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Web-Based Substance Use Intervention: Literature Review and Assessment of Feasibility in Australia

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EXECUTIVE SUMMARY

This report reviews the literature on the effectiveness of internet-based substance use interventions, and assesses feasibility of developing such an intervention is Australia. The review includes an examination of relevant related literature on the efficacy of computer-based interventions for mental health and behavioural problems.

The internet marries computing and telecommunication technology to produce a unique communication channel. It combines attributes of mass communication (e.g. broad reach) with attributes of interpersonal communication (e.g. interactivity). This combination may make the internet an effective means of delivering behavioural interventions on a far wider scale than previously possible.

Internet-based interventions have a number of potential advantages over traditional interventions including a high level of convenience for the user (24/7 availability) and being non location-specific (can be accessed from anywhere). Intervention software is completely consistent in its treatment delivery, and there is some evidence that people more readily disclose sensitive information in a computer assessment than in a one-to-one interview. After initial capital outlay, it may also be cost efficient.

The public health impact of alcohol, tobacco, and illicit drug use is substantial and well documented. It is estimated that 7.7% of Australian adults (or approximately 1,041,000 individuals) had a substance use disorder in the past 12 months. One in three (34.4.%) of people aged 14 and over used alcohol in a way that put them at risk of short-term harm at least once in the past 12 months. Frequent episodes of high risk alcohol use is most common among people with 15% drinking a levels which risk short-term harm at least weekly.

Despite high levels of substance use rates of treatment seeking and access to services are relatively low, which may indicate a level of unmet need. Internet-based services could provide a contribution to "broadening the base" of intervention by forming part of a stepped care model. Given the rapid uptake of the internet in Australia (over 72% aged 16 or over have access, and 87% of school age children have access), it provides an opportunity for broad dissemination of interventions for substance use problems.

A number of studies have investigated the efficacy of interventions for a range of mental health and behavioural conditions delivered by stand-alone computer (i.e. non-networked). Typically these interventions are developed for specific clients groups and are based on cognitive and/or behavioural treatment principles which lend themselves to computer implementation due to their well-defined and systematic approach. Despite considerable variability among the studies, generally positive outcomes have been reported in the treatment of depression, anxiety, specific phobias, panic disorder, and obsessive compulsive disorder. These studies provide some supporting evidence of the feasibility, acceptability and effectiveness of the computer-delivered treatment paradigm.

The therapeutic potential of internet-delivered intervention has been widely reported but less frequently rigorously investigated. Positive results have been reported but the evidence from the general internet-based intervention literature is less clear, with many studies involving small sample sizes, lacking control groups, or having high drop-out rates. These studies have, however, been successful in attracting users to the intervention

to begin with, and the evaluation data reported generally indicate client satisfaction with the mode of treatment and, in particular, its convenience of access. This is consistent with the notion that the internet is a viable medium by which to deliver treatment.

With regard to internet-based substance use interventions, there is a very clear gap in the literature: outcome measurement. While studies have demonstrated the existence of a sizable demand for internet based interventions, little has been done to examine their efficacy in leading to changes in substance use behaviour. Such research is essential to identify the most effective elements of interventions, to identify who may most benefit from participation in an online intervention, and to ensure the efficient use of resources.

The currently available online substance use interventions vary tremendously in quality and complexity. The majority focus on alcohol or tobacco use, with very few interactive resources for other drug use. Many sites offer some sort of "self-test" involving screening and feedback. The better quality sites (e.g. http://www.carebetter.com and http://www.stop-tabac.ch) provide theory-driven and evidence-based approaches to treatment, but nonetheless they remain unevaluated.

In summary, while the literature on internet based substance use interventions is sparse and flawed, the potential impact of effective intervention is huge. On the basis of the limited research available, and arguing by analogy from the computer based and general internet intervention literature, it seems reasonable to suggest that a demand for intervention in Australia probably exists and there is a good likelihood that such an intervention model would be effective. A pragmatic first step would be to develop and implement a trial of an internet-based brief intervention based on best practice intervention principles for alcohol tobacco and cannabis-related disorders. Following this phase, the efficacy of this model should be subjected to a randomised controlled trial.

1.0 INTRODUCTION

This report reviews the literature on the use and effectiveness of internet-based substance use interventions, and assesses the feasibility of developing such an intervention in Australia. Existing web-sites are examined with respect to their technical features, usability and structure. The review includes an examination of the more general literature assessing the efficacy of internet-based and other computer-based interventions for related mental health and behavioural conditions.

The therapeutic potential of internet-delivered interventions for substance abuse problems has been widely reported, but less frequently rigorously investigated. A recent review of the literature concerning primary care computing reported "a descriptive feast but an evaluative famine" (Mitchell & Sullivan, 2001). Similarly with regard to substance abuse interventions on the internet, the current literature includes few controlled trials and is largely descriptive (Cloud, 2001; Cunningham et al, 2000; Skinner et al, 2001) or commentary.

1.1 Data gathering

The material included in this review was gathered from a variety of sources. Electronic databases (Medline, Current Contents, PsycInfo, Cochrane Controlled Trials Register, Cochrane Database of Systematic Reviews, Embase, Australasian Medical Index, Web of Science, CINAHL) were searched using terms including internet, web, online, computer, software AND intervention, treatment, therapy. Only those studies which involved a therapeutic component delivered via computer were included in review. The search was refined using the terms alcohol, drug, substance, addiction, and the names of individual substances of abuse to identify studies of computer based substance use intervention. Previous reviews and commentary on related research (Kaltenthaler et al., 2002; Marks, 1999; Marks et al., 1998; Kenardy & Adams, 1993) were identified and reference lists of studies were hand-searched. Internet search engines were used to identify online treatment websites and to seek unpublished studies. Several authors in the field, and creators of intervention websites, were contacted in a further attempt to identify any "grey" literature.

1.2 The Internet

The internet marries computing and telecommunications technology to allow multimedia, interactive communication on a global scale. It enables various types of communication and information exchange using utilities such as email, newsgroups, forums, real time chat groups, video conferencing, and the World Wide Web (Barak, 1999).

The internet has been described as a "hybrid" communication channel in that it combines attributes of mass communication (e.g. broad reach) with attributes of

interpersonal communication (e.g. interactivity, rapid individual feedback). Cassell et al (1998) suggest that this combination of qualities may make the internet an effective means of implementing behavioural health interventions on a far larger scale than previously possible. The capacity for interactivity allows intervention software to solicit information from individual users and provide feedback tailored to their characteristics and responses. The specifics of the interaction are reciprocally determined by the theoretical basis of the intervention software and the responses of the user. The Stages of Change model (Prochaska & DiClemente, 1986), for example, sees behavioural change as a process rather than an event, and proposes that people at different stages may require different messages to promote progress toward change. An interactive online assessment is able to determine an individual's stage of change and quickly deliver relevant stage-appropriate messages.

Internet-based interventions have a number of strengths in addition to interactivity. The nature of the medium allows the user a high level of convenience and flexibility of use; the intervention is not confined to a specific physical location, and is available 24 hours a day. This allows the user to access the service as required without regard to normal business hours, set appointment times, or waiting lists. Intervention software is also completely consistent in the application of its therapeutic model; there are no issues of fatigue or forgetfulness (Fotherington, 2000). The intervention is able to be updated centrally (at the host site) relatively easily in the light of new knowledge or to incorporate current data. With regard to client assessment, a heightened level of disclosure of sensitive information has been reported in studies of computer-based assessment. That is participants disclosed sensitive information, such as high risk sexual behaviour and drug and alcohol use, more readily in a computer assessment than in a one-to-one interview (Turner et al., 1998; Gerbert et al., 1999), although Miller et al (2001) failed to find any significant difference in self-report of alcohol use amongst college students between internet-based and traditional paper-and-pencil assessment. Finally, after a period of time from the initial capital investment in system development, the costs associated with internet-based interventions are potentially less than those associated with clinician delivered intervention,.

1.3 Public health

The public health impact of tobacco, alcohol, and illicit drug use is substantial. In 1998 an estimated 19,019 people died in Australia as a result of tobacco smoking, and 3271 people died as a result of hazardous or harmful levels of alcohol consumption. A further 1023 deaths can be attributed to illicit drug use.

