesteros et al., 2004; Beich, Thorsen, & Rollnick, 2003; Bertholet, Daeppen, Wietlisbach, Fleming, & Burnand, 2005; Bien, Miller, & Tonigan, 1993; Cuijpers et al., 2004; Emmen, Schippers, Bleijenberg, & Wollersheim, 2004; Gould & Clum, 1993; Kahan, Wilson, & Becker, 1995; Kaner et al., 2007; Mains & Scogin, 2003; Miller & Wilbourne, 2002; Moyer et al., 2002; Poikolainen, 1999; Raistrick et al., 2006; Walters & Neighbors, 2005; Wilk, Jensen, & Havighurst, 1997). (3) Unpublished literature was searched by scanning Dissertation Abstracts and Digital Dissertations. (4) Reference lists of retrieved papers were screened, and papers that possibly met inclusion criteria were retrieved and studied (figure 7.1). No language restrictions were applied.

Selection of primary studies

For inclusion in the meta-analysis we selected studies on personalized feedback (PF) for problem drinkers which (1) applied a randomized controlled design

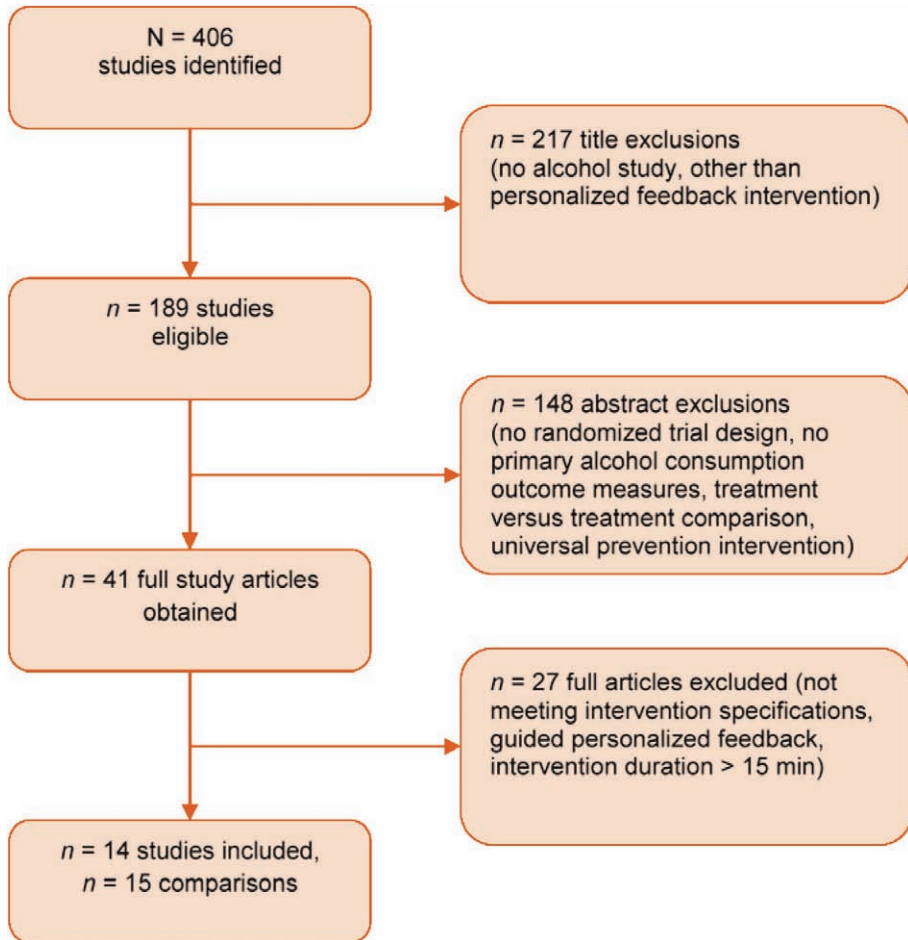
(including control groups with assessment only and no treatment, with wait-listing, and with semi-placebo in the form of an alcohol information brochure); (2) reported data that was usable for meta-analytic procedures; (3) assessed alcohol drinking behavior (e.g. frequency or quantity) as a primary outcome measure; (4) applied individually focused PF interventions; and (5) delivered the interventions without therapeutic support, with a maximum duration of 15 minutes per participant (table 7.1).

Assessment of studies for inclusion in the review was undertaken by two independent raters (HR and MK). Pre-selection from the initial search was based on information derived from titles, abstracts and keywords. If titles, abstracts and keywords yielded insufficient information to assess the inclusion criteria, then the full paper was retrieved. One author rechecked all papers excluded at this stage to ensure that all potentially relevant papers had been retrieved. All retrieved papers were assessed for inclusion using the above criteria (table 7.1); any disagreement was resolved by discussion and consensus. Cohen's kappa was used to assess the agreement on inclusion between the two raters, $k= 0.72$, which reflects a substantial agreement (SPSS 15, Inc., Chicago, IL).

Methodological quality assessment of primary studies

At least 25 scales are available to assess the validity and quality of randomized controlled trials (2008). As there is no evidence that the more elaborate scales give more reliable assessments of validity than simpler ones, an approach as suggested by Higgins & Green (2008) was used and as applied in several reviews of brief interventions for problem drinking in primary care (Kaner et al., 2007; Whitlock et al., 2004). This resulted in four basic criteria to assess the validity and quality of the studies analyzed: (1) allocation to condition by an independent third party, (2) adequacy of random allocation concealment to respondents, (3) blinding of assessors of outcomes, and (4) attrition in follow-up data.

Figure 7.1 Flow chart of study selection resulting in inclusion of 14 studies (15 comparisons)



Meta-analysis

Effect sizes (d) were calculated by subtracting the mean pre-test score of the control condition (M_c) from the mean post-test score of the experimental condition (M_e) and dividing the result by the pooled standard deviation of the experimental and control conditions (SD_{ec}). An effect size of 0.15 or less can be regarded as small, 0.45 as moderate and 0.90 or greater as large (Lipsey & Wilson, 2001).

Effect size calculations were restricted to instruments that explicitly measured alcohol consumption (table 7.1). If a study used more than one alcohol measure, the mean of the effect sizes was calculated, giving each study (or contrast group) a single effect size. In one study where more than one experimental condition was compared to a control condition, the number of participants in the control condition was divided evenly over the experimental conditions so that each participant was used only once in the meta-analysis.

Mean effect sizes were calculated using both random and fixed effects models. A fixed effects model assumes that all studies in the meta-analysis are considered to have been conducted under similar conditions with similar subjects. The only difference between studies is their power to detect the outcome of interest. In a random effects model, studies are regarded as having been drawn from a population of studies. Effect sizes may vary due to error across studies. This allows for more uncertainty in the meta-analytical data, does not make the (possibly too restrictive) assumption that all studies are exact replications, and generally produces wider confidence intervals around the pooled estimates. By implication, the random effects model is more conservative in flagging significant results. In the absence of heterogeneity (see below), the fixed and the random effects models produce the same results. In that case, one would usually prefer the more simple fixed effects model. As the studies we analyzed used different measures (both continuous and dichotomous) to indicate effectiveness, we had to convert some odds ratios into effect sizes in terms of Cohen's *d*. We did so using the formula provided by the Comprehensive Meta-Analysis program (version 2.2.021).

Next the mean effect sizes were converted into numbers needed to treat (NNT) and areas under the curve (AUC) (Kraemer et al., 2003). NNT estimates how many people must receive the intervention to achieve a good clinical outcome in one person; hence, a smaller NNT is better than a large one. AUC is a measure of an intervention's effectiveness; scores above 0.50 indicate that its outcome is

superior to that in the control condition, and scores below 0.50 indicate it is inferior.

Our analysis also tested whether genuine differences underlay the results of the studies (heterogeneity) or whether variations in findings were attributable to chance alone (homogeneity) (Higgins, Thompson, Deeks, & Altman, 2003). The Q statistic was calculated as an indicator of homogeneity. A significant Q rejects the null hypothesis of homogeneity and shows that the variability among effect sizes is greater than what would likely have resulted from sampling error alone in the primary studies. Additionally the I^2 statistic was calculated, an indicator of heterogeneity; 0% indicates no observed heterogeneity, and larger values show increasing heterogeneity, with 25% regarded as low, 50% as moderate and 75% as high (Higgins et al., 2003). As heterogeneity was non-existent in all analyses and the differences between the fixed and random effects results were negligible, we report here only those from the simpler fixed effects model. Meta-regression analyses were performed to assess whether effect sizes decayed over time and whether multi-component personalized feedback differed in impact by comparison with personalized normative feedback solely.

To assess and adjust for any publication bias, a fail/safe analysis was conducted, a funnel plot was constructed and Duval and Tweedie's trim-and-fill analysis was performed. Comprehensive Meta-Analysis (version 2.2.021) was used for all such operations.

7.3 RESULTS

Description of the primary studies analyzed

The combined literature search generated 406 abstracts and yielded 14 studies (15 comparisons) that met the inclusion criteria (table 7.1). The analysis involved a total of 3,682 participants (1,904 in PF and 1,778 in control conditions). The number of participants ranged from 11 to 877 per condition per comparison.

All but one study used non-clinical samples from either community, higher education or work settings. Nine studies recruited their participants from higher education institutions in an age range of 17 to 24. Four studies recruited from the general adult population and one study targeted employees in a work setting. Six studies delivered the PF intervention by post, and the other eight did so via the world wide web. Five studies delivered the PF intervention in situ, i.e. in a research laboratory, health service clinic or within a work setting. The remaining nine studies delivered the intervention by postal mail (6) or enabled participants to access the intervention by internet at their venue of preference (3). Eight studies used binge drinking as the primary inclusion criterion; two used drinking in excess of a sensible drinking guideline (including binge drinking); two used the AUDIT (Saunders, Aasland, Babor, Defuentes-Merillas, & Grant, 1993) screening test (with a score of 8 or higher indicating problem drinking); and two studies used the amount of alcohol intake (> 40 oz ethanol past month (Agostinelli, Brown, & Miller, 1995) and ≥ 40 standard drinks past month (Walters, Bennett, & Miller, 2000)). There were different types of control conditions: seven studies used an assessment-only format, three used a wait-list condition, and four gave control participants a short psychoeducational leaflet on alcohol use. Six of the studies were based on intention-to-treat analysis (ITT) and eight on completers-only analysis (CO). The studies were conducted in various Western countries.

Table 7.1 Principal characteristics of randomized controlled studies on personalized feedback for problem drinking