During the same period a large number of hospital treatment episodes were attributable to tobacco smoking (142,525 treatment episodes), hazardous or harmful levels of alcohol use (71,422), and illicit drug use (14,471) (Ridolfo & Stevenson, 2001). This constitutes a considerable burden of disease that comes at great economic and social cost, much of which is preventable.

1.4 Patterns of substance use

The patterns of substance use and prevalence of substance use disorders in Australia have been investigated in the National Survey of Mental Health and Wellbeing, and the National Drug Strategy Household Survey. It is estimated that one in thirteen Australians

aged 18 and older (7.7%) had a substance use disorder in the past 12 months (i.e. met ICD-10 diagnostic criteria for substance abuse or dependence). Males (11.1%) were more than twice as likely as females (4.5%) to have had a substance use disorder in that time. This gives a population estimate of approximately 1,041,000 Australian adults having a substance use disorder in the past 12 months (Andrews et al, 1999).

Alcohol use disorders were the most common with 6.5% of Australian adults meeting criteria for either alcohol abuse (3.0%) or alcohol dependence (3.5). Again alcohol use disorders were more prevalent among males than females, 9.4% and 3.7% respectively (Teesson et al., 2000).

The possibility of substance-related harm is not, however, confined to those with a diagnosable disorder. Differing patterns of alcohol consumption have different levels and types or risk associated with them. The National Health and Medical Research Council (NHMRC, 2001) specifies levels of alcohol consumption that are "low risk", "risky" and "high risk" of harm to health in the short or the long term. Short-term risk is associated with levels of drinking on a single occasion, leading to problems of intoxication such as accidents, falls and violence. Long- term risk is associated with high levels of consumption over months or years, increasing risk of health problems such as liver disease, hypertension, and some forms of cancer. During the past 12 months, one in ten (9.9%) Australians aged 14 years and over consumed alcohol in way considered "risky" or "high risk" to health in the long term. People aged 20-29 years are the group most likely (14.7%) to consume alcohol in a way that puts them at risk of long-term harm. One in three (34.4%) people 14 years and over put themselves at risk of short-term harm at least once in the past twelve months. Frequent episodes of high risk drinking were most common among teenagers and young adults. Drinking at levels that put them at risk of short term harm, at least weekly, were 11.8% of females aged 14-19, and 14.6% of males aged 20-29 years (AIHW, 2002).

Of the illicit drugs, cannabis accounted for more drug use disorders than any other; 1.7% of Australian adults had a cannabis disorder in the past 12 months (Andrews et al, 1999). One in three people (33.1%) aged 14 and over reported having used cannabis at some time in their lives, and 12.9%, or over 2,000,000 individuals, had used it in the past 12 months. People aged 20-29 were the most likely have used cannabis in the past 12 months (29.3%), followed by almost a quarter (24.6%) of young people aged 14-19. In all age groups, males are more likely than females to have used cannabis (AIHW, 2002).

Of the other drugs, 0.4% of adults had a sedative use disorder, 0.3% had a stimulant use disorder, and 0.2% opioid use disorder in the past 12 months (Andrews, 1999).

The majority of Australian adults (83% of males and 63% of females) report consuming alcohol in the last 12 months. In the same period 6.5% had met ICD-10 diagnostic criteria for an alcohol use disorder; 3.5% with dependence and 3% with harmful use. Males (9.4%) had higher rates of alcohol-use disorder than females (3.7%). This means that in a 12 month period almost half a million Australians met criteria for alcohol dependence. Alcohol use disorders were most prevalent among the 18-34 years age group (Teesson et al, 2000).

1.5 Treatment seeking

Analyses of treatment seeking amongst Australians with diagnosed alcohol dependence has revealed that less than 1 in 3 sought treatment for a mental health problem in the past 12 months (Proudfoot & Teesson, 2002). Of those who did not seek help, only 23% expressed interest in getting any help. The low rate of treatment seeking among even those with alcohol dependence, in conjunction with the high prevalence of risky drinking in the general population indicates a considerable level of unmet need in the community. It is clear that a substantial number of people who may benefit from treatment for substance misuse are currently not accessing services. Facilitating greater treatment access for this under-served group could potentially result in significant reductions in substance-related mortality, morbidity, and social harm.

1.6 Improving treatment access

Over a decade ago an influential report from the Institute of Medicine (1990) made a case for "broadening the base" of interventions for alcohol problems. It called for expanding the continuum of care beyond intensive abstinence-oriented treatment, developing forms of assistance specifically targeted toward non-dependent problem drinkers, and creating more responsive intervention systems.
While progress has been made toward these recommendations, Humphreys and Tucker (2002) comment that ample room for improvement remains. They provide various suggestions for how alcohol intervention systems can increase their effectiveness. These include: use of a "stepped care" model of service delivery; broader dissemination of brief interventions for drinkers with mild to moderate problems; adoption of active outreach approaches to screening individuals for problems (rather than waiting for them to present for treatment); and lowering the thresholds and requirements for access to services, e.g. making interventions available on demand (Humphreys & Tucker, 2002). Developing effective internet-based interventions would be a positive contribution toward achieving these goals.

1.7 Census of internet users

Over the past decade there has been massive growth in internet use. Although the internet originated in the late sixties as the US government ARPAnet project, it was not until 1991 that the World Wide Web was developed and the first commercial search engines only became available in 1995 (Bessell et al, 2002). In 1996 Australia had 250,000 internet users; by 1998 this had increased to 1 million (ABS, 2002). By April 2002, 52% of Australian households were connected to the internet, up from 25% in 1999. Currently 72% of Australians aged 16 or over have access to the internet, with 80% of those aged 16-34 having access (NOIE, 2002). School age children have the highest level of access at 87% (ABS, 2002). This is an unprecedented rate of adoption of a new technology, surpassing that of the telephone, radio, TV, VCR or fax machine (Patrick, 2000). Such widespread and growing availability presents a unique opportunity for broad dissemination and improved access to interventions for substance use problems.

2.0 COMPUTER-BASED INTERVENTION

Given the relative paucity of studies examining internet-based or computer-based interventions for substance use problems, it is instructive to consider studies that have evaluated computerized treatments for other behavioural or mental health conditions. While these studies do not address substance use issues they do provide a useful perspective on treatment approaches and the viability, efficacy, and client acceptability of computer-based interventions.

Interest in computer-based treatment dates back to the development of the programme ELIZA which simulated a non-directive Rogerian therapy style by producing responses on a screen to statements or questions typed on a keyboard by the "client" (Weizenbaum, 1966). However, ELIZA was not designed to be used as treatment, it was a pilot project exploring the use of natural language in communicating with a computer. This and other computerized attempts to simulate open therapeutic dialogue have major limitations due to the inability to respond appropriately to the subtleties of language (Kenardy & Adams, 1993). Subsequent research has focused on more structured approaches to treatment.

Computer-based treatments are most commonly developed for specific client groups, such as people with depression or phobias. The majority are based on cognitive and/or behavioural treatment principles, which lend themselves to computer implementation due to their well defined procedures, targeting of specific symptoms and behaviours, and systematic approach (White et al., 2000; Selmi et al, 1990). They typically include components such as psychoeducation, self monitoring, assessment and individualized feedback, identifying and modifying automatic thoughts, activity scheduling, and homework assignments to extend the therapy beyond the clients' time using the computer.

There is considerable variability among the studies reviewed in terms of client populations; length and content of treatment; study setting; comparison groups; outcome measures; and amount of therapist contact. Although interventions are often described as a form of self-treatment or self-help (Kalthenthaler et al, 2002; Williams & Whitfield, 2001; Marks, 1999), all studies involved at least some therapist contact, ranging from minimal contact at screening to active involvement in each session. The mode of treatment delivery also differs between studies; some desktop computer interventions being heavily text based (Bowers et al., 1993) and others using sophisticated multimedia (Proudfoot et al., submitted). Hand help computers have been employed in treatment (Argras et al., 1990), as have Interactive Voice Response (IVR) systems that deliver the computer generated intervention by telephone (Greist et al., 2002). The studies reviewed present treatment outcome data from controlled trials of computer-based interventions. Internet-based systems are considered separately.

2.1 Depression and anxiety

A computer-administered CBT package for the treatment of mild to moderate depression was compared to traditional therapist-led CBT in a randomized controlled trial (Selmi et al., 1990). In this study 36 volunteer patients who met the Schedule for Affective Disorders and Schizophrenia (SADS) diagnostic criteria for major or minor

depressive disorder were randomized to three groups, receiving (a) six sessions of traditional therapist-led CBT, (b) six sessions of computerized CBT, or (c) a waiting-list control condition. The session agendas of the therapist-led CBT matched those of the computer CBT. The computer intervention presents psychoeducational material, conducts assessments, provides regular feedback, and assigns homework. It uses text-based exposition, case examples, and self-monitoring to teach patients how to use CBT principles to reduce symptoms. Each session builds on the last with comparisons made with earlier assessments, and verification of homework tasks. Treatment outcome was assessed by three measures of depressive symptoms; the Beck Depression Inventory (BDI), the Hamilton Rating Scale (HRSD), and the Hopkins Symptom Checklist (SCL). All participants completed treatment and follow-up. At the end of six weeks of treatment and at 2-month follow-up, the two CBT groups had improved significantly more than the control group. Outcome did not differ between the two treatment groups at either time. The computer-led CBT condition included some minimal contact with the experimenter, who helped start and end each session, and there was the option for users to ask questions throughout. The computer CBT programme used in this study has been described as somewhat outdated due to its user interface and its complete reliance on written text to communicate with the user (Wright & Wright, 1997). Nonetheless, the study provides evidence that computer-delivered treatment can be as effective as therapist-delivered treatment, even in the absence of significant therapist involvement or oversight.

Bowers et al (1993) investigated the efficacy of "Overcoming Depression"; a computer-based cognitive therapy programme. Twenty two inpatients with major depression were randomly assigned to daily sessions over two weeks in one of three conditions; (a) therapist-led CBT, (b) treatment by "Overcoming Depression", or (c) treatment-as-usual (which included mileu therapy, occupational therapy, vocational rehabilitation, and informal staff talks). The computer intervention provided information about depression and cognitive strategies for alleviating it (e.g. identification and rational disputation of automatic thoughts and cognitive distortions). It responded to key words entered by the patient, gave case scenarios and provided a summary of each session. Outcome was assessed by BDI and HRSD. Three patients originally recruited for the study dropped out after being assigned to the computer-led group, saying they did not want to be involved with treatment by a computer.

At the end of treatment the therapist-led group had improved significantly more than both other groups on the depression rating scales. The computer-led group did no better than the treatment-as-usual patients. This study has been criticised because the computer programme taught only cognitive techniques rather than the cognitive and behavioural approach of the therapist-led CBT. The computer intervention did not include activity scheduling or suggest behavioural homework (Marks et al, 1999). Thus the study may have been an unreasonable comparison. Wright and Wright (1997) comment that in this severely depressed inpatient population, lowered energy levels and physical problems associated with depression may have interfered with the use of a programme that requires the patient to read, interpret and type responses to large amounts of text. The style of treatment interaction used by the programme may be poorly suited to the treatment of severely depressed patients.

A less text-reliant mode of treatment delivery was used in "Beating the Blues"; a computerised multimedia package designed to deliver CBT for anxiety and depression. It begins with a 15 minute video introduction followed by 8 one-hour sessions using CBT

techniques to develop more helpful thinking styles and behaviours. Each session builds on the previous one, and summaries, progress reports and homework assignments are generated. Sessions include video vignettes of case study "patients" to act as role models for the real patient. In an unpublished RCT (Proudfoot et al., submitted) 167 patients with depression and/or anxiety were recruited from general practices and randomized to receive either the computer-led CBT or treatment-as-usual. The computer-led treatment was delivered in GP surgeries with minimal oversight from nursing staff. A nurse explained how to use the programme and was available to assist with technical difficulties, but spent no more than 5 minutes with each patient at the beginning or end of each session. Drop-out rates were similar in both groups. Outcome measures were the BDI, BAI, and Work and Social Adjustment Scale (WSA). Measures were taken pre and post treatment, and at one, three and six month follow-ups. Intention-to-treat analyses showed the computer-CBT group to have significantly greater improvement on all measures at post-treatment and all follow-up points than the treatment-as-usual group. The improvements were of clinical significance; mean scores for both depression and anxiety fell to the near-normal range. These changes were accompanied by similarly enduring improvements in adjustment to everyday life, in areas such as work, social life, leisure and relationships (as measured by the WSA). Further, the effects of computer-CBT were independent of baseline level of depression, which shows the treatment to be as effective with severe depression as with mild depression.

2.2 Specific phobia

Cognitive-behavioural techniques have been shown to be effective in the treatment of depression, and are also a standard treatment for anxiety disorders such as phobias, generalised anxiety disorder and panic disorder. Ghosh, Marks, and Carr (1988) tested the effectiveness of a computer delivered treatment for phobias. Eighty four outpatients with diagnosed phobias were randomly assigned to receive exposure therapy instruction in one of three ways; (a) computer-delivered, (b) by self-help book (bibliotherapy), or (c) therapist-delivered. The computer programme elicited the patients' problems and treatment goals, explained treatment strategies, assessed symptoms with a fear questionnaire, gave information on coping strategies, assigned homework, and provided individualized feedback. Following assessment the patients used the computer for eight treatment sessions. The computer group also saw a therapist for 5-10 minutes each session. All treatment groups improved significantly on all measures by the end of treatment, and this improvement was maintained at 3 and 6-month follow-up. Patients rating of satisfaction with treatment did not vary between groups, which indicates the computerised intervention was acceptable to users.

Computer aided treatment for spider phobia was investigated in an RCT (Gilroy et al., 2000). Forty-five volunteers who meet diagnostic criteria for specific phobia (spiders) were randomly assigned to one of three groups: (a) computer-delivered vicarious exposure; (b) therapist-delivered live exposure; (c) relaxation training control group. (Exposure therapy is a behavioural treatment for specific phobias based on habituation/extinction of the phobic response through increased exposure to the feared object.) Each group received three 45-minute sessions. The computer-delivered group had minimal contact with the therapist; at the first session the therapist stayed for approximately 5 minutes to ensure the participant was comfortable using the programme. At post-treatment both the therapist and computer-delivered groups had improved significantly on all measures, and improved significantly more then the control group.

On six of the eight outcome measures there was no significant difference in improvement between the computer group and the therapist group. The therapist group showed greater improvement on two measures. At follow-up, however, there was no difference between the computer and therapist groups on any variables. This study shows computer-delivered vicarious exposure is an effective treatment for spider phobia and comparable to therapist-delivered exposure in reducing phobic symptoms.

2.3 Panic disorder

Newman, Kenardy, Herman, and Taylor (1997) evaluated a palm-top (hand-held) computer programme as an adjunct to brief CBT for panic disorder. The study compared two treatment conditions. The first used a palm-top computer as a treatment aid in conjunction with a short course of therapist-led CBT; the second involved a considerably longer course of therapist-led CBT without computer assistance. The computer operated in two modes; diary and treatment. The diary mode beeped regularly during the day to ask patients to report levels of anxiety and panic attacks. The therapy mode included questions about patients' fears, CBT education, motivational statements, and suggestions to help patients remain in anxiety provoking situations. It also included breathing retraining instructions. Eighteen patients with panic disorder were randomly assigned to receive 12 sessions of CBT with a therapist or 4 sessions with a therapist plus use of a palm-top for 12 weeks. At the end of treatment statistically significant improvements in all major panic symptoms were observed for both treatment conditions. Compared to the 12 session CBT, however, the computerized treatment produced, on some measures, less clinically significant change at post-treatment. These differences disappeared at 6-month follow-up when both treatments were found to be equally effective on all measures. Although the computer group had 66% less therapist contact, the outcomes were comparable between groups.