First author	C	Target population	Diagnosis	Recruitment	Conditions	N	Follow-up	LFU	Outcome instruments	ITT/CO
Agostinelli 1995	US	Cst	> 40 oz ethanol past mo.	CC/V	1) PF/N: Mail 2) Cirt: WLC	1) 13 2) 13	1½ mo.	11.5%	DDO/BAC	CO
Boon 2008a	NL	Gpop age 18+	≥ 21/14 SU m/f wk; ≥ 6/4 in row ≥ once past mo.	GPop/Internet/V	1) PF/N: Web 2) Cirt: PBA	1) 102 2) 89	9 mo.	31.6%	WR, OFV, RCQ	CO
Boon 2008b	NL	Gpop/males only age 18+	≥ 21/14 SU m/f wk; ≥ 6/4 in row ≥ once past mo.	Gpop/Internet/V	1) PF/N: Web 2) Cirt: PBA	1) 230 2) 220	1) 1 mo. 2) 6 mo.	1) 10.5% 2) 15%	WR, OFV, RCQ	ITT
Collins 2002	US	Cst age 17-20	≥ 5/4 SU in row m/f ≥ twice past mo.	CC/V	1) PF/N: Mail 2) Cirt: PBA	1) 47 2) 48	1) 1½ mo. 2) 6 mo.	1) 1% 2) 28.5%	DDO; DNRF	ITT
Cunningham 2002	CA	Gpop age 18+	≥ 5 drinks at least once a month	Gpop/V	1) PF/N: Mail 2) Cirt: AO	1) 21 2) 26	6 mo.	21%	AUDIT/WRC/PI	ITT
Doumas 2008	US	Empl age 18-24	≥ 5/4 SU in row m/f past 2 wks	workplace/V	1) PF/N: Web/IS 2) Cirt: AO	1) 38 2) 23	1 mo.	36.7%	QFV, WRC, DDO	CO
Juarez 2006	US	Cst	≥ 5/4 SU in row m/f ≥ once past 2 wk.	CC/V	1) PF/N: Mail 2) Cirt: AO	1) 20 2) 21	2 mo.	27%	DDO /BAC	CO
Kypri 2004	AUS	Cst	≥ 8 AUDIT	Stud. health service/V	1) PF/N: Web/IS 2) Cirt: PBA	1) 51 2) 53	1) 6wks 2) 6mo.	1) 20.2% 2) 10.4%	AUDIT; OF	CO
Lewis 2007	US	1st-year Cst	≥ 5/4 SU in row m/f ≥ once past mo.	CC/V	1) PNF: Web/IS 2) PNF/Gend: C 3) Cirt: AO	1) 82 2) 75 3) 88	5 mo.	14.7%	DDO; DNRF	ITT
Neighbors 2004	US	Cst	≥ 5/4 SU in row m/f ≥ once past mo.	CC/V	1) PNF: Web/IS 2) Cirt: AO	1) 126 2) 126	1) 3 mo. 2) 6 mo.	1) 21% 2) 18%	ACI/WEEK/PEAK/ RAPI	ITT
Neighbors 2006	US	1st-year Cst	≥ 5/4 SU m/f ≥ 1 drinking session past mo.	CC/V	1) PNF: Web/IS 2) Cirt: AO	1) 108 2) 106	2 mo.	13.5%	DNRF; DDO; RAPI	CO
Walters 2000	US	Cst	≥ 40 SU standard drinks past mo.	CC/V	1) PF/N: Mail 2) Cirt: AO	1) 11 2) 12	1½ mo.	14%	SIP/AUDIT/ CHUG/AEFQ	CO
Walters 2007	US	1st-year Cst	≥ 5/4 SU m/f ≥ 1 occ. past mo.	CC/V	1) PF/N: Web 2) Cirt: WLC	1) 103 2) 103	1) 2 mo. 2) 4 mo.	1) 28.3% 2) 22.6%	WRC/DDO RAPI	ITT
Wild 2007	CA	Gpop age 18+	≥ 8/6 m/f AUDIT	Gpop/Com/V	1) PNF: Mail 2) Cirt: WLC	1) 877 2) 850	6 mo.	24.4%	AUDIT	CO

Abbreviations: For the abbreviations of the measurement instruments the reader is referred to the references of the included studies. ip: in preparation. C: Country, CSt: college students; Gpop: general population; Empl: employees; SU= standard unit of alcohol; CC: college community; V: voluntarily; CoM: community; PF/N: personal feedback, including normative feedback; PNF: personalized normative feedback; Mail: PF delivered by mail; Web: PF webbased delivery; Web/IS: PF web-based but completed in situ (research lab, health care setting or workplace); WLC: waitlist control; PBA: psycho-educational alcohol information brochure; AO: assessment only; mo: month; LFU: lost to follow up; DDO: Daily Drinking Questionnaire, BAC: Blood Alcohol Concentration; WR: Weekly Recall; OFV: Quantity, Frequency, Variability; RCO: Readiness to Change Questionnaire; DNRF: Drinking Norms Rating Form; AUDIT: Alcohol Use Disorder Identification Test; QF: Quantity & Frequency; ACI: Alcohol Clinical Index; RAPI: Rutgers Alcohol Problem Index; SIP: Shortened Inventory of Problems; CHUG: Check Up to Go; AEFQ: Alcohol Effects Questionnaire; ITT: intention to treat; CO: completers only

The quality of the studies varied. All used randomized controlled designs, well validated alcohol consumption measures and well described, theoretically based interventions. Only three studies, however, reported independent allocation of participants, concealment of random allocation to participants, and blinding of assessors; such conditions were not possible in all studies. Loss to follow-up ranged from 1% to 37%.

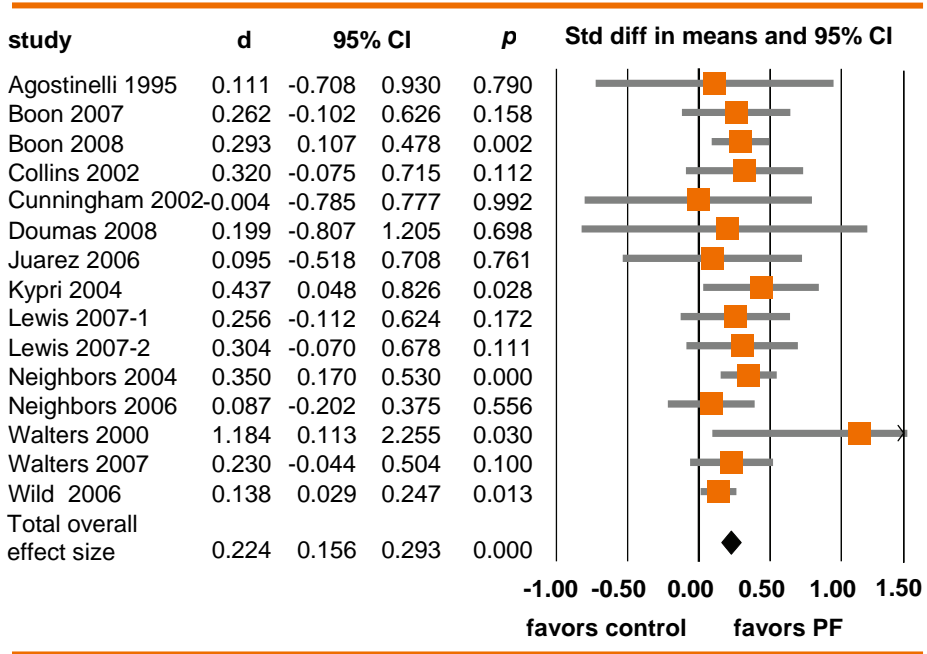
Effects of PF on alcohol consumption at follow-up

Fourteen studies with fifteen contrast groups assessed the effects of PF on alcohol use at post-intervention (Table 7.2). The overall mean effect size was 0.22 (95% CI: 0.16 – 0.29), in the fixed model. Outliers were not excluded, as there was no heterogeneity among the studies ($Q = 10.962, p = 0.69, I^2 = 0$). These results correspond to a number needed to treat (NNT) of 8.06, indicating that about eight people need to be recipients of the intervention in order to generate one good clinical outcome (AUC = 0.562).

Sensitivity analyses

The overall mean effect size was maintained even when the largest study (N= 1,727 (Wild, Cunningham, & Roberts, 2007)) was excluded. Without this study the overall effect size rose from $d = 0.22$ (CI: 0.16 – 0.29) to $d = .028$ (CI: 0.19 - 0.37), which is not statistically significant as evidenced by the overlapping CIs. Separate analyses were conducted to correct for small sample bias; however results showed an identical overall effect size and corresponding CIs as reported for the pooled standardized difference in means. Meta-regression analyses did not establish significant differences in effects of PF interventions over time ($B = -0.006, 95\% \text{ CI: } -0.014 - 0.0015, P = .12$) nor could a significant difference be established for PF interventions inclusive of normative feedback and PF interventions solely based on this normative feedback ($B = 0.09, \text{ CI: } -0.05 - 0.24, p = 0.22$).

Table 7.2 Pooled estimates for the efficacy of personalized feedback interventions



Duval and Tweedie’s trim-and-fill analysis did not detect any publication bias (observed $d = 0.22$, 95% CI 0.16 – 0.29; adjusted $d = 0.22$, 95% CI 0.15 – 0.29), neither did the funnel plot analysis. The fail/safe analysis indicated that 122 zero finding studies need to be ‘out there’ before the pooled effect size would be no longer statistically significant ($p > 0.05$). In view of these results, we believe our results are robust (Hedges & Waddington, 1993; Wilson, 2000).

7.4 DISCUSSION

Main findings

This meta-analysis shows that single-session, individually personalized feedback without professional guidance can be an effective intervention for reducing risky alcohol consumption in young and adult problem drinkers. Adverse consequences in terms of increased alcohol use among participants resulting from their exposure to PF interventions were not identified (Whitlock et al., 2004). These results may indicate that PF is an effective intervention for different target groups across different settings, using a variety of delivery modes. Despite the modest effect sizes overall, PF could have a major health impact at the population level, in view of the high percentages of problem drinkers who could potentially benefit (Kahan et al., 1995).

The effect sizes reported here are comparable to those from several other meta-analyses of brief interventions to curb problem drinking. Those were in the small-to-moderate range both for college students (Carey et al., 2007) and the adult population in both non-clinical and primary care samples (Apodaca et al., 2003; Burke et al., 2003; Kaner et al., 2007; Moyer et al., 2002; Vasilaki, Hosier, & Cox, 2006). The NNT of 8.06 found in this meta-analysis for the overall effect of PF seems appreciable given the brief and unguided nature of the intervention. It is in the range of those reported for brief face-to-face alcohol reduction advice in primary care, which ranged from 7 (National Health Committee, 1999) to 8 (Ehrlich et al., 2006).

The meta-analysis by Carey et al. (2007) indicated that individual brief interventions are more effective than group interventions for college drinkers (with *d*'s ranging from 0.11 to 0.41 on several alcohol-related outcome measures). This study also showed that brief interventions based on motivational interviewing and normative feedback are more effective than those not including these features. In her review dedicated to PF interventions for students, White (2006) found more favorable results for written and computer-based PF

interventions than for face-to-face individual or group interventions; Walters and Neighbors (2005) found similar results. The effectiveness of PF may therefore depend not on personal contact, but on the content of the feedback such as normative feedback and the mode of postal and web-based delivery (Larimer & Crouce, 2007; White, 2006). For example, this meta-analysis showed that personalized normative feedback was as effective as multi-component personalized feedback. Further research into the effective components is, however, required to evaluate the robustness of this observation.

Limitations

Several limitations need to be taken into account when interpreting the results of this study. First, this meta-analysis is based on 14 primary studies; the findings can only be generalized to the groups studied (Heather, 1995), who were at-risk drinkers in student and general populations. Second, some studies had methodological drawbacks such as small samples (Agostinelli et al., 1995; Collins et al., 2002; Walters et al., 2000), or dropout rates above 30 per cent (see table 7.1). Third, all studies relied on self-reported alcohol consumption measures. Though there is some concern about the reliability and validity of such measures (Hustad & Carey, 2005; Lewis et al., 2007), they are currently the best option available (Laforge, Borsari, & Baer, 2005; Whitlock et al., 2004). Indeed, their validity actually improves in interventions delivered online, which facilitate self-disclosure in comparison to pen-and-paper questionnaires (Chiauzzi et al., 2005; Kypri, Gallagher, & Cashell-Smith, 2004; Lewis et al., 2007).

Conclusions

PF without therapeutic guidance may be cost-effective in view of the minimal time and money investments needed to make it widely available. It is expected that this potential cost-effectiveness, the attractiveness of PF for participants (Kypri, Saunders, & Gallagher, 2003), and its diffusion potential could be

greatly expanded by delivering it over the internet. Many of the traditional impediments to implementing brief interventions could be thereby overcome (Doumas et al., 2008; Moyer et al., 2005). Advantages of web-based delivery include the widespread availability of PF to underserved or difficult-to-reach groups such as college students or female problem drinkers (Carey et al., 2007; Cunningham et al., 2005) and those in geographically dispersed areas (Chiauzzi et al., 2005; Moyer et al., 2005) – many of whom now have internet access (Internet World Stats, 2008). Brief web-based PF interventions appear more readily accepted by both young and mature risky drinkers, as the unobtrusive nature of the interventions allays their fears of stigmatization and privacy violation (Curry, 2007; Simon-Arndt, Hurtado, & Patriarca-Troyk, 2006). The constant availability of these web-based interventions makes it more convenient to take part (Cunningham et al., 2005). ICT technology also now facilitates personal needs assessments, including those needed for public health interventions (Copeland & Martin, 2004). A further advantage is that the internet, and in particular the advent of Web 2.0 technologies (O'Reilly, 2005) facilitates the gathering of knowledge about targeted groups as well as their active participation in the interventions. The use of ICT devices in group settings is yet another promising avenue as shown by the recent randomized trial of LaBrie et al. (2008) among college students. This study evaluated the efficacy of a professionally guided, interactive, group-specific, personalized, normative feedback intervention by means of personal digital handhelds. Results demonstrated the effectiveness of this intervention on reducing alcohol consumption up to two month follow-up.