2.4 Obesity treatment

Hand-help computers were also used in an earlier study in which they were employed as an aid to treatment for moderate obesity (Argras et al., 1990). The computer prompted patients to set daily goals of food intake and exercise, and tracked achievement of these. It suggested meal plans, and provided feedback on the amount of exercise taken and calories consumed. It also provided praise for goals achieved, positive self-statements, and graphs depicting progress. Ninety women were randomized to one of three treatment groups: (a) a single group session introducing the computer and its treatment rationale, a users manual, a written obesity plan, and a calorie book; (b) as for group A, plus four group sessions of therapist-led CBT; (c) ten group sessions of therapist-led CBT. After 12 weeks of treatment all three groups had achieved similar weight loss, and remained similar at 12-month follow-up.

2.5 Behavioural problems and obsessive compulsive disorder

A controlled clinical trial comparing short-term traditional individual therapy with a computer-based intervention overseen by a therapist was reported by Jacobs et al (2001). Ninety clients presenting with a range of problems and symptoms were randomly

assigned to receive either 10 weeks of individual focused psychotherapy or 10 weekly sessions using the Therapeutic Learning Program (TLP) with some therapist oversight (20 minutes per treatment session). The TLP allows the client to address any psychological problem, as long as the treatment goal can be behaviourally specified. The program gives the user the opportunity to explore a problem area, develop coping strategies, formulate an action plan, and consider issues that might interfere with implementation of the plan. At the end of treatment, significant reductions in severity of symptoms were found on four standardized assessment instruments and two therapist rating scales, with no difference between the two treatment groups. On these objective measures both treatments were equally effective. The improvements were maintained at 6-month follow-up. The individual therapy group, however, reported a significantly greater subjective level of improvement in presenting symptoms. This self-reported improvement is an important measure of treatment outcome in this study, as the participants were a heterogeneous group who identified their individual issues of concern at the outset of treatment, and these may not have been adequately captured by the four standardized instruments used. Individual therapy clients also reported greater satisfaction with the treatment they received than TLP clients. Despite these differences the TLP was positively valued by clients, and it generated similar treatment effects to individual therapy while involving only half as much therapist time.

A behavioural therapy self-help programme for obsessive-compulsive disorder (OCD) was developed using a computer-controlled interactive voice response system (IVR), in addition to a written treatment manual. Patients use a touch-tone telephone to access the IVR system and select relevant segments of pre-recorded speech. The programme, called "BT-Steps", includes self-assessment and treatment components, and assists patients to develop assignments for self-directed exposure and ritual prevention. In an RCT 218 patients with OCD diagnoses were randomly assigned to receive 10 weeks of treatment by (a) BT-Steps IVR system, plus user workbook, or (b) a behaviour therapist or, (c) systematic relaxation training delivered by audio tape and manual (Greist et al., 2002). After 10 weeks of treatment, an intention-to-treat analysis showed a significantly greater improvement on the Yale-Brown Obsessive Compulsive Scale in the therapist-led group than in the computer-led group. Both therapist and computer-led groups were significantly more improved than the relaxation group, which was ineffective as treatment. Patients were more satisfied with either behaviour therapy group than with relaxation. Patients in the computer-led group showed more improvement the longer they spent using the system. It is noteworthy that most of the calls to the system were made outside of normal office hours. Overall, computer-led behaviour therapy was shown to be effective for OCD, although therapist-led behaviour therapy was more effective.

Despite some methodological limitations (e.g. small sample sizes, lack of intention-to-treat analyses), outcome studies of computer-led interventions have generally found that they can be an effective method of treatment. While not consistently reported, patient acceptance and satisfaction with computer treatment appear to be high. Some questions, however, require further research:

- how much therapist involvement is required?
- what length and frequency of sessions is optimal? &
- are there patient characteristics that predict adherence or outcome of computer-led treatment?

Although computer-based interventions have not been widely implemented, and further research is required, the studies reviewed provide some evidence of feasibility, acceptability and treatment effectiveness.

3.0 INTERNET-BASED INTERVENTION

The internet is a relatively young and dynamic technology. Its widely touted potential as a medium for therapeutic intervention remains largely unrealized, and poorly researched. The literature includes few evaluations of internet-based interventions, and even fewer well designed controlled studies. Consequently, small pilot studies, uncontrolled outcome studies, and some descriptive reports are included in the review.

3.1 Panic disorder

Carlbring et al (2001) evaluated an internet-delivered self-help program plus minimal therapist contact via email for people suffering from panic disorder. The 41 people who met inclusion criteria were randomised to receive treatment via the internet or to a waiting-list control group. The intervention consisted of six modules and included psychoeducation; breathing retraining; cognitive restructuring; interoceptive exposure and in-vivo exposure; and relapse prevention. On completion of each module the participants were asked a series of questions to determine their understanding of what had been presented. Their answers were emailed to the investigators who replied with feedback and a password to allow access to the next module of the program. The time from beginning of treatment to post-test varied from 7 to 12 weeks according to how long the individual participant took to complete the program. The pre-post analyses revealed that participants in the treatment condition improved significantly more than control participants on 12 of the 15 outcome measures; including frequency, duration and intensity of panic attacks, and scores on the Beck Depression Inventory, the Beck Anxiety Inventory, and the Quality Of Life Inventory. These gains were considered clinically significant. No further follow-up was reported. In their evaluations of the program, participants rated the treatment as having a high level of credibility, and almost all mentioned the advantage of being able to access the treatment in the comfort of their own homes and whenever it suited them.

In an RCT, Klein and Richards (2001) assigned 23 people with panic disorder to a brief internet-based intervention or to a self-monitoring control condition. The intervention consisted of two parts; the first focused on the nature, effects and causes of panic, the second on useful ways of managing panic. It included self- assessment quizzes that provided immediate feedback. The treatment condition involved one week of monitoring, followed by one week of active intervention, and finally one week of post-intervention assessment. It included some therapist contact by telephone to assist participants in accessing the internet-based programme, and to ensure they were using it during the active intervention phase. At post-intervention assessment all measured outcomes (panic frequency, fear of panic, general anxiety, and excessive body vigilance) showed significantly greater improvement in the treatment group in comparison with the control group, with the exception of depressive affect. No follow-up beyond the three week post-treatment assessment was reported.

3.2 Weight-loss and dietary awareness

A structured behavioural weight-loss programme delivered via the internet was evaluated by Tate et al (2001). Participants (n=91) were randomly assigned to a 6-month weight loss programme consisting of either (a) internet education only, or (b) internet delivered behavioural therapy. All participants received one face-to-face group weight loss session at the start of treatment and access to a web site with links to various internet weight loss resources. In addition, the behaviour therapy condition included 24 weekly behavioural lessons via e-mail, weekly online submission of self-monitoring data, individualised therapist feedback via e-mail, and access to an online bulletin board for communication among participants.

The primary outcome measures were body weight and waist circumference. Complete data were obtained for 65 participants (71% of the original sample), with the attrition rate no different between groups. Intention-to-treat analysis revealed significantly greater weight loss and reduction of waist circumference in the behaviour therapy group compared with the education group at 3 and 6 months from baseline. A greater proportion of the behaviour therapy than the education group achieved the recommended goal of losing at least 5% of initial body weight by 6 months (35% vs 18%). The frequency with which participants logged on to the website was significantly correlated with weight change in both groups. These promising results demonstrate the feasibility of delivering an effective behavioural intervention via the internet. It is not possible, however, to determine which of the intervention components are critical (e.g. self-monitoring; ongoing therapist contact and encouragement) or most useful to participants. Although the study was an initial trial of a novel intervention, no data were reported to indicate participants' preference, satisfaction, and acceptability of treatment.

The impact of a brief web-based intervention on dietary awareness and intentions was assessed by Oenema et al (2001) in a controlled trial. Participants (n=204) were randomly assigned to receive either a single session of web-based intervention, or a general nutrition information letter. Pre-test assessment, the intervention, and post-test were conducted during a single session. The web intervention involved an interactive assessment and feedback of the individual's current intake of fats, fruits and vegetables; awareness of recommended intake levels; attitudes to dietary change; and self-efficacy for change. Feedback included text and graphic components, and was tailored according to the participants' dietary status, intentions, and stage of change. At post-test, participants in the web intervention group were significantly more likely to have changed their opinion about their diet and to express the intention to change to a healthier diet. The web intervention was also rated as more personally relevant than the nutrition letter. Both experienced and inexperienced computer users rated the web intervention as attractive and easy to use. The authors conclude that brief web-based intervention can have an impact on the determinants of dietary change. While these results are promising, the absence of further follow-up allows no conclusions to be drawn regarding the longer term effects on motivation or whether the intervention is associated with behavioural change.