All such features of web-based PF could increase the effectiveness of intervening, and could make it possible, as Neighbors et al. (2006) have pointed out, to reach out with preventative interventions to people in different settings and on a large scale. In a public health approach to problem drinking, it would therefore seem beneficial to integrate PF into the first stage of a stepped care model for problem drinking. We therefore recommend that PF be further

investigated. However, many of the expected advantages still lack an empirical basis while potential disadvantages are yet not fully investigated. Alternative strategies to reach out to high risk drinkers are also required, as with effect sizes in the small to medium range not all high risk drinkers benefit from PF. In addition, research into the cost-effectiveness of PF interventions is required. While it is expected that PF can be delivered at low cost, the empirical evidence for it is not yet available. Cost-effectiveness studies should also include evaluations of effective recruitment strategies for single session PF interventions, as the latter could involve higher costs than the actual PF intervention itself. Future studies should focus on factors that influence the long-term effectiveness of PF, as well as examining for which groups (for example mandated students and adults) it might have greater or lesser effectiveness. Research should also explore its applicability to other settings, such as primary care. As is also the case in college settings, a whole range of barriers exist to implementing interventions in primary care. These involve motivating and training GPs to use them, a lack of pragmatic screening interventions (Beich et al., 2003; Bertholet et al., 2005; Kaner et al., 1999; Moyer et al., 2005) and the costs of implementation (Boyd & Faden, 2002; Raistrick et al., 2006). Future research should therefore investigate the role that single-session PF could play in primary care with and without GP involvement. As the effects of PF appear comparable to those of more intensive (and hence costly and intrusive) brief interventions, it could be of interest to a range of stakeholders, including university officials, public health planners, insurance companies and employers. In addition, it is worthwhile to further investigate the potential applicability of single session PF for altering life style behaviors such as overeating or common mental health disorders such as depression.

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General Discussion



8.1 INTRODUCTION

The primary aim of this book was to assess whether digital self-help interventions could help to curb problem drinking in the adult general population. This is part of the ongoing search for an evidence-based public health and prevention strategy to combat problem drinking. Increasing importance is being attached to clinical and cost-effectiveness evaluations, brief interventions and insights into the natural remission of drinking problems (Babor, 2008; De Bruijn, 2005). Broader developments in health care and the socioeconomic context have also led to a growing emphasis on self-help and self-management as essential ingredients in both the qualitative and the financial sustainability of health care systems (World Health Organization, 2002). For all these reasons, it seemed appropriate to investigate whether digital interventions could meet the challenge of Rose's (1992) theorem that a 'large number of people at small risk may give rise to more cases of disease than a small number who are at high risk'. Could substantial health gains at the population level be achieved by approaching the large number of adult problem drinkers in the general population with digital self-help? I will now summarise and discuss some of our answers to this central research question, while acknowledging answers that I cannot provide due to study limitations. I start with a summary of the main findings and limitations of our study (8.2 – 8.3). Next, I discuss a number of concerns and considerations in assessing the current state of the art in digital self-help for problem drinking (8.4). Section 8.5 highlights three such issues in more detail. In the final section (8.6), I propose ten guidelines for future research and routine practice, in the hope that these will serve as an inspiration to people involved in efforts to combat problem drinking.

8.2 KEY FINDINGS

Drinking Less, our low-threshold online self-help intervention without therapist guidance (www.minderdrinken.nl), was found in the pragmatic randomised trial to be effective in helping problem drinkers to reduce their alcohol consumption for up to six months. At the twelve-month follow-up, the difference between the experimental and control conditions was no longer significant, mainly due to improvement in the control group. The gradual attenuation of treatment outcome differences between experimental and control groups is a common phenomenon in intervention trials. One possible explanation is that controls may experience delayed improvement due to greater awareness of their alcohol consumption as a result of the regular assessments (Sobell et al., 2002). Drinking Less was still associated with positive economic effects after twelve months, due mainly to its favourable impact on labour productivity.

At six-month follow-up, we were unable to convincingly establish predictive value of specific baseline characteristics of problem drinkers for positive treatment response to Drinking Less. At twelve months, we did find modest prognostic value for female gender and for higher levels of education. Interestingly, the added benefit of high education in the treatment group coincided with a remarkable decrease in alcohol consumption by lesser educated males in the control group. As one can only speculate about other factors that may account for this phenomenon, additional research is needed. The psychoeducational information provided in the control condition may have had a delayed effect; another possible explanation is a higher natural remission rate in this subgroup compared to the others (Brown & Wood, 2001). This issue warrants further investigation, especially since people with lower educational backgrounds appear less likely to participate in online health interventions (Lieberman & Huang, 2008).

Little was known about the effectiveness of digital self-help interventions in routine practice. Our implementation study addressed this question. In a

comparison between the trial group and a group sampled in daily practice on the Drinking Less website, we found that the six-month impact of Drinking Less in terms of improved drinking outcomes was similar in both groups. Currently we are examining whether these similarities also obtain for cost-effectiveness at twelve-months. The television-based self-help intervention we tested (Teleac, 2006) not only proved effective in reducing problem drinking among adult viewers in the general population, but it also reached a higher proportion of low-educated people than web-based self-help interventions. Television may hence be a promising channel for groups with lower educational backgrounds. Digital and printed self-help interventions can be very concise and still have a positive impact on alcohol consumption. This was illustrated in our meta-analysis, which showed a small but appreciable effect size for interventions based on unguided, single-session, personalised feedback for student and adult populations of problem drinkers.

8.3 LIMITATIONS

It is important to critically evaluate the results and conclusions of this study. A first limitation involves the public health approach that we have chosen for tackling problem drinking. A public health approach should consist of various preventative strategies, but we have focused on one such strategy – digital self-help interventions. The impact of other intervention strategies such as tax legislation, drink-driving laws or alcohol advertising bans have not been studied here (but see Babor et al., 2005; Chisholm, Rehm, Van Ommeren & Monteiro, 2004). Behavioural change is, of course, very complex and is influenced by multiple individual, social and environmental determinants. To curb problem drinking, all these different strategies are required, preferably in an integrated approach that can influence drinking behaviours on a population level (Lemmers

& Riper, 2007). Addressing problem drinking from this broad perspective was beyond the scope of this book.

Hazardous alcohol consumption appears in many forms (Whitlock, Polen, Green, Orleans & Klein, 2004). Our focus was on ‘problem drinkers’, defined as persons who exceed the limits of low-risk drinking guidelines (Posma & Koeten, 1998) and who also experience problems due to this excess (Van Dijck & Knibbe, 2005). We targeted adult problem drinkers with an interest in unguided digital self-help and a desire to moderate their alcohol intake. Our results can hence be generalised to this group only, and not, for example, to those problem drinkers who are unmotivated to change their drinking habits but who might well need to do so (Prochaska & Velicer, 1997; Sobell et al., 2002).

At the twelve-month follow-up, the difference between the experimental and control conditions was no longer significant, mainly due to improvement in the control group. Further investigation on the maintenance of clinical improvement over time would be warranted. The Dutch programme Resultaten Scoren (Scoring Results) has developed guidelines for the prolongation of care and the provision of booster sessions after clinical treatment for addiction problems (De Wildt, 2005). Additional research is needed into how such guidelines could be applied to digital self-help and treatment interventions. We are currently undertaking such an investigation by evaluating the feasibility of booster sessions and referrals in the post-intervention period for Drinking Less participants who have not succeeded in cutting down their alcohol intake. Two of our studies (the pragmatic trial and the implementation study) had high rates of participant attrition, meaning that many participants were ‘lost-to-follow-up’ for questioning. This phenomenon is a well known feature of many alcohol intervention studies and of other digital self-help interventions without therapeutic guidance (Christensen, Griffiths & Jorm, 2004; Eysenbach, 2005; Miller & Wilbourne, 2002). While we dealt with this attrition as rigorously as possible in our analysis, it is still a point of concern and it may have somehow biased our study results.

Last but not least, our findings on the cost-effectiveness of digital self-help interventions for adult problem drinking are among the first to be published (see Bewick et al., 2008). We based our clinical findings on two large pragmatic trials, a pretest-posttest routine practice study and a meta-analysis. All of these suggest small to medium effects for digital self-help interventions and a potentially important public health impact. Replication of our findings is necessary in order to assess the robustness of the results and to enlarge the systematic evidence base on digital interventions for problem drinking. The addiction field is keenly awaiting the results of a number of studies currently in progress (Blankers, Kerssemakers, Schramade & Schippers, 2007; Murray et al., 2007; Postel, De Jong & De Haan, 2005), as the evidence base is less well established for problem drinking than for other mental health disorders such as depression (Hester & Miller, 2006; Riper et al., 2007).

8.4 CONCERNS AND CONSIDERATIONS

The high prevalence of adult problem drinkers in the general population, combined with their low rate of health service utilisation and their consequently high unmet needs, underlines the need for low-threshold self-help interventions. Our overall findings point to a sizeable population of problem drinkers who are motivated to seek digital self-help without therapeutic guidance and who may do so effectively. This indicates that digital self-help could function well within a public health approach. It seems promising as a first step in a stepped care approach to problem drinking, as large-scale dissemination is possible at relatively low cost. There are various signs that the Netherlands is headed towards this kind of public health approach to problem drinking. Both the control of problem drinking and the provision of digital prevention have been recognised at the national policy level as promising avenues to improving health and securing social and economic gains (Meijer, Smit, Schoemaker & Cuijpers,

2006; Ministerie van Volksgezondheid, Welzijn en Sport, 2006). Dutch addiction agencies that provide prevention and treatment services are becoming more and more digitally enabled (GGZ Nederland, 2004). Health authorities and insurance companies are exploring the role that digital interventions could play in health service delivery and the related insurance coverage (CVZ, 2007; Riper et al., 2007). Yet the most salient driver of such developments may be the very group whose health is at stake – problem drinkers in the general population. A poll in 2007 showed that almost 4 out of 10 Dutch adults were familiar with online help for problem drinking and would consider using it if confronted with psychological problems, including problem drinking (Riper et al., 2007). The results, conclusions and limitations of this book raise a number of considerations and concerns, which I shall now discuss. Many of the proclaimed benefits of digital prevention and treatment interventions for problem drinking still lack an empirical foundation, and potential drawbacks are not yet fully understood.

Benefits

The potential advantages of digital self-help have been documented in many studies (Blankers et al., 2007; Cuijpers & Schuurmans, 2007; Emmelkamp, 2005; Marks, Cavanagh & Gega, 2007), including our present study. Benefits can be identified in terms of (1) intervention delivery, (2) intervention components and (3) user-centredness.

Digital self-help interventions are apparently as effective as brief face-to face interventions, but the costs of broad-scale delivery are expected to be lower (Hester & Miller 2006). Other cost-efficiency savings could be realised if self-help is applied as one component of therapist-delivered treatments, thus freeing up therapist time (e.g., as shown by Kypri, Sitharthan, Cunningham, Kavanagh & Dean, 2005). Further efficiency is possible because the interventions can be delivered in a variety of clinical and ‘population-based’ settings with only small adaptations (I will discuss this advantage in more detail in section 8.5). Digital

applications also make it possible to enrich self-help and other treatment interventions with interactive components such as automated feedback and progress monitoring (for both clients and therapists). These added ingredients could enhance their effectiveness as compared to written self-help (Ritterband et al., 2003). The content of digital interventions can be modified and upgraded promptly to incorporate the latest changes in evidence for treating problem drinking (Cuijpers & Riper, 2007). By virtue of the easily accessible data storage potentials, digital intervention delivery also enables a high level of treatment transparency for clients, therapists and supervisors.

Ample studies have shown that digital self-help interventions are attractive to adult problem drinkers in the general population (Cunningham, Humphreys, Koski-Jannes & Cordingley, 2005; Hester et al., 2006). They may fit into the natural recovery trajectories of many people and support their motivation to change. Unguided, easy-access online self-help has particular appeal because it enables them to search for help anonymously, guard their privacy and deal with the feelings of shame that often accompany problematic alcohol use. Physical obstacles, such as mobility problems or geographical distances, can also be overcome (Cunningham, Selby, Kypri & Humphreys, 2006).

Drawbacks

Notwithstanding the many potential advantages of digital interventions, careful reflection is needed to understand their full potential for the prevention and treatment of problem drinking. We have discussed many concerns and considerations in previous chapters. We also investigated them in our state of the art study on e-mental health in the Netherlands (Riper et al., 2007), which assessed the evidence base for the delivery of digital prevention and treatment in trials and routine practice. Limitations and concerns were evaluated from the perspectives of key stakeholders such as policymakers, insurers, health service providers, clients and researchers. We distinguished three waves of concerns in the 10 years of digital intervention development, which we labelled as 'high

tech, high touch, high trust'. During the first wave (1998-2002), concerns and drawbacks were mostly expressed in terms of access barriers to clients and professional resistance to digital intervention practices. Concerns of the second wave (2002-2006) were expressed as questions and doubts about whether online client-therapist contact could have good therapeutic quality. Current data would not appear to justify these concerns. Knaevelsrud and Maercker (2006) showed, for example, that for some clients online therapeutic contact can be as good as face-to-face contact, or even better if sensitive information needs to be revealed. The major concerns of the current third wave (2006-) can be categorised under the umbrella of 'trust'. If digital interventions are here to stay, then their quality and trustworthiness must be guaranteed. Concerns now relate to the quality of digital interventions, including their implementation and maintenance. Issues involve client data protection, liability of providers, the reliability of information provided by services and clients, and inequities for groups not competent in using digital interventions. All these issues need further investigation, including the question of whether they are unique to e-mental health (Looi & Raphael, 2007; Wells, Mitchell, Finkelhor & Becker-Blease, 2007).

Digital self-help has several limitations from a user perspective as well. As we have noted throughout, problem drinking is multi-faceted in nature, as is the problem-drinking population. Our study of television-supported self-help showed, for example, that those interested in that form of help did not need additional digital intervention. A range of self-help modalities should therefore be developed, as well as other forms such as brief face-to-face interventions (Cuijpers & Riper, 2007). Some drawbacks of digital self-help interventions relate to their openness and ease of use. For example, many problem drinkers take part in the user forums that are usually a component of self-help interventions. These forums have both strengths and weaknesses. While many problem drinkers use them as a support tool in moderating their alcohol consumption, the forums can be susceptible to verbal vandalism as well, as we have witnessed in the Drinking Less forum. More empirical evidence is needed

to improve the effectiveness of forums in problem drinking interventions. The results of our study, together with concerns and considerations as raised in this section, certainly justify efforts to expand the evidence base on digital self-help interventions. I shall now discuss three key issues in more detail.

8.5 EXTENDING THE PRIMARY RESEARCH QUESTION

The role that digital self-help can play to combat problem drinking has been investigated here by asking ‘Are these interventions cost-effective?’ both in research and routine practice settings. To further assess the evidence base for digital interventions, more research is needed along this line, such as to estimate consequences of different cost-effectiveness ratios at the population level (Smit et al., in progress). New directions of research are also needed to address the following questions: (1) How do such interventions exactly work and what are their effective components? Does user compliance affect treatment response? (2) Is digital self-help suited to both less severe and more severe problem drinkers? (3) Is digital self-help applicable in other settings than the general population? How can it be embedded into a stepped care approach that includes online and face-to-face elements? How, for instance, could tailor-made digital advice lead problem drinkers to digital self-help, and subsequently to professionally guided digital treatment if appropriate? I will now elaborate on these questions and other issues that ought to be taken into account as further studies are considered.

How do digital self-help interventions work?

The fact that unguided web-based self-help interventions for problem drinking show effect sizes comparable to those of brief face-to-face interventions raises some questions relating to the ‘Dodo bird verdict’ debate. Decades ago, Rosenzweig (1936) hypothesised that implicit common factors in different psychotherapies were accountable for similarities in their treatment effects.

These factors might be specifically therapeutic components, such as cognitive restructuring, or non-specific components, such as the client-therapist relationship. Researchers investigating this hypothesis refer to this phenomenon using Rosenzweig's quote from *Alice in Wonderland*: 'Everybody has won and all must have prizes', otherwise known as the Dodo bird's verdict (Cuijpers, 1998; Luborsky et al., 2002). Presumably the Dodo bird is no longer alive and adjudicating, as numerous studies and meta-analyses have shown that some interventions are truly more effective than others for reducing problem drinking (Miller et al., 2002; Moyer, Finney, Swearingen & Vergun, 2002). Yet whether the Dodo bird is now completely extinct, as claimed by Chambless (2002), remains debatable.

Effective interventions actually do not differ much in their degree of effectiveness, as shown by Project MATCH (1997) and Moyer et al. (2002), the latter for brief and self-help interventions in particular. In contrast to the treatments assessed by MATCH, one could basically argue that self-help interventions 'all win prizes', as they use similar components to induce behavioural change. Alcohol consumption monitoring and cognitive restructuring, for instance, are therapeutic components of most self-help interventions (Hester, 1995; Miller & Munoz, 1982; Miller & Rollnick, 1991; Miller et al., 2002; Schippers & De Jonge, 2002). Similarly, our meta-analysis of personalised feedback interventions found results for multi-component personalised feedback that were comparable to those for single-component normative feedback. The next question, then, is whether this also holds for the influence of non-specific intervention components? One such component, the therapist-client relationship, is not at play in unguided digital self-help. So what are the common specific and non-specific factors that are decisive in the effectiveness of digital self-help interventions? Could these involve the type of motivated client or the human-digital interaction? 'Dismantling studies' may shed more light on effective treatment components, enabling the quality and effectiveness of digital interventions to be improved.

This book has also shown that digital self-help interventions are effective even after their low compliance rates are taken into account. Low compliance is reported to have a diluting impact on treatment response (Brouwer et al., 2008; Eysenbach, 2005; Ritterband, Andersson, Christensen, Carlbring & Cuijpers, 2006), but its impact on digital self-help is yet not fully understood. Little is known about the reasons why participants fail to adhere to treatment, or drop out before the recommended treatment period is finished. And if low adherence does adversely influence treatment response, how strong is that effect? If it is found to pose insurmountable problems in terms of reduced intervention impact, then the answers may lie in improved intervention design and in better impressing on participants the importance of compliance. Improved screening to help users assess whether they are suited for self-help, or perhaps need more professional guidance, may be another solution. This is already known to improve compliance in digital self-help interventions for depression and anxiety (Cuijpers et al., 2007; Cuijpers, Van Straten & Andersson, 2007; Spek et al., 2007). It would also be worthwhile to investigate whether *guided* self-help for problem drinkers would improve compliance and what form of guidance might be acceptable to this group; some studies have found that problem drinkers with an interest in self-help are not automatically in favour of personal guidance (Cunningham & Breslin, 2004; Koski-Janne & Cunningham, 2001).

If, on the other hand, the low adherence rates prove to have a negligible impact on treatment outcome, then shortening the interventions and accepting the poor compliance might be an answer. After all, low compliance and high participant dropout do not necessarily imply negative treatment outcome. Some dropouts may have quickly attained their alcohol moderation goals; others may have moved on to more intensive treatment (Christensen, Griffiths, Korten, Brittliffe & Groves, 2004; Matano et al., 2007). Whatever the case, new benchmarks are needed to realistically interpret levels of digital intervention compliance and enable comparisons of compliance rates in different types of treatments, such as

brief interventions and pharmaceutical therapies. In other words, more research is needed on the nature and consequences of low compliance and high attrition in digital self-help.

For which problem drinkers is digital self-help suitable?

It is often assumed that brief and self-help interventions are best suited to the less severe problem drinkers (Moyer et al., 2002; Shand, Gates, Fawcett & Mattick, 2003). While this might seem obvious, the evidence base is less robust. Our predictor analysis for Drinking Less, for example, could not confirm that less severe problem drinkers (≥ 21 – ≤ 50 standard units of alcohol weekly for men and ≥ 14 – ≤ 35 for women) had achieved better treatment outcomes after six or twelve months than the more severe ones (> 50 units for men and > 35 for women). If natural remission is high for both the moderate and the more severe problem drinkers, then they both might benefit from low-threshold self-help (De Bruijn, 2005; Van Dijck & Knibbe, 2006) – a proposition that requires further investigation. More research is also needed on the role digital self-help could play in lowering the clinical threshold for people who ultimately need more intensive treatment (Babor, 2008).

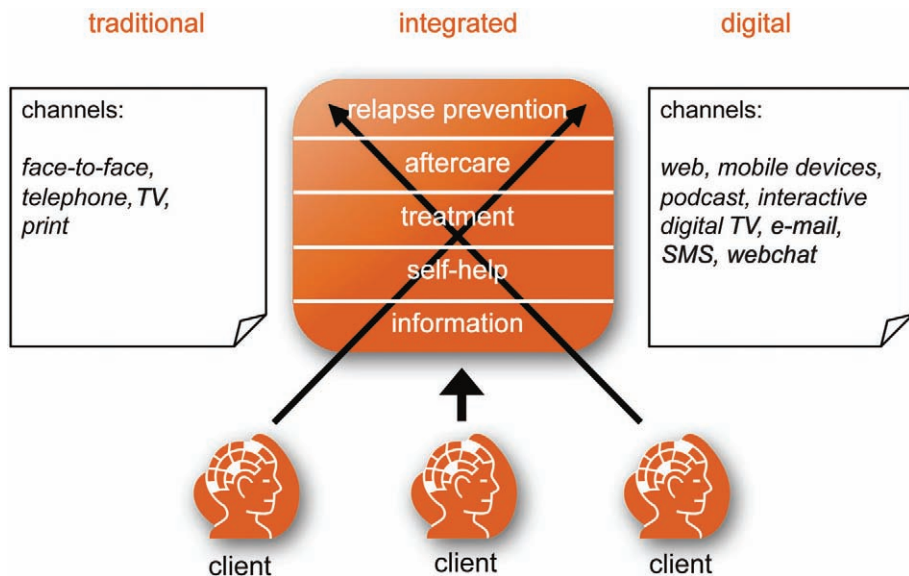
As shown at the beginning of this book, the digital gap is closing between people with PC and Internet access and those without. Some 85% of the Dutch are now online, and initially disadvantaged subgroups like older or ethnic minority people have also gained access (Mira Media, 2008). Hence, a lack of Internet access is not to blame for the digital divide in the utilisation of self-help, but other forms of disparity may still play a role. Low health literacy (Christensen & Griffiths, 2000; Kohn, Saxena, Levav & Saraceno, 2004) or a lack of attractive or meaningful interventions (Glasgow 2007) may be responsible for low uptake of digital self-help interventions. To date, greater percentages of highly educated than lesser educated people use web-based interventions for problem drinking (Cunningham et al., 2004; Cunningham et

al., 2005; Riper et al., 2008). More investigation is needed as to whether improved recruitment strategies or varied types of digital or face-to-face interventions could bridge this non-suitability gap for certain groups.

Can digital self-help interventions be applied in other settings?

It seems worthwhile to investigate the potential of digital self-help beyond its usual application in stand-alone online interventions for self-referred problem drinkers in the general population. It can also be used as a step-up to guided, more intensive online treatment. In the Netherlands, tailor-made online advice (www.drinktest.nl) is now available for people concerned about their alcohol consumption, and it has been shown effective (Boon & Huiberts, 2008; Boon, Risselada, Huiberts & Smit, 2008). In addition to the Drinking Less intervention (www.minderdrinken.nl) that we have found effective, other unguided and guided digital self-help interventions are available from Dutch addiction services, including Jellinek (www.jellinek.nl), Tactus (www.alcoholdebaas.nl; Postel et al., 2005) and Brijder (www.brijder.nl).

figure 8.1 Comprehensive stepped care model



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Further research is recommendable on how these interventions could be implemented within a comprehensive stepped care model offering both online and face-to-face services (see figure 8.1). Many illustrations can be given of the potentials of digital self-help in clinical settings. Among the most significant applications may be in primary care. Opportunistic screening and brief guided interventions can be effective in primary care and can also reach problem drinkers who are less motivated to change (Anderson, Laurant, Kaner, Wensing & Grol, 2004; Ballesteros, Duffy, Querejeta, Arino & Gonzalez-Pinto, 2004; Bertholet, Daeppen, Wietlisbach, Fleming & Burnand, 2005). Nevertheless, large-scale implementation of brief interventions in primary care is still far away (Beich, Thorsen & Rollnick, 2003). GPs are often reluctant to address problem drinking or provide interventions. Often they are simply too busy to offer these or other face-to-face lifestyle interventions, such as those aimed at smoking or diabetes. Yet digital self-help may work efficiently, as shown by Kypri et al. (2008) for problem-drinking adults and students attending primary care services. It would be worthwhile to explore the potential of online alcohol self-help within a broader context of lifestyle interventions. One advantage is that problem drinkers would be invited in less threatening or stigmatising ways to reduce their alcohol consumption (Emmen, Schippers, Wollersheim & Bleijenberg, 2005); another is that it would be time- and cost-effective for GPs. It would require developing what Glasgow (2008) has called generic digital interventions, which work for multiple risk factors across different illnesses and produce beneficial outcomes for multiple health-related behaviours.