3.3 Headache treatment

A more intensive and behavioural approach to intervention was taken by

Strom et al (2000) in a controlled trial of a self-help treatment for recurrent headache. A website developed for the study provided general information about the different types of headache, specific information about the study, and a range of self-rating scales and forms. Potential participants (n=102) were recruited via newspaper articles and screened for suitability online at the website. One hundred and two met inclusion criteria of a headache history of at least six months, and a headache frequency of at least weekly. During four weeks of baseline assessment participants recorded their headache intensity, frequency and duration in a daily diary on the website. They also noted medication use. Following assessment, participants were randomly assigned to one of two conditions: (a) internet-based applied relaxation and problem solving training or (b) waiting-list control. The treatment was delivered by email in six parts over six weeks and included training in progressive relaxation; controlled breathing; differential relaxation; and various approaches to problem identification, analysis and resolution. Participants receiving treatment were requested to provide weekly reports (via the website) of how much time they spent on problem solving and relaxation training. If no report was received from the participant a reminder was sent via email. After the treatment phase all participants completed another four weeks assessment of headache symptoms. There were significant improvements in headache frequency and peak intensity in the treatment group but not the control group. Among participants in the treatment group, 50% showed clinically significant improvement compared with 4% in the control group. This study, however, had a very large drop-out rate of 56%, and no intention-to-treat analysis is presented. Given this rate of attrition, the results of the study cannot be considered reliable. With regard to treatment acceptability, all treated participants reported the internet intervention to be handy and easy. A pervading theme in the comments was an appreciation of the freedom to control the time of communication and participation in the treatment.

3.4 Depression and anxiety

Freedom of access to treatment is an issue highlighted by an uncontrolled study that describes the implementation and usage of “MoodGym”; a freely available web-based cognitive-behavioural intervention for depression and anxiety (Christensen et al., 2002). MoodGym (http://www.moodgym.edu.au) is an interactive multimedia programme comprising five cognitive-behavioural training modules; a personal workbook that records responses to exercises and assessments; an interactive game; and an evaluation form. It includes virtual “characters” that model dysfunctional and adaptive types of thinking and behaviour. The various modules provide information on the relationship between mood and thinking; types of dysfunctional thinking and behavioural techniques to overcome it; and training in assertiveness, self-esteem, relaxation, and problem solving. Exercises and self-assessments are integrated into each module. The modules were designed to take 30 – 45 minutes to complete, which varies according to the responses of the user. The programme is fully self-contained and involves no direct interaction with a human therapist.

During the six months for which data are presented the MoodGym website recorded 817284 “hits” (an indication of the amount of web traffic) and 17646 “sessions” (an indication of the number of visitors to the site). This was achieved without any direct marketing of the site. There were 2909 people who registered with the site, i.e. provided personal details about themselves and gave permission for their data to be used in research. Of these, 1503 completed at least one assessment. The Goldberg Depression

and Anxiety Scales were administered prior to each module, giving a means of monitoring symptoms over time. Significant reductions in both anxiety and depression scores were found as participants progressed through the modules. Although the absence of a control group means these changes cannot confidently be attributed to the intervention, the results are certainly promising. The volume of traffic recorded on the site suggests a high level of interest, and possibly unmet need, along with a willingness to engage with web-based intervention.

3.5 Post-traumatic stress disorder

A very different method of treatment delivery via a website was employed in an online treatment for post-traumatic stress disorder developed by Lange and colleagues, which involves structured writing assignments and therapist feedback (Lange et al., 2001). A secure website (http://www.interapy.nl) was created for the intervention, which included automated screening, psychoeducation, ongoing assessment, and 10 structured writing assignments (essays) designed to guide the individual's cognitive reappraisal of traumatic events. Each participant in the treatment group was assigned to a therapist who provided individualised feedback on each assignment, and instructions on how to proceed. All interactions between participants and therapists were conducted via the website. A randomised controlled trial (n=30) of the treatment compared the experimental group with a waiting-list control group on symptoms of post-traumatic stress, general psychopathology and mood; as measured by the Impact of Events Scale (IES), Symptom Checklist 90 (SCL-90), and Profile of Mood States, respectively. Treatment lasted 5 weeks and follow-up data were collected 6 weeks after treatment completion. Five participants dropped out during the treatment period; two from the experimental group and three from the control group. Data are reported only for those participants who completed the study (n=25). From pre- to post-treatment the experimental group showed significant improvement on 10 of the 12 outcome measures, including the key measures of avoidance, intrusions, anxiety and depression. These improvements were significantly greater than those of the control group and were maintained at 6-week follow-up. In their evaluations, 95% of the treatment group rated the treatment as helpful and "most" indicated the approach was "appealing".

It is noteworthy that the participants' level of experience in using the internet was not related to treatment outcome, which suggests that a high level of computer literacy is not a prerequisite for successful involvement in internet-based treatment.

The interventions reviewed above all use, to a greater or lesser extent, computer programmes that interact with the user by automatically generating responses according to pre-programmed algorithms. A different approach to internet-based intervention uses the internet purely as a medium of communication between individuals. Variously described as "online therapy", "e-therapy" or "cybertherapy", this type of service aims to provide treatment through email correspondence between a human therapist and a client, without face-to-face contact (King, 1998). There are over 300 independent e-therapy sites on the internet plus three large "e-clinics" with an additional 500 therapists (http://www.metanoia.org). This approach to treatment is controversial due to its unregulated nature and issues of clinical responsibility, therapist licensing, and treatment effectiveness (Pomerantz, 2002; Oravec, 2000; Laszlo et al., 1999; Barak, 1999). Despite the number of e-therapists available, lack of empirical research makes it impossible at this stage to provide an objective evaluation of the effectiveness of online therapy.

4.0 INTERNET AND COMPUTER-BASED INTERVENTION FOR SUBSTANCE USE DISORDERS

The internet allows users access to a vast amount of alcohol and other drug related information. A simple search for the terms "alcohol abuse" or "drug abuse" on a popular search engine returned over 1.5 million "hits" (http://www.google.com, accessed Dec 02). The content of the websites varies widely according to the site's intended audience and its primary purpose; be it educational/informational, marketing, advocacy, news, or social. The quality and accuracy of available information also varies; in contrast to the many providers of high quality evidence-based data, some prominent drug-related websites have been reported to contain information that is both factually incorrect and potentially harmful (Boyer et al., 2001). Regardless of the data quality, the provision of general drug information alone is not necessarily effective in promoting behavioural change with regard to substance use (Mattick & Jarvis, 1993).

Given the large number of websites with content relating to substance use, it is somewhat surprising that so few interventions for substance-related problems currently exist. The variability found among informational sites is reflected in the quality and approach of the interventions available, which range from minimal (brief screening and feedback) to long-term support programmes. The majority focus on tobacco or alcohol use, with very few interactive resources for other drug use. A sample of available online interventions is presented below, none of which has been formally evaluated with regard to outcome and process. Given the lack of even process evaluation data, the description of each site includes subjective impressions of its usability, functionality and face validity.

4.1 Alcohol

Many sites offer a "self test" for alcohol use involving some form of screening and feedback. The complexity, quality and content of these interventions vary enormously, with some using validated screening/assessment instruments and others employing ad-hoc collections of questions.

The self test at http://www.councilonalcoholism.net/selftest.htm derives from the disease model of alcoholism and consists of a single html page questionnaire followed by notes on the interpretation of test results. No indication of the origin or validity of the questionnaire is given. This self-test is non-interactive, non-personalised and static; it is essentially the equivalent of a printed page. Respondents are asked to complete the questionnaire, note their score and read the text relevant to that score. This provides general feedback as to whether the individual shows symptoms of "early stage", "middle stage" or "late stage" alcoholism. Recommendations regarding problem recognition, the nature of alcoholism, and treatment engagement are given from an abstinence-based perspective. This site provides an example of the idea of "self-test" at its most simple and general. The more sophisticated "self-tests" at sites listed below all involve interactive data collection and the dynamic production of feedback for each user based on their responses.