Another potential benefit of digital self-help lies in its applicability for people waitlisted for specialised alcohol addiction services. It may tide them over and sustain their readiness to change their behaviour. Specialised services could also use self-help and more intensive digital interventions as components of their face-to-face treatment. That could improve the quality of face-to-face treatment and shorten its duration. Evidence for the effectiveness of opportunistic brief

interventions for problem drinkers in general hospital settings or casualty departments is still inconclusive (Emmen, Schippers, Bleijenberg & Wollersheim, 2004), but a recent review by Nilsen et al. (2008) has shown promising results for alcohol moderation in emergency patients. The use of mobile telephones to deliver brief interventions to problem drinkers after their discharge from emergency departments may be a new avenue, as a recent study by Mello et al. (2008) illustrates.

8.6 TEN GUIDELINES FOR FUTURE RESEARCH AND ROUTINE PRACTICE

When we started our first study, the notion of web-based self-help for problem drinking was perceived as far-fetched by many in the addiction field and the academic world. Today, more than a billion users are connecting together digitally to exchange social, academic and entertainment information. Imagining ways in which new digital technologies might improve public health approaches to problem drinking is a necessary but still risky exercise – necessary, because it can explore alternative avenues to tackle alcohol misuse; risky, because of the frequent tendency to dwell on what is not yet possible. Predicting the future is an impossible task anyhow. What I aim to do in this final section, though, is to explore some of the potentials that new digital technologies might have for curbing problem drinking. The next generation of digital prevention and treatment will presumably make use of integrated media channels such as Internet, mobile phones and television. Today over 1.3 billion people have adapted to a digital lifestyle, with the Internet being used by around 20% of the world's population and by 85% of the Dutch (Internet World Stats, 2008). An even higher penetration rate of 50% exists for mobile phones worldwide (80% in the Netherlands; International Telecommunications Union, 2008). Meanwhile, these two digital channels are merging. An estimated 70% of mobile phone

users will be using their mobile devices for Internet access within the next five years (International Telecommunications Union, 2008). All this is culminating in a 'digital galaxy', where everyone is connected to information (and to everyone else).









New generations of digital technologies are being developed, fuelling ongoing phases of transition in the World Wide Web and other media. Presumably we are now on the eve of Web 3.0. Web 2.0 represented a transition from the mainly information retrieval (reading) capacities of Web 1.0 to a 'read-and-write' stage (O'Reilly, 2005), enabling Internet users to become 'prosumers' rather than solely consumers of information. The idea of Web 3.0 has been introduced to hypothesise about what might be called 'the intelligent Web', which would use a machine-facilitated understanding of information to provide a more productive and intuitive user experience (Spivack, 2006). According to Charles Leadbeater (2008), social media, which allow involvement by many participants, will continue to play an important part in Web 3.0 developments, possibly resulting in 'mass innovation' as opposed to 'mass production'. In describing this development, Leadbeater has rephrased Descartes's *cogito ergo sum* ('I think, therefore I am', 1637) as We-Think (therefore we are). Social media consist of collaborative web-based tools, such as wikis, blogs and podcasts. These communication devices could also be of use in public health and treatment strategies for problem drinking (Boulos, Maramba & Wheeler, 2006). Podcasts, for instance, have the potential to offer interventions to those groups who prefer, or need, spoken communication, such as the visually impaired. Vodcasts (video podcasts) could be used for those who need or prefer visual communication, such as people with hearing impairments.

The potential of virtual reality for treatment and research endeavours is another avenue worth exploring. Virtual reality allows users to interact with a computer-simulated environment, as in Second Life (Emmelkamp, 2005; Looi et al., 2007). It can be used as a web-based experimental laboratory, as Wiers and

colleagues (Wiers et al., 2006) did in investigating the role of implicit cognitions at play in alcohol consumption.

A recent poll showed that 3 out of 4 Dutch people above 8 years of age are involved in some form of digital gaming (TNS-NIPO & Newzoo, 2008). A development called 'serious gaming' is now becoming an important component of a broad range of services beyond the usual applicability of computer games. Examples can be found in education and finance, as well as in health-oriented applications for gaming consoles such as the Wii (GamePro, 2008).

figure 8.2 Explanation of terms

	Avatar: A user's representation of himself or herself used on Internet forums and other communities
	Blog: A contraction of 'weblog' – an online web journal that can offer a resource-rich multimedia environment
	Cloud computing: Use of internet- ('cloud')based applications and services such as Google Apps
	Crowdsourcing: Mass collaboration enabled by Web 2.0 to achieve goals such as Wikipedia
	Podcast: Repositories of audio and video materials that can be 'pushed' to subscribers, to be used on portable devices
	SMS: Short message service, text interchange service on mobile phones, also know as 'text messaging' or 'texting'
	Virtual reality: A technology that allows users to interact with and in a computer simulated environment such as Second Life
	Wiki: Website that can be edited by anyone. Wikipedia is the well know web-based, free-content encyclopedia project.

Source: Wikipedia 2008: www.wikipedia.org

A new generation of digital self-help interventions for problem drinking could be improved by including serious gaming components like avatars, through which client and therapist could experiment with different roles and situations, such as alcohol cue exposure (Looi et al., 2007). Adding these components may increase the attractiveness of the interventions or boost intervention compliance. While an exploration of these developments is beyond the scope of this study, it is not unreasonable to imagine that they may all impact upon how we shape future digital interventions. Research should explore ways to integrate such tools into interventions for problem drinking.

10 R's for future research

Early this decade, Eysenbach (2001) introduced a framework to guide e-health into the 21st century. He summarised it in 10 E's, indicating that the 'e' in 'e-health' means more than just 'electronic communication'. It also stands for (1) efficiency, (2) enhancing quality, (3) evidence-based, (4) empowerment, (5) encouragement, (6) education, (7) enabling information exchange and communication, (8) extending the scope of health care, (9) ethics and (10) equity. He adds that e-health should be easy-to-use, entertaining, exciting and that it should exist. Eysenbach's framework is still invaluable as a guide to developing digital interventions. Given the current state of practice, research and development, I believe it is now time to expand it with supplementary premises that I will call the 10 R's (see also Riper, 2007). The 10 R's can serve as guidelines for both research and practice relating to digital prevention and treatment for problem drinking in the years to come. They apply to the third wave of digital interventions, and they highlight issues in implementation and dissemination as well as in development and evaluation.

(1) Road map

A road map for evidence-based development, implementation and dissemination strategies should be designed. It will provide an impetus for digital interventions for problem drinking.

(2) Replication and robustness

There is promising evidence that digital interventions can be successful in curbing problem drinking, but the evidence base needs to be strengthened on a number of issues. Few studies have assessed the cost-effectiveness of interventions, and few trials have been replicated. More randomised trials are needed to assess the robustness of available results and to shed light on unanswered issues raised in the present study: (1) the effective components of digital interventions, (2) the dose-response relationship, (3) the types of problem drinkers for whom digital interventions are best suited and (4) ways to improve treatment compliance. These issues are relevant to the entire continuum of digital alcohol services, from prevention and treatment to aftercare measures such as relapse prevention.

(3) Research and response monitoring online

The use of web-based surveys and methods has expanded astronomically in the past decade. All studies presented in this book were conducted online. Both the potentials of online research and the current constraints need further evaluation, extending to all aspects of evaluation research, such as screening, diagnosis and assessment of intervention outcomes. Online surveying, including randomised trials, can produce data rapidly and efficiently. Research has also shown that study participants prefer to reveal sensitive data online and that online surveys lower the threshold for participation (Sutter & Klein, 2007).

Technological developments have opened up efficient ways to question participants, such as computer-adaptive testing (CAT). CAT procedures make it possible to assess a person's problem-drinking status with a minimum number

of the questions normally required (McGlohen & Chang, 2008). The monitoring of intervention delivery and the automatic monitoring of treatment response within a disease management approach are further potentials of digital intervention and research. Possible drawbacks of online surveying such as 'easy access, easy dropout' are meanwhile well known phenomena. For most of the pros and cons of online monitoring and research, systematic evaluation has yet to take place on how they might affect the measurement of treatment outcomes (Dillman & Smyth, 2007).

(4) Reach

The digital divide in terms of PC and Internet accessibility is narrowing, at least in Western countries. But ready access to digital interventions is not a sufficient condition for tackling problem drinking. To significantly extend the reach of such interventions, one must make sure they are meaningful and acceptable to a wide range of problem drinkers, including those who are not yet motivated to change and those who do not fare well with cognitive-behavioural interventions. As yet, few digital interventions are available for groups like these.

(5) Recruitment

Although access to digital interventions seems guaranteed by the increasing PC and Internet penetration in Western societies, little is known about cost-effective recruitment strategies for attracting problem drinkers to these interventions. Even less is known about recruitment of groups not yet adequately reached, like younger and older problem drinkers or people whose religion or culture condemns alcohol use.

(6) Risk assessment and trust confirmation

Few studies have addressed the potential risks of using digital self-help. These include insufficient client data protection and unexpected consequences from participation in user forums. Strategies must be developed to communicate these

potential risks to users and providers. The quality of digital interventions should be assured by developing a benchmark endorsed by stakeholders (clients, providers, insurance companies, health authorities).

(7) Referral

The successful recruitment of problem drinkers who are not yet motivated to change requires the involvement of primary and secondary care professionals. Effective referral procedures from first-step digital interventions like self-help to more intensive online or face-to-face treatment services should strengthen the health and social impact of these interventions. Such referral procedures still need to be developed.

(8) Return on investment

More knowledge is needed of the costs for developing, disseminating and maintaining digital interventions. Dissemination costs of digital self-help are low, but start-up costs, such as for intervention development or the provision of new releases, are substantial. Moreover, it has not yet been resolved who will pay for implementing anonymous, unguided self-help digital interventions – and why they should pay. While the health and social benefits of large-scale implementation are clear, the economic gains at individual, organisational and population levels need further exploration.

(9) Remission & relapse

More insight is required into natural versus guided remission and relapse prevention, including how the former can contribute to improving the latter and vice versa. Online communities and user discussion forums are two widely used elements of self-help interventions. Such online support groups could be sources of valuable knowledge about how problem drinkers can help one another in moderating alcohol consumption. It is unclear, however, whether research evidence exists on the role of these forums.

(10) Realism & ranking

Priority should be given to further developing and evaluating user-centred intervention models for use by health care and prevention services in daily practice. This should include participant evaluation. Such models would make it possible to approach problem drinkers during their behavioural change process. Realism also compels an awareness that digital intervention alone cannot reduce the total prevalence and burden of problem drinking. Integrating such interventions with public health measures such as environmental strategies is therefore advisable.

We believe that research based on these ten guidelines will help to improve evidence-based public health approaches for combating problem drinking. A blend of new and old media will make it possible to reach out to the heterogeneous group of adult problem drinkers. If effectively implemented, such an approach should bring about health improvements and economic gains at the population level.

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Summary

SUMMARY

Primary research questions (chapter 1)

The central question in this book is whether problem drinking can be curbed by using a new generation of motivational and cognitive-behavioural digital self-help interventions.

Background

Problem drinking is multi-faceted in nature, and so is the problem-drinking population. An estimated 10% of Dutch adults qualify as problem drinkers year by year. They exceed the recommended guidelines for low-risk drinking and may experience psychological, physical or social problems as a consequence. Alcohol misuse is associated with elevated morbidity and mortality levels, and it has considerable social and economic ramifications. At the same time, general and specialised health service uptake by problem drinkers remains low at about 10%.

Although problem drinking has reasonably high rates of natural remission, many problem drinkers still have unmet needs. They often experience high access barriers to health services, attributable partly to fears of stigmatisation, loss of privacy or problems in work or family, and partly to a lack of motivation to change their behaviour. Meta-analyses show that opportunistic screening and brief intervention in primary care settings can be effective strategies for overcoming low service uptake and reducing alcohol consumption among people who use primary care. Yet many problem drinkers are not in contact with primary care services, or they are not recognised there as problem drinkers. Moreover, brief interventions are only sparsely available in routine primary care practice, and this seriously limits the public health impact of brief interventions for problem drinking. Alternative ways of reaching out to problem drinkers are therefore needed. Digital self-help interventions aimed at the general population are one such alternative.

Is web-based self-help cost-effective and for whom? (chapter 2-4)

Drinking Less (DL) is an interactive web-based self-help intervention without therapeutic guidance. It assists problem drinkers in their attempts to moderate their alcohol consumption. Our first hypothesis was that DL would be more effective than an online psychoeducational brochure in reducing problem drinking six and twelve months later. Participants ($N = 261$) were included in the study as 'problem drinkers' if they were exceeding the limits specified by the Dutch guidelines for low-risk drinking (male/female $> 21/14$ standard units of alcohol per week or $\geq 6/4$ units at least one day a week for the past three months). They were randomly allocated to the DL intervention condition ($n = 130$) or the psychoeducation control condition ($n = 131$). The vast majority had never received professional help for their problem drinking.

Six months after baseline, significantly more participants in the DL condition (17.2%) than controls (5.4%) were drinking within the guideline levels (OR = 3.66; 95% CI 1.3–10.8; $P = .006$; NNT = 8.5). DL was also effective in decreasing mean weekly alcohol intake (by 15 units) relative to the control condition (2.9 units; $d = 0.40$; 95% CI 5.9–18.1; $P < .001$). This six-month effectiveness of DL is comparable to that found in meta-analyses for brief interventions, and the NNT of 8.5 is comparable to the figures of 7 to 8 achieved by brief face-to-face advice in primary care (chapter 2).

Cost-effectiveness is another important indicator of the potential for widespread implementation of DL into daily practice. As no cost-effectiveness studies of digital self-help interventions for problem drinkers had yet been done, we conducted an economic evaluation of DL treatment response in terms of drinking within the low-risk guideline levels twelve months after starting the intervention (chapter 3). The hypotheses were that DL would not significantly lower the costs of health care utilisation (because the group of problem drinkers interested in self-help would not make much use of such services anyway) but that cost reductions would nevertheless be achieved by curbing production

losses due to absenteeism (work-loss days) and poor job performance (work-cutback days).

Although the difference between the experimental and control conditions in terms of low-risk drinking according to the guideline was no longer statistically significant at the twelve-month follow-up (OR = 1.74; $P = .30$), DL was nonetheless associated with favourable economic effects. The intervention showed a robust 73% probability of being acceptable from a cost-effectiveness point of view. The slightly higher costs of DL in comparison to the psychoeducational control intervention were more than offset by lower costs elsewhere, mainly by virtue of reduced production losses through better work performance.

Subsequently we asked whether *specific* baseline characteristics of DL users could be identified as predictors of positive response in terms of reduced alcohol consumption (chapter 4). To this end we conducted a secondary analysis of the DL trial data, designating six baseline participant characteristics as putative predictors of treatment response: (1) gender, (2) education, (3) Internet competence, (4) mean weekly alcohol intake, (5) prior professional help for alcohol problems, and (6) participants' expectancies of web-based interventions for problem drinking.

At twelve months, female gender (beta = .22, $P = .045$, $R^2 = .02$) and higher level of education had modest predictive power (beta = .33, $P = .01$, $R^2 = .03$). These results suggest that web-based self-help without therapeutic guidance may hold a slightly stronger attraction for female or more highly educated problem drinkers. These are also population segments that might be difficult to reach with face-to-face brief interventions. At the same time, since none of these baseline characteristics persuasively predicted a favourable treatment outcome, the intervention may still be deemed well suited for a heterogeneous group of problem drinkers.

Effectiveness of web-based self-help in daily practice (chapter 5)

Little is known about how to translate the new generation of digital self-help interventions tested in randomised trials into routine daily practice. We assessed whether the improved six-month drinking response found in our Drinking Less randomised trial (DL-RCT) would be sustained when DL was implemented into routine practice (DL-RP). For this purpose, we gave the general public anonymous, free access to DL on a 24/7 basis and conducted an online pragmatic cohort study. A total of 378 of the 1,625 people who registered for DL from May to November 2007 took part. Primary outcome measures were identical to those of the DL-RCT study.

In the DL-RP condition, 18.8% of participants ($n = 71$) were drinking successfully within the prescribed limits at six months after baseline; the DL-RP group had also decreased its mean weekly alcohol intake by 7.4 units ($d = 0.29$, $P < .001$). The alcohol reduction in DL-RP was of a similar magnitude to that in DL-RCT in terms of drinking within the guidelines and mean weekly intake. The results demonstrate that web-based self-help without therapeutic guidance is feasible, well accepted and effective in treating adult problem drinking in daily practice.

Effectiveness of a television-based self-help intervention (chapter 6)

Television, like the Internet, could potentially enable low-threshold, low-cost dissemination of interventions for problem drinking. We therefore investigated the effectiveness of a televised self-help course. We hypothesised a beneficial posttreatment effect in terms of reduced alcohol consumption as compared to a waitlisted control condition. To our knowledge this was one of the first randomised controlled trials of a television-based self-help intervention for problem drinking in the general population.

Dutch television viewers ($N = 181$) who were drinking in excess of the low-risk alcohol guidelines were included in the study. They were randomly assigned either to the *Drinking Less* self-help course (consisting of five televised sessions,

a self-help manual and an associated self-help website) or to a waitlisted control group. To ensure that the control group had no access to the intervention during the trial, broadcast delivery was mimicked beforehand by sending course participants five weekly DVDs in advance of the actual telecasts in 2006. At the five-week posttest, intervention participants were significantly more likely to be adhering to the guidelines than those in the waitlist group: 36 participants (40%) versus 6 controls (6.6%; OR = 9.4, $P < .001$). Intervention participants had also moderated their mean weekly alcohol consumption by a significantly greater amount than the controls. The between-group difference showed a large, clinically important standardised differential effect size ($d = 0.90$, $P < .001$). The effects were maintained in the intervention group at three months. The television-based course *Drinking Less* thus appears effective in reducing alcohol consumption in the short term.

***How minimal and non-intrusive can self-help interventions be?
(chapter 7)***

The results of our studies led us to ask how brief one could actually make self-help interventions for problem drinkers and still have them be effective. We therefore conducted a meta-analysis on the effectiveness of single-session, personalised feedback without therapeutic guidance (PF) in reducing problem drinking. No such meta-analysis had previously been carried out. PF interventions provide personal feedback on an individual's alcohol consumption patterns. The feedback may consist of different components, such as an overview of mean weekly alcohol intake, blood alcohol concentrations, associated health and social risks of excessive alcohol use, and normative feedback. Our expectation was that PF interventions would be more effective than non-intervention in reducing problem drinking.

The relevant studies were identified in 2008 through systematic searches in various bibliographical databases. The pooled standardised effect size (14 studies, 15 comparisons) for reduced alcohol consumption at post-

intervention was $d = 0.22$ (95% CI: 0.16–0.29; NNT 8.06). Single-session PF without therapeutic guidance thus appears to be a viable, and probably cost-effective, option to curb problem drinking in student and general populations. The Internet offers ample opportunities to deliver PF on a broad scale.

Limitations of the studies

It is important to critically evaluate the results reported here in the light of limitations of the underlying studies. The most important of these limitations are summarised below.

Public health perspective

The first limitation relates to the public health strategy we chose for tackling problem drinking in the adult general population. Our focus was on digital self-help interventions. The impact of other intervention strategies such as tax legislation, drink-driving laws or alcohol advertising bans was not studied. Behavioural change, of course, is very complex and is influenced by multiple individual, social and environmental determinants. To curb problem drinking, all these strategies are required, preferably in an integrated approach that can influence drinking behaviours on a population level.

Target group

Problematic alcohol consumption appears in many forms. The focus here was on problem drinkers who had an interest in unguided digital self-help and a desire to moderate their alcohol intake. The results can therefore be generalised to this group only. Moreover, as we kept our study exclusion criteria to a minimum, we did not conduct diagnostic interviews. It is therefore unknown what percentage of the samples would have met the diagnostic criteria for alcohol abuse or dependence. Yet given the high levels of mean weekly alcohol intake and alcohol-related problems reported at baseline, we appear to have reached a high-risk group.

Long-term effectiveness of Drinking Less

At the twelve month follow-up, the difference between the experimental and control conditions was no longer significant, mainly due to improvement in the control group. The twelve-month results for DL-RP will be available in 2009. For the television-based DL intervention, the trial results for posttreatment response could only be obtained at five-week follow-up. Further investigation into the maintenance of clinical improvements over longer time periods is therefore warranted.

Loss to follow-up

Two of our studies (DL-RCT and DL-RP) had high rates of participant loss to follow-up (around 45%) – a well known feature of many alcohol intervention studies. Loss to follow-up appears higher for interventions delivered over the Internet, as easy accessibility may also mean easy dropout. While we dealt with this problem as rigorously as possible in our analyses, it remains a point of concern and it may have somehow biased our study results.

Predictor analysis

The number of putative predictors in our secondary analysis of DL-RCT was kept to a minimum and was appropriate in relation to the sample size. However, false-positive or false-negative predictors as a result of multiple testing cannot be ruled out. The fact that we detected different predictors at six- and twelve-month follow-up could mean that different factors operate at different stages during the post-intervention period.

Drinking Less in routine practice

One out of four users who initially registered for DL in daily practice took part in our online survey. This may reflect a selection bias between those who registered for the DL self-help intervention and those who registered but participated in the study as well. Since the DL-RP study was uncontrolled, the

data can only show whether the use of DL was correlated with improved drinking outcomes, and not whether any association was causal. Our comparison of DL-RP with the randomised controlled trial DL-RCT did, however, suggest evidence for causality.

Conclusions and beyond (chapter 8)

The overall findings point to a sizeable population of problem drinkers who are motivated to seek digital self-help without therapeutic guidance and who may do so effectively. Our outcome studies have shown small to medium effects for digital self-help interventions in reducing problem drinking. Such interventions could therefore have an important public health impact, provided that they can be disseminated on a large scale at relatively low cost. Our routine practice study (DL-RP) showed that this is a viable prospect. Digital self-help could be offered as a first step within a stepped care approach to problem drinking. That would allow users to move on to booster sessions or more intensive treatments either online or face-to-face, such as maintenance therapy or relapse prevention, should that be necessary. But while the potential public health impact is encouraging, the results also show that not all problem drinkers benefit from digital self-help. Formidable challenges remain to ensure that additional interventions and recruitment strategies are in place for groups not reached by digital self-help.

There are signs that the Netherlands is now developing this public health approach to problem drinking. Both the control of alcohol misuse and the provision of digital self-help are now recognised by Dutch national policy as promising prevention strategies. Addiction agencies delivering prevention and treatment services are becoming increasingly digitally enabled. Health authorities and insurance companies are exploring what role digital interventions might play in health service delivery and the related insurance coverage. Yet the most salient driver of such developments may be the very group whose health is at stake – problem drinkers in the general population.

Ten recommendations (**10 R's**) are presented here to guide research and routine practice involving digital prevention and treatment in the coming years. These guiding premises include designing a **road map** for evidence-based development, implementation and dissemination strategies for digital interventions to curb problem drinking. This could function as a framework to initiate **randomised controlled studies** on cost-effectiveness, effectiveness of specific intervention components, dose-response relationships, and improving compliance and lowering dropout rates in interventions and studies. **Replication** of our studies is needed, to test the robustness of the findings and to strengthen the evidence base for digital interventions aimed at problem drinking. This approach could be further enhanced by digital surveying methods, which can produce data rapidly and efficiently and can unobtrusively monitor treatment. A powerful potential of digital intervention research is the automatic monitoring of treatment **responses** within a disease management approach. To broaden the **reach** of digital interventions, these should not only be accessible to a wide range of problem drinkers, but should also be meaningful and acceptable to them. Alternative digital interventions need to be developed and evaluated for groups not yet reached, such as problem drinkers who do not fare well with cognitive-behavioural interventions, individuals with lower educational backgrounds, younger and older problem drinkers or people whose religion or culture condemns alcohol use. This requires more insights into cost-effective **recruitment strategies** for attracting diverse groups of problem drinkers to digital interventions. Successfully recruiting problem drinkers not yet motivated to change requires the further development of effective **referral procedures**. These may include referrals from first-step digital interventions to more intensive online or face-to-face treatment services, and need the involvement of primary and secondary care providers. This means more knowledge is needed about the actual costs of developing, evaluating, disseminating and maintaining digital interventions. While the health and social

benefits of large-scale implementation are already clear, further exploration is needed of the potential **returns on investment** strategies and the potential economic costs and gains at individual, organisational and population levels. Many of the proclaimed benefits of digital prevention and treatment interventions for problem drinking still lack an empirical basis, and potential drawbacks are not yet fully understood. The potential **risks** of using digital self-help need to be further investigated. These include insufficient client data protection, unexpected consequences of participation in user forums, and possible negative side-effects of early treatment dropout. Many such risks might be overcome by developing a benchmark endorsed by key stakeholders (clients, providers, insurance companies, health authorities), which could assure the quality of digital interventions. More insight is also needed into the workings of *natural* versus *guided* **remission** and relapse prevention and into the role that digital intervention could play in strengthening such processes. Priority should be given to further developing and evaluating user-centred intervention models suitable for use in daily practice. This might include a **ranking of interventions** by the participants themselves. It might also involve analysing the influence that participants' choice of treatment might have on treatment response or the influence that posttreatment factors (such as social support) might have on the maintenance of treatment gains. **Realism** compels an awareness that digital intervention alone cannot reduce the total prevalence and burden of alcohol misuse. Integrating such interventions with public health measures such as environmental strategies is therefore advisable.