A relatively simple interactive screener for alcohol use is available at http://www.mentalhealthscreening.org/screening/feedback.asp.; a site that provides

online mental health screening services to various US colleges. The alcohol module consists of the AUDIT and a range of demographic and educational-status questions. Data are collected via several pages of questions with check-boxes, and collated to provide individualised feedback of demographic and AUDIT data.
Some limitations are evident with this screener, in particular the feedback includes little interpretation of the AUDIT results and no normative data comparisons. In addition, a large quantity of demographic data is collected via numerous pages of questions and check-boxes, little of which is required for the feedback. This may be useful for monitoring purposes (e.g. who is using the site, what college they come from) but the alcohol screening itself is somewhat buried within it.

Another very brief screening site, http://www.alcoholscreening.org, uses a modified version of the AUDIT. On completion of the questionnaire a single page of feedback is generated, which includes general comment on the AUDIT score obtained and a comparison with American population norms for alcohol use (matched for gender but not for age). This site is graphically appealing and simple to use but the feedback is rather insubstantial and impersonal.

More substantial information is provided at http://www.HabitSmart.com, which uses the Short Form Alcohol Dependence Data (SADD) questionnaire. Personal feedback is included in several pages of discussion of alcohol use and cognitive behavioural treatment techniques. Statements to enhance motivation and support self-efficacy are included. Personal choice and responsibility are emphasised in relation to treatment goals and help-seeking. Although text-intensive the site is simply laid out and easy to use.

Similar but more personalised and focussed is http://www.CareBetter.com, one of the few brief intervention sites to offer data encryption for confidential communication. The screening at this site comprises the AUDIT, the Stages of Change Readiness and Treatment Eagerness Scale (SOCRATES), three alcohol history questions, and eight demographic questions. It provides several pages of specific age and gender matched feedback, motivational messages, and advice tailored to the severity of any alcohol problem detected and appropriate to the individual's stage of change. The feedback is non-judgemental, emphasises personal responsibility for change, and gives encouragement. The site includes various FAQs (frequently-asked-questions files) that provide information on alcohol use and abuse, options and techniques for change, and links to self-help groups and other resources. The information and feedback provided is derived from the research literature and includes references. While the "CareBetter" intervention is theory-driven, evidence-based and of a high standard, the site itself has some problems in terms of presentation. The page layout is very unwelcoming; it is dense, cluttered and non-intuitive. Prior to accessing the assessment users are presented with a closely written full-page legal disclaimer; again this is unwelcoming, a precis in plain language and a link to the full text would seem more appropriate. Also, the feedback is delivered in large unbroken blocks of text, with little regard to readability. Greater attention to the design of the site would make the intervention far more appealing, and minimise the loss of potential users who may be put off by the current unwieldy interface.

4.2 Tobacco

One of the most long-standing online substance use interventions is "QuitNet" at http://www.quitnet.org. The site was launched in 1995 and now claims to attract over 3000 visitors per day and have 20,000 registered members from 160 countries. It provides advice on smoking cessation and a personalized interaction which provides feedback on the annual amount smoked and the associated cost in terms of money spent and impact on "lifespan" (based on epidemiological estimates). Once a user has stopped smoking the site provides ongoing monitoring and feedback including noting of "anniversaries" such as 1 month, or 6 months since the last cigarette. In addition to educational information and individualized assistance in formulating a "quit plan", the site also offers a range of online forums which enable users to communicate with and each and support each other through the processes of quitting and avoiding relapse. These general forums are very well patronized and have spawned a large number smaller "clubs" of users, whose special-interest forums are also hosted on the site. Access to the general "quit" services at this site are free but there is an option for a paid "premium membership" which entitles users to additional features. The site is undoubtedly well managed, well publicized, and attractive to users. To date, however, no evaluation data have been presented.

Another well established smoking cessation programme is available at http://www.stop-tabac.ch. This site was launched in 1996 and may be accessed in any of five languages. In addition to educational information, forums, referral contacts, and a range of interactive tests, the site includes an assessment and very thorough personalized feedback report. The report includes objective feedback about smoking rates, costs involved, perceived risks, high risk situations and a range of cognitive and behavioural strategies tailored to the requirements of the individual. Users are requested to register so their progress over time can be incorporated into subsequent feedback reports. The site is clearly laid out and easily navigable. Some very brief commentary on this site has been published (Etter, 2002), but included no process evaluation or treatment outcome data.

5.0 INTERNET AND COMPUTER-BASED INTERVENTION LITERATURE

Behavioural self-control training (BSCT) is a cognitive behavioural treatment designed to teach people how to change their drinking behaviour; usually to achieve a goal of moderate, non-problematic drinking. Hester and Delaney (1997) conducted a controlled trial of the effectiveness of a computer-delivered BSCT programme in the treatment of heavy, but not severely dependent, drinkers. Participants were recruited from the general community and met eligibility criteria including scores of 8 or more on the AUDIT and less than 20 on the MAST. Those scoring more than 20 on the MAST were referred on to more intensive treatment. Forty-two individuals met the criteria and were randomly assigned to either immediate treatment, or a delayed treatment control condition. Two participants dropped out (one from each group) prior to treatment completion and their data were not included in the analysis. The treatment was delivered in the researchers' offices and involved 8 sessions over 10 weeks. The computer programme conducted interactive assessment, elicited drinking goals, and provided training in areas such as self-monitoring, drink refusal skills, functional analysis of drinking, and problems solving. It

also produced individualised behavioural contracts and feedback on self-monitoring data and progress toward treatment goals. Although a therapist was present at the beginning of each session, the computer programme was self-contained and therapist supervision was minimal. Follow-ups were scheduled at 10 weeks, 20 weeks, and 12 months. The main outcome measures were self-reported quantity and frequency of alcohol use, and estimated peak blood alcohol concentration (BAC). Additional reports of participants' alcohol use were obtained from collateral sources nominated by each participant at the beginning of the study. There were no significant pre-treatment differences between then two groups. At the 10 week point, the immediate treatment group showed significant reductions in quantity of alcohol use (i.e. number of drinks per week, drinks per drinking day, and peak BAC) as compared with baseline and compared with the delayed treatment group. The delayed group then began treatment, and showed an equivalent level and pattern of improvement as the immediate group by the end of 10 weeks, at which point the two groups no longer differed. Participants' self-reports were corroborated by the reports of collaterals, which also documented significant reductions in alcohol use following treatment. These gains were maintained at 12 month follow-up by both groups. The magnitude of the treatment effect from pre-treatment to 12 month follow-up is indicated by effect sizes (Cohen's *d*) that are medium ($d > .5$) or large ($d > .8$) on all outcome measures. On the variable "standard drinks per week" the effect size was 1.04, which is comparable to the mean of 1.11 (range .89 – 1.36) derived from six previous studies of BSCT. These prior studies involved administration of BSCT in individual or group therapy formats, or by means of a self-help manual with therapist supervision. This suggests that, for the BSCT protocol, computer-delivered treatment may be as effective as treatment provided by a therapist.

Promising results were also reported in one of the first studies to evaluate the online delivery of an intervention for substance use. A 5-week smoking cessation programme was developed by Schneider et al. (1990) and made available 24 hours on the *CompuServe* network. The interactive system conducted assessments of users, allocated them to treatment groups, and provided behavioural instruction designed to help smokers break the link between urges to smoke and the act of lighting up. Instruction modules included identifying and managing personal triggers for smoking, changing smoking habits, establishing no-smoking zones and times, thought stopping, goal setting, and self-monitoring. Intervention content was tailored according to the individual user's smoking history, responses to computer-generated questions, and treatment progress. In addition, an online stop-smoking forum was set up to allow discussion between users and contact with treatment staff.

In a controlled trial of the intervention's efficacy 1158 smokers were randomized to one of four groups in a 2x2 factorial design. Half of the participants received the full version of the programme, while half received a control version that lacked most features of the full version. Half the participants had access to the stop-smoking forum, and half did not. The processes of obtaining informed consent and randomisation to group were automated and conducted online. Follow-up data (self-report of past week smoking) were collected 1, 3, and 6 months after participants' first use of the system. The attrition rate was large with 38% of participants accessing the system only once, and just 44% of the total sample providing 6-month follow-up data. Those who received the full programme were significantly more likely than the control group to access the system more than once. Calculated by intention to treat, the abstinence rate for the total sample was 9.4% at 6-month follow-up. (Among only those participants who did provide follow-up data the rate was 21.5%). At all follow-up points abstinence was reported by a

(non-significantly) greater proportion of the full programme group than the control version group. Participants who received the control version and had no access to the forum were significantly less likely to report abstinence than those in all other groups. Among the participants from all groups who provided follow-up data but did not report abstinence, there were significant reductions in mean daily cigarette consumption at all follow up points as compared with baseline. These data suggest that an online smoking intervention can be useful in assisting individuals to reduce their cigarette consumption. With regard to the high drop-out rate, it is worth noting that the barriers to entry to this study were very low, i.e. people could sign up immediately online, with no need to plan appointments, sign physical documents, or leave the house. The minimal effort required to sign up for the study may have resulted in a greater proportion of poorly motivated participants entering the study than would be the case in a face-to-face treatment. Despite the attrition rate, the study shows that an online smoking intervention can attract a large number of participants and retain the majority (61% accessed the system more than once). Given that *CompuServe* had about 360,000 subscribers at the time of the study, the authors estimate that they attracted about 1.1% of the current smokers among them into the study within a 3-month period. This suggests that this type of intervention is attractive and that there is an existing demand for it. It also provides an example of an efficient means of making an intervention widely available, even to those who may be poorly motivated to access more traditional treatments.

The possibility of increasing the availability of effective treatment via the internet is also discussed by Cunningham et al (2000) in their pilot study of an internet based brief intervention for alcohol use. They describe the development of the intervention and report preliminary data on its acceptability as reported by users' evaluations. The intervention was loosely modelled on the Brief Drinker's Check-up (Miller et al.,1988) and involved a brief anonymous assessment (21 questions including the AUDIT; quantity/frequency of weekly alcohol use; demographics; and 6 questions relating to harmful consequences of alcohol use), and the production of a "Personalized Drinking Profile" derived from the assessment data. This single page report provided feedback in both graphic and written forms. It included a pie chart depicting the individual's weekly alcohol use compared with the population norm (matched for age and gender and based on either Canadian or US data); the total number of drinking days and drinks consumed annually; the estimated annual cost of alcohol consumed; a graphic depiction and explanation of the AUDIT score; a summary of negative consequences; and information on safe drinking levels. After receiving feedback participants were invited to complete a brief survey that asked their impressions of the site, whether they had provided a description of their own drinking, and to rate whether their drinking was a problem in the past year.

During the period of the study the programme attracted approximately 500 "hits" per month. The authors report that of the first 1729 users only 243 (14%) responded to the survey, and 214 stated they had provided data on their own drinking. Only the data from these 214 participants are reported, as it is unknown what proportion of the total group provided hypothetical data. The age of these participants ranged from 14 to 69 years with a mean of 34, and 58% were female. The AUDIT scores obtained were indicative of possible problem drinking (using a cut-off of 8 or more) for 47% of this group, although 70% of individuals rated their drinking as unproblematic. More than half (56%) rated the feedback as very or extremely useful, and 34% said they were surprised by how much more they drank than the norm. More self-identified problem drinkers (53%) than non-problem drinkers (17%) reported surprise at how their consumption compared to the

norm. Given the low response rate to the survey it is unclear whether the evaluation data reported is representative of the reactions of the entire sample of users. Nontheless, the study does show that the programme was widely used and able to serve a wide geographical area. The authors also note that the programme was "cheap" to run, with very low staffing requirements after initial set-up. As no outcome data were collected, no conclusions can be drawn as to the efficacy of the intervention in promoting any changes in drinking behaviour.

A similar, although somewhat more sophisticated, brief intervention for alcohol use was implemented in a study by Cloud and Peacock (2001). This pilot study describes the rationale and development of the "CareBetter" site and provides preliminary data on its users. The intervention remains freely available online at http://www.carebetter.com, and is described above. In short, the intervention was also modelled after the Brief Drinker's Check-up (Miller et al., 1988), and involved a 43-question assessment followed by specific objective and personalised feedback. It also offered educational information in the form of FAQs and links to other resources for further information and assistance. All feedback was presented in a non-judgmental tone, included suggestions on healthy and unhealthy drinking limits, and emphasized personality responsibility, choice and self-efficacy for change. During the 172 day period of the study the site attracted 10253 "hits" to the homepage, with 2813 users completing the assessment. This is an average of 60 visits and 15 completed assessments per day. Of those who completed the assessment 2253 reported they were using it for the first time and providing responses based on their own drinking. The mean age of this group was 32 years (range 18 - >60), 64% were male, and the majority were resident in the USA (83%) or Canada (7%) with the remaining 10% residing in one of 40 other countries.

Of particular interest are the AUDIT scores of respondents, the mean of which was 16.9 (SD = 7.5). Eighty nine percent of participants scored above the recommended AUDIT cut-off score of 8, and 74% scored above 12. This suggests a high level of harmful alcohol use and/or alcohol dependence in this population, yet only 6% reported having been professionally diagnosed as alcohol dependent. Such a disparity between the level of apparent alcohol problems the level of professional diagnosis is consistent with the possibility that internet based intervention is attractive to a large population whose alcohol use may be problematic but who have not sought, or are unwilling to seek, traditional treatment. The authors point out that the volume of site visitors during the study was achieved with very little advertising. Most users were referred from listings on search engines. More active promotional activities could greatly increase the utilization of the site.

Another descriptive study reports on the development of the Drug and Alcohol Problem Assessment for Primary Care (DAPA-PC): an internet based system designed to facilitate drug and alcohol screening in the primary care setting (Holtz et al., 2001). The internet was chosen as the means to deliver this screening protocol as a matter of ease of access and implementation. It provides a simple way to integrate a screening process into a busy medical practice by making the screener available to patients in the waiting room. The DAPA-PC system is a two level screening instrument. It begins with a brief trauma assessment (e.g. in the past 5 years have you: broken any bones?, had a head injury?) followed by a 12-question drug and alcohol use screening questionnaire derived from various other published instruments. On completion the user is provided with very brief personalized feedback, in the form of a paragraph or two of text, including motivational statements and advice to talk further with the healthcare provider. The system also

produces a summary report for use by the patient, the provider, or both. This is very much a brief screener rather than an in-depth assessment, feedback, and decision making protocol. It is available online at http://www.danya.com/dapa, but given the content of the feedback it is clearly most suited to use in the primary care setting for which it was designed. This study is purely descriptive; it reports no process evaluation or treatment outcome data.

A more comprehensive alcohol use intervention is described by Matano et al. (2000). This internet delivered alcohol abuse prevention and early intervention programme was developed as part of an employee assistance programme for a large Silicon Valley company. Although delivered via the internet it is currently available only to employees who apply for an access code. Components of the intervention include self assessment, education on cognitive and behavioural strategies for change, an online drinking journal for self-monitoring, links to other resources, and an online forum for users to correspond with each other. Following assessment participants receive individualized feedback including their quantity of alcohol use, level of risk, financial cost, family history of alcohol use, beliefs about alcohol, comparison with normative use, and information on their stress levels and coping styles. The authors present a discussion of the perceived benefits of online intervention such as privacy, convenience, and immediacy of access, but include no data from user evaluations to support it. An experimental design to evaluate the efficacy of the intervention is described, but again no data are presented. Clearly, the complete absence of data in the study makes it impossible to infer anything about the intervention's acceptability or utility. Even so, the study provides a useful insight into the development of an online intervention.

In an unpublished doctoral dissertation Miller (2001) reports on the implementation of a brief intervention for alcohol use which employed both web-based and stand-alone computer components. The study tested the effectiveness of two brief interventions; one computer-delivered (CD-ROM), the other delivered by trained peer educators, compared with two assessment-only control conditions. The interventions each involved two 90-minute sessions delivered in a group setting. The content of the interventions was similar and included general alcohol education, normative data, risk reduction strategies, self-monitoring, consideration of alcohol-related expectancies, and skills training. The CD-ROM intervention was overseen by a therapist and included some group discussion. Outcome measures were taken 6 months after treatment. Two control conditions were included; a single assessment condition (in which one assessment was conducted at the end of the follow-up period), and a multiple assessment condition which involved 3 assessments over the 6 month course of the study. The assessment battery required about 30 minutes to complete and included measures quantity, frequency and peak alcohol consumption, as well as a range of standardised instruments used to assess level of use, alcohol-related problems and symptoms of dependence.