We believe that research based on these ten guidelines will help to improve evidence-based public health approaches to problem drinking. A blend of new and old media will make it possible to reach out to the heterogeneous group of adult problem drinkers. If effectively implemented, such an approach should result in both health improvements and economic gains at the population level.

Samenvatting

SAMENVATTING

Centrale vraag

De centrale vraag is of problematisch alcoholgebruik gereduceerd kan worden door de inzet van een nieuwe generatie van digitale zelfhulpinterventies.

Uitkomsten

De algemene bevindingen van deze studies laten zien dat een flink aantal probleemdrinkers gemotiveerd is om met digitale zelfhulp zonder therapeutische begeleiding hun probleemdrinken aan te pakken. Bovendien, doen zij dit met succes. Bij grootschalige verspreiding kunnen digitale zelfhulpinterventies, zoals MinderDrinken, tegen lage kosten een grote invloed op alcoholreductie op populatieniveau hebben. Het onderzoek naar MinderDrinken in de dagelijkse praktijk toont aan dat zo'n verspreiding een haalbare en effectieve optie is. Digitale zelfhulp kan hiermee worden aangeboden als eerste stap in een *stepped care*-benadering van probleemdrinken. Als dat nodig is, kunnen booster-sessies of meer intensieve therapie, zowel offline als online aangeboden worden. Ook zelfmanagement en terugvalpreventie kunnen deel uitmaken van deze *stepped care*-benadering.

Waarom dit onderzoek?

Volgens schattingen is op jaarbasis één op de tien volwassen Nederlanders een probleemdrinker. Ze drinken meer dan de richtlijnen voor verantwoord alcoholgebruik en ondervinden hiervan vaak fysieke of psychosociale problemen. Slechts 10% van de probleemdrinkers doet een beroep op de algemene of specialistische zorg.

Er is ook een de andere kant: een substantieel deel van de probleemdrinkers komt van hun schadelijke alcoholgebruik af door natuurlijk herstel. Dat wil zeggen, zonder tussenkomst van professionele hulpverlening. Maar er blijft een grote groep probleemdrinkers die wel behoefte heeft aan professionele hulp.

Ze vragen echter geen hulp, omdat ze hoge drempels ervaren. Dit heeft te maken met angst voor stigmatisering, verlies van privacy en baan, en een gebrek aan motivatie om het schadelijke alcoholgebruik met gedragstherapie te veranderen. In de eerstelijnszorg kan weliswaar een aantal probleemdrinkers over deze drempel worden geholpen, maar hiermee wordt niet de grote groep probleemdrinkers bereikt die niet als zodanig wordt herkend, of die überhaupt geen beroep op de eerstelijnszorg doet. Dit maakt andere manieren om de groep van probleemdrinkers te bereiken wenselijk, zo niet noodzakelijk. Digitale zelfhulpinterventies zijn een van deze alternatieve manieren.

Het onderzoek

Opzet en uitkomsten deelonderzoeken

De centrale onderzoeksvraag is verdeeld over zes empirische studies met elk een focus op een ander aspect dat van invloed kan zijn op de effectiviteit van digitale zelfhulpinterventies. De eerste 3 vragen zijn beantwoord in een gerandomiseerd, gecontroleerd effectonderzoek, een zogenoemde RCT. Onderzocht werd MinderDrinken. Dit is een interactieve web-based zelfhulpinterventie zonder begeleiding van een hulpverlener. Het helpt probleemdrinkers in hun streven minder alcohol te drinken.

1. Is de digitale interventie MinderDrinken effectief?
2. Is MinderDrinken kosteneffectief?
3. Kunnen we voorspellers definiëren voor een positief behandelresultaat van MinderDrinken?
4. Is deze interventie in de dagelijkse praktijk ook effectief?
5. Zijn TV-gebaseerde interventies effectief?
6. Hoe minimaal en laagdrempelig kunnen zelfhulpinterventies zijn?

Effectiviteit (hoofdstuk 2)

De hypothese in dit deel van het onderzoek was dat MinderDrinken bij 6 en bij 12 maanden follow-up effectiever is dan een online psycho-educatieve informatiebrochure, als het gaat om het verminderen van problematisch alcoholgebruik. Hiervoor hebben we een RCT uitgevoerd. Er namen 261 personen deel die meer dronken dan de richtlijn voor verantwoord alcoholgebruik. Na de beginmeting is de ene helft toegewezen aan de experimentele MinderDrinken-groep, de andere helft aan de controlegroep met de online brochure.

Na 6 maanden dronken significant meer deelnemers aan MinderDrinken binnen de richtlijn dan die aan de controlegroep: 17,2% tegenover 5,4%.

MinderDrinken bleek ook effectief in het verminderen van de gemiddelde wekelijkse alcoholconsumptie: 15 eenheden minder tegenover 2,9 eenheden in de controlegroep. Deze effectiviteit van MinderDrinken na 6 maanden is vergelijkbaar met die gevonden in meta-analyses van kortdurende interventies. De geschatte *number needed to treat* (NNT) van 8,5 is vergelijkbaar met de NNT-aantallen tussen de 7 en 8 die zijn berekend voor kortdurende face to face-interventies in de eerstelijnszorg.

Kosteneffectiviteit (hoofdstuk 3)

Naast de klinische effectiviteit was ook onderzoek naar de kosteneffectiviteit van digitale zelfhulp interventies voor probleemdrinken nog niet eerder uitgevoerd. Daarom voerden we een economische evaluatie uit van MinderDrinken in termen van het aantal deelnemers dat succesvol dronk binnen de richtlijn, en wel 12 maanden na het begin van de interventie. De hypothese was dat de kosten voor gezondheidszorg in de MinderDrinken-groep niet significant zou verminderen, omdat de groep van probleemdrinkers met een interesse in zelfhulp nauwelijks gebruik maakt van zorg. Kostenbesparingen

kunnen echter ook komen door verminderd productieverlies, door bijvoorbeeld minder ziekteverzuim en minder verlies door verminderde arbeidsprestaties.

Na 12 maanden was er in termen van drinken binnen de richtlijn, geen statistisch significant verschil meer tussen de MinderDrinken en de controlegroep. Toch kon MD na 12 maanden geassocieerd worden met gunstige economische effecten. De licht hogere additionele kosten van MD in vergelijking met de controle-interventie werden ruimschoots gecompenseerd door minder overige kosten in de MinderDrinken-groep, voornamelijk door minder productieverlies vanwege meer efficiënte arbeidsprestatie in deze groep.

Voorspellers (hoofdstuk 4)

Aanvullend stelden we ons de vraag of we voorspellers konden identificeren voor een positief MinderDrinken-behandelresultaat, in termen van verminderde alcoholconsumptie. Zes deelnemerskarakteristieken zijn aangewezen als mogelijke voorspellers van een positieve behandeluitkomst: sekse, educatie, internet-gebruiksvaardigheden, gemiddelde wekelijkse alcoholconsumptie, eerdere professionele hulp voor alcoholproblemen, en verwachting van de deelnemer van digitale interventies voor probleemdrinken.

Vrouwelijk geslacht had na 12 maanden een gematigd voorspellende waarde, evenals een hoger opleidingsniveau.

Deze resultaten suggereren dat digitale zelfhulp zonder begeleiding mogelijkwijs in het bijzonder aantrekkelijk is voor vrouwen en hoger opgeleiden. Deze beide groepen zijn over het algemeen moeilijk te bereiken met kortdurende face to face-interventies in de eerstelijnszorg.

In zijn algemeenheid moeten we echter stellen dat geen van de geïdentificeerde kenmerken overtuigend een positieve behandeluitkomst kon voorspellen.

De dagelijkse praktijk

De effectiviteit van interventies in de dagelijkse praktijk kan afwijken van de effectiviteit van interventies in strak gecontroleerde settings. Voor grootschalige implementatie is het daarom belangrijk om te weten wat het effect is in de dagelijkse praktijk. We onderzochten de effectiviteit van MD in de dagelijkse praktijk en vergeleken deze effectiviteit met die van de resultaten van de RCT. We stelden MD gratis en anoniem beschikbaar aan het algemene publiek op een 24/7-basis. Van 1625 mensen die zich hadden geregistreerd namen 378 personen deel aan het onderzoek. Van deze laatste groep dronken 360 deelnemers meer dan de richtlijn voor verantwoord drinken.

Na 6 maanden dronk 18,8% binnen de richtlijn voor verantwoord drinken. Het gemiddelde wekelijkse alcoholgebruik daalde in deze groep met 7,4 standaard eenheden. De resultaten (drinken binnen de richtlijn en het wekelijkse gemiddelde) verschilden niet significant van de resultaten van de RCT-groep. Dit wijst erop dat digitale zelfhulp zonder therapeutische begeleiding haalbaar, geaccepteerd en effectief is in de dagelijkse praktijk bij het verminderen van probleemdrinken.

Effectiviteit TV-gebaseerde zelfhulpinterventies (hoofdstuk 6)

Publieke TV-uitzendingen kunnen, net als internet, een belangrijke rol spelen bij de verspreiding van laagdrempelige interventies tegen lage kosten. TV is hiervoor nog slechts beperkt ingezet en over de effectiviteit hiervan is zeer weinig bekend. Daarom hebben we een RCT uitgevoerd naar de effectiviteit van een televisieserie van Teleac (Minder Drinken? Doe het zelf!). Deze was gericht op het reduceren van problematisch alcoholgebruik. De hypothese was dat deelnemers aan ‘Minder Drinken? Doe het zelf!’ meer volgens de richtlijn voor verantwoord alcoholgebruik zouden drinken in vergelijking met de wachtlijst controlegroep. 181 Nederlandse televisiekijkers die meer dronken dan de Nederlandse richtlijn voor verantwoord alcoholgebruik hebben deelgenomen

aan de studie. Ze zijn verdeeld in twee groepen: De Minderdrinken-TV-zelfhulp cursus of een wachtlijst-controlegroep. De zelfhulp cursus bestond uit 5 afleveringen, een zelfhulpboek en een bijbehorende website. Het onderzoek vond plaats voorafgaande aan de daadwerkelijk landelijke uitzending. Dit voorkwam dat de controlegroep de televisie-uitzendingen zou kunnen zien. De Minderdrinken-TV-groep kreeg de TV-afleveringen op DVD in 5 achtereenvolgende weken.

Na 5 weken dronken deelnemers aan de Minderdrinken-TV-interventie significant vaker binnen de richtlijn dan de wachtlijst controlegroep: 40% tegenover 6,6%. Ook het gemiddeld alcoholgebruik per week was in de interventiegroep significant lager dan in de controlegroep. Het positieve effect in de Minderdrinken-groep hield ook na 3 maanden aan. Daarmee lijkt aangetoond dat de TV-interventie Minderdrinken effectief is in het verminderen van alcoholgebruik op de korte termijn.

Minimaal en laagdrempelig (hoofdstuk 7)

De resultaten van onze voorgaande onderzoeken bracht ons tot de vraag hoe minimaal en laagdrempelig zelfhulpinterventies voor probleemdrinken kunnen zijn. Om deze vraag te beantwoorden is een meta-analyse uitgevoerd op de effectiviteit van eenmalig persoonlijk advies zonder therapeutische begeleiding voor het reduceren van probleemdrinken. Een dergelijke meta-analyse was nog niet eerder uitgevoerd. Dergelijke interventies geven advies over het individuele alcoholgebruik van mensen die zo'n advies aanvragen. Dit advies kan bestaan uit meerdere onderdelen, zoals een overzicht van wekelijkse alcoholconsumptie, alcoholconcentratie in het bloed, gezondheidsrisico's, sociale risico's en normatieve feedback. Onze verwachting was dat deze interventievorm effectiever is dan geen interventie voor het verminderen van probleemdrinken.

De conclusie uit de meta-analyse is dat eenmalig persoonlijk advies zonder therapeutische begeleiding een haalbare en effectieve optie is voor het reduceren van probleemdrinken onder zowel studenten- als volwassenenpopulaties. Het internet biedt een goede mogelijkheid om deze interventie op grote schaal aan te bieden.

Beperkingen van het onderzoek

De resultaten en conclusies moeten worden gezien in het licht van de beperkingen van de hier besproken onderzoeken.

Volksgezondheid

Gedragsverandering is complex van aard en wordt beïnvloed door vele individuele en omgevingsfactoren. Ons onderzoek richtte zich op digitale zelfhulpinterventies voor het reduceren van probleemdrinken. Uitgangspunt was volksgezondheid. De invloed van andere interventies zoals accijsregels, wetgeving voor alcohol in het verkeer, en advertentierichtlijnen zijn in onze studies niet onderzocht. Om probleemdrinken op populatieniveau maximaal te verminderen zijn echter al deze strategieën nodig, bij voorkeur in een integrale aanpak.

Doelgroep

We hebben ons gericht op probleemdrinkers die belangstelling hebben in digitale zelfhulp, én hun alcoholgebruik wilden matigen. De resultaten kunnen dus alleen worden gegeneraliseerd naar deze groep. Deelnemers hadden makkelijk toegang tot het onderzoek. Probleemdrinkers ervaren immers een hoge drempel voor zowel hulpaanbod als onderzoeksdeelname. Daarom hebben we geen diagnostische interviews onder deelnemers afgenomen. Het is dus niet bekend welk percentage van de onderzoeksdeelnemers voldeed aan de diagnose alcoholmisbruik of afhankelijkheid. Gelet op het hoge wekelijkse gemiddelde

alcoholgebruik nemen we echter aan dat we een hoog risicogroep bereikt hebben.

Lange termijn-effectiviteit van MinderDrinken

Nader onderzoek naar het behoud van de klinische verbetering voor langere perioden is noodzakelijk. Het verschil tussen de onderzoekscondities was na 12 maanden niet meer significant. Dit werd echter vooral veroorzaakt door een voortgaande verbetering van de controleconditie. De lange termijn resultaten van het onderzoek naar de effectiviteit in de dagelijkse praktijk komen beschikbaar in 2009. De resultaten van de TV-zelfhulp cursus golden voor 5 weken na aanvang. Deze resultaten rechtvaardigen dus allen nader onderzoek voor wat betreft de effecten op langere termijn.

Uitval

De RCT en het onderzoek naar de effectiviteit in de dagelijkse praktijk kenden een hoge uitval van deelnemers (45%). Hoge uitval is een bekend fenomeen bij alcoholinterventie-onderzoek. Dit geldt ook voor onderzoek naar digitale interventies, waarbij laagdrempelige toegang het misschien ook wel makkelijker maakt om voortijdig uit het onderzoek te stappen. We hebben hier in onze analyses zo strikt als mogelijk rekening mee gehouden. Het is echter een serieus aandachtspunt dat wellicht onze resultaten heeft beïnvloed.

Voorspellers

Het aantal mogelijke voorspellers in onze secundaire analyse van de RCT-gegevens is tot een minimum beperkt en staat in goede verhouding tot de omvang van de steekproef. Echter, vals-positieve of vals-negatieve voorspellers kunnen niet worden uitgesloten vanwege het veelvuldig testen. Daarnaast kan het verschil in voorspellers bij 6- en 12-maanden follow-up erop duiden dat er verschillende voorspellers actief zijn op verschillende tijdsperioden tijdens de post-interventieperiode.

MinderDrinken in de dagelijkse praktijk

Eén op de vier geregistreerde gebruikers heeft deelgenomen aan ons onderzoek naar MinderDrinken in de dagelijkse praktijk. Dit kan geleid hebben tot een verschil tussen mensen die wel de interventie gebruikten maar niet meededen aan het onderzoek en hen die ook deelnamen aan het onderzoek. Dit onderzoek was ongecontroleerd, zodat de resultaten alleen aantonen dat er een verband is tussen het gebruik van de interventie en verminderd alcoholgebruik, maar niet of dit verband oorzakelijk is. Onze vergelijking van het RCT-onderzoek en dat naar de dagelijkse praktijk suggereert echter wel een causaal verband.

En verder...

Het verminderen van probleemdrinken en digitale zelfhulp zijn door de Nederlandse overheid erkend als veelbelovende preventiestrategieën. Preventieprogramma's van de Nederlandse verslavingszorg worden in toenemende mate digitaal aangeboden. Zorgverzekeraars onderzoeken de rol die digitale interventies kunnen spelen in het zorgaanbod en vergoedingstelsel. De belangrijkste katalysator voor deze ontwikkelingen is waarschijnlijk de groep die er het meeste baat bij heeft: de probleemdrinkers in de algemene bevolking. In elk geval blijkt uit vele studies, inclusief de studies die wij hier presenteren, de hoge acceptatiegraad van digitale zelfhulp bij uiteenlopende groepen van probleemdrinkers.

Deze volksgezondheidsaanpak ziet er veelbelovend uit, maar niet iedereen wordt met digitale zelfhulp bereikt. Het is ook niet voor iedereen effectief. Hier ligt dan ook een formidabele uitdaging om aanvullende strategieën en interventies te ontwikkelen voor die groepen die nu niet bereikt worden.

Tien R's

Tot slot presenteren we hier tien aanbevelingen (10 R's) die kunnen dienen als richtsnoer voor onderzoek naar digitale preventie en behandeling in de komende jaren. Dit zijn:

- | | |
|----------------------------|-------------------|
| 1. roadmap | 6. referral |
| 2. RCT & replicatie | 7. return |
| 3. respons | 8. risico's |
| 4. reach | 9. remissie |
| 5. rekruteringsstrategieën | 10. rangschikking |

Deze tien richtlijnen omvatten de ontwikkeling van een **roadmap** voor *evidence based*-ontwikkeling, implementatie en verspreiding van digitale interventies. Deze roadmap kan functioneren als een kader voor het uitvoeren van **RCT's** naar de kosteneffectiviteit, effectieve componenten van digitale interventies, *dose respons*-relaties, het verbeteren van therapietrouw en het verminderen van studie- en interventie-uitval. **Replicatie** van de hier gepresenteerde studies is nodig om de robuustheid van de resultaten te bevestigen en om de empirische basis van digitale interventies voor het terugdringen van problematisch alcoholgebruik te verstevigen.

Deze aanpak kan verder worden verbeterd door digitale survey-methodieken te gebruiken. Met deze onderzoeksmethode kunnen snel en efficiënt gegevens worden verzameld en kan **treatment response** onopvallend worden gevolgd. De automatische monitoring van deze treatment response binnen een disease management-benadering geeft vele onderzoeksmogelijkheden.

Om het bereik (**reach**) van digitale interventies te vergroten, moeten deze niet alleen toegankelijk, maar ook zinvol en aanvaardbaar zijn voor een breed scala van probleemdrinkers. Alternatieve digitale interventies kunnen ontwikkeld en

geëvalueerd worden voor groepen die nog niet bereikt worden, zoals voor probleemdrinkers met een lage sociaaleconomische status of groepen waarvoor alcohol een taboe is zoals bij personen met een islamitische achtergrond.

Dit vereist ook inzicht in kosteneffectieve **rekruteringsstrategieën** voor deze doelgroepen. Succesvolle werving van problematische drinkers die nog niet gemotiveerd zijn om te verandering vraagt de verdere ontwikkeling van effectieve doorverwijzingsprocedures (**referral**). Dit geldt voor de eerste stap naar digitale interventies, maar ook voor meer intensieve behandelvormen zowel online en offline, daarvoor is verwijzing door de eerste- of tweedelijjn noodzakelijk.

Meer kennis is daarom nodig over de werkelijke kosten van het ontwikkelen, evalueren, verspreiding en onderhouden van digitale interventies. Hoewel de voordelen voor de gezondheid van grootschalige implementatie duidelijk zijn, is meer inzicht nodig in de **return on investment**-strategieën, en in de economische kosten en baten op individueel en populatieniveau.

Bij veelgeclaimde voordelen van digitale preventie en behandeling van problematisch alcoholgebruik ontbreekt nog vaak een empirische basis en de mogelijke nadelen zijn nog niet volledig onderzocht. De potentiële **risico's** van het gebruik van digitale zelfhulp moeten verder in kaart worden gebracht. Deze risico's kunnen variëren van onvoldoende bescherming van patiëntgegevens, onvoorziene gevolgen van deelname aan een gebruikersforum of negatieve effecten van vroegtijdig afbreken van een behandeling. De ontwikkeling van een keurmerk, goedgekeurd door bijvoorbeeld cliënten, zorgverleners, zorgverzekeringen en de overheid, kunnen sommige van deze risico's inperken. Meer inzicht is ook nodig in de rol van **natuurlijke remissie** tegenover **begeleide remissie**- en terugvalpreventie (**relapse prevention**).

De verdere ontwikkeling en evaluatie van *user centred* interventiemodellen voor het terugdringen van problematisch alcoholgebruik in de dagelijkse praktijk moet prioriteit krijgen. Dit kan door een evaluatie en **rangschikking** van de interventies door de deelnemers zelf. Ook kan het onderzoek bevatten naar de

invloed van een eigen behandelkeuze op het behandelresultaat, en ook naar de invloed van *post-treatment*-factoren (zoals sociale ondersteuning) op het behandelresultaat.

Realisme tenslotte is nodig om te beseffen dat enkel digitale interventies nooit de gehele prevalentie en ziektelast van probleemdrinken kunnen aanpakken. Een integrale aanpak met andere volksgezondheidsmaatregelen wordt daarom aanbevolen.

Het is de verwachting dat onderzoek langs deze tien richtlijnen bij kan dragen aan de verbreding van een *public health*- en *evidence based*-benadering van het terugdringen van problematisch alcoholgebruik. Oude en nieuwe media kunnen worden gecombineerd voor het bereiken van de heterogene groep van volwassen probleemdrinkers. De verwachting is dat, wanneer efficiënt uitgevoerd, een dergelijke aanpak leidt tot algemene gezondheidswinst en kostenbesparing op populatieniveau.

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Curriculum Vitae

CURRICULUM VITAE

Maria Magdalena Riper (Heleen) graduated cum laude from Utrecht University, receiving a masters degree in Social Work and Adult Education with a concentration in Social Psychology. She went on to work at the Centre of Innovation and Cooperative Technology at the University of Amsterdam, where she conducted a number of studies on palliative care. She investigated the use of information and communication technology to improve quality of life for people with a limited but uncertain time perspective. She continued that line of study at the University of Limerick, where she conducted research on palliative care and hospices. Back in the Netherlands, she resumed work at the Bonger Institute of Criminology (UvA), doing research on severely addicted or at-risk populations, including polydrug users and homeless people. Since 2000 she has been a senior researcher and programme head at the Trimbos Institute in Utrecht, charged with the development, evaluation and implementation of e-mental health interventions for psychological disorders, including problem drinking. She has meanwhile authored or co-authored about 20 publications in the field of e-mental health in national and international journals and books. She has been awarded 15 national research grants as project leader and 4 European research grants, and has collaborated on a number of Dutch and European projects on e-mental health. In 2007, she and her co-authors compiled a state-of-the-art review of e-mental health in the Netherlands. In the same year, she established the Innovation Centre of Mental Health and Technology at the Trimbos Institute, of which she is programme director. She is an ad hoc reviewer of e-health-related journals, including the *Journal of Medical Internet Research* (JMIR). She is also initiator of GGZ & Nieuwe Media, the Dutch biannual conference on e-mental health, which will be organised on an international scale in 2009. In 2008, she was assigned the Mentaal Vitaal project by the Ministry of Health, Welfare and Sport, which is to further the use of ICT in the prevention of depression. She lives happily in Amsterdam with her husband and dogs.