An interesting aspect of this study is that although the CD-ROM intervention was delivered by stand-alone computer, all assessments (for all participants) were conducted online via a website. A total of 547 first year university students were randomised to one of the four conditions. The overall attrition rate of 29% did not differ between groups. Intention-to-treat analysis revealed significantly greater quantity, frequency and peak alcohol consumption, and significantly higher scores of alcohol-related harm and alcohol dependence in the single assessment group compared with the three other groups. There was no difference between the two intervention groups and the multiple assessment

group on these measures. One interpretation of these results is that the multiple assessment condition constituted a form of web-based brief intervention, perhaps by prompting participants to consider their alcohol-related goals or by providing implicit feedback and encouraging self-monitoring. Whatever the mechanism, this study suggests that web-based intervention may be as effective as therapist-led group intervention for this population. The use of web-based assessment was well received by participants, with 90% of the sample reporting that it was “very”? or “extremely” convenient.

6.0 DISCUSSION

6.1 Assessment of evidence

There is good evidence that computer-delivered interventions for mental health and/or behavioural problems can be effective. In particular, studies of programmes based on cognitive-behavioural principles have reported positive results in the treatment of depression, anxiety, specific phobia, and problematic alcohol use. Cognitive-behavioural-type interventions appear to be the most amenable to being adapted for delivery by computer.

Although positive results have been reported (Tate et al., 2001; Carlbring et al., 2001; Lange et al., 2001) the evidence from the general internet-based intervention literature is less clear, with many studies involving small sample sizes, lacking control groups, or having high drop-out rates (Christensen et al., 2002; Strom et al., 2000; Schneider et al., 1990). These studies have, however, been successful in attracting users to the intervention to begin with, and the evaluation data reported generally indicate satisfaction with the mode of treatment. This is consistent with the notion that the internet is a viable medium by which to deliver treatment. The huge potential of the internet to be used for therapeutic purpose has been widely recognized.

With regard to internet based substance use interventions, there is a very clear gap in the literature: outcome measurement. While studies have demonstrated the existence of a sizable demand for internet based interventions (Cunningham et al., 2000; Cloud & Peacock, 2001), little has been done to examine their efficacy in leading to changes in substance use behaviour. Such research is essential to identify the most effective elements of interventions, to identify who may most benefit from participation in an online intervention, and to ensure the efficient use of resources. As Bessel and colleagues have pointed out:

“At present there is almost no evidence regarding the effects of consumer internet use on health outcomes. Well designed controlled studies, instead of anecdotes and opinions are urgently needed” (Bessel et al., 2002, p34).

As it stands numerous questions remain unanswered by the current literature. Initial consideration might be given to where along the continuum of use an intervention might best be targeted? Would it be most useful to provide an in-depth long-term programme aimed at those who are heavily dependent, or a relatively simple brief intervention primarily targeting those who are currently risky users but who have yet to become dependent? Perhaps both. Brief interventions (in a variety of forms) have been the most commonly reported; probably as a result of the lesser degree of complexity involved in

developing a minimal screener/feedback programme in comparison to a fully automated series of CBT sessions.

Currently two well designed studies of online alcohol use interventions are known to be underway internationally. Both have undergone extensive development and are being subjected to RCTs. The first is a brief intervention based on the Brief Drinkers Check-up that has been developed by Behavior Therapy Associates in the US as a commercial product (Hester, 2002). The second is a suite of 6 sessions of computer delivered CBT that was developed at the Trimbos Institute in the Netherlands (Cjupers, personal communication). These trials are still in progress and final data are not yet available.

A further unanswered question relates to local demand. The convenience and availability of online services have been repeatedly mentioned by participants in the literature reviewed as positive attributes (Miller, 2001; Carlbring, 2001; Strom, 2000). Given the increasing number of services that are provided and used online (e.g. banking, shopping, booking travel, filing tax returns etc) it is plausible that online substance use interventions would find an audience in Australia. In view of Australia's vast size, it may be the case that online intervention will allow greater access to at least some type of service for rural communities who may have less ready-access to more traditional services. Ready availability of services could also prove a considerable advantage in capitalising on what may be an individual's fluctuating motivation to seek treatment. The international literature suggests that a demand exists for online substance use intervention, but whether this is the case in the Australian context remains unknown.

What is known is that tobacco, alcohol and other drug use continue to be a major preventable source of premature death, illness and societal harm in Australia. Intensive expert-led in-person interventions have relatively high success rates, but reach only a small proportion of the substance using population. One potential means for reducing the national prevalence of substance use and abuse (and substance-related problems) lies in the widespread dissemination of brief interventions. However, there are constraints on the effective implementation of brief interventions by primary care professionals, including lack of time and/or interest in the area. Consequently, other avenues of dissemination could usefully be explored. Internet delivery of such intervention is one way of achieving wider dissemination, and potentially having a significant impact on public health.

Given that the demand for internet based intervention in Australia is untested, and that brief interventions are targeted at a wide population it would seem prudent to begin investigation into online intervention by developing and implementing such a brief intervention. This would have a number of pragmatic advantages over development of a specialised multi-session intervention targeting people with established dependence.

1) **Lower cost**. The CareBetter brief intervention site (Cloud & Peacock, 2001) was developed, implemented and maintained wholly at the cost of the principal investigator, who described the "favourable cost" as one of the advantages of online intervention. The intervention developed by Cunningham et al., (2000) was described by the authors as relatively "cheap". Neither of these studies mention dollar amounts, but both endorse low cost an advantage of the approach. In contrast, the CBT package currently being evaluated by the Trimbos Institute incurred development costs in the order of 500,000 Guilders; approximately equivalent to $A500,000 (Cjupers, personal communication).

2) **Shorter development time.** The relative conceptual simplicity of a brief intervention would require less time to be invested in analysis, coding, testing and debugging .the software than would be the case for the development of a more complex intervention

3) **Larger target population**, i.e. the large number of risky substance users who may or may not see their use as problematic. (Many studies of internet intervention have reported poor participant retention rates. This may be less of a problem for a brief, population-based intervention. Earlier meta-analyses revealed a "numbers needed to treat" (NNT) estimate of the efficacy of GP delivered brief intervention in reducing alcohol consumption of NNT=7, suggesting that 7 drinkers must be treated before one will reduce alcohol consumption (NHC, 1999). If the NNT for online intervention is remotely comparable, which is at this stage unknown, the high throughput of the site could make up for the drop-out rate and still be able to contribute a significant treatment effect at the population level).

7.0 RECOMMENDATIONS

In the light of the evident promise and potential demand for web-based treatment for substance use disorders, we make the following recommendations.

As an initial investigation into online substance use intervention in Australia, to develop and trial an internet based brief intervention with content derived from evidence-based best practice guidelines for brief intervention for alcohol, tobacco, and/or cannabis in the first instance. The brief intervention could be initially trialled as computer-delivered prior to moving onto the web.

A working party of interested parties should be formed to consider the structure of the intervention itself and the content and style of additional features (e.g. content of associated FAQs; appropriate referral lists; whether or not to provide access to a users forum as an adjunct to the core intervention).

To ensure that the implementation of the intervention is accompanied by a diverse and long lasting range of promotional strategies, as even the most effective treatment can only be useful if it is accessed. Sponsored links on major search engines may need to be considered in addition to: links in from other health-related websites; promotion of the intervention among GP associations and other primary care organizations; occasional postings on newsgroups; and traditional print media.

Given the lack of evaluation data in the literature, a complete and thorough evaluation of process and outcome should be conducted. A randomised controlled trial to assess the efficacy of the intervention should include a delayed treatment control group (to avoid denying anyone access to services) and multiple follow-ups, which will enable both between subjects (experimental group vs delayed treatment group) and within subjects (delayed treatment group, pre and post treatment) comparisons. Plans for aggressive follow-up should be made to minimise the loss-to-follow-up rate which has proved problematic for some earlier studies. This is a resource issue for such a clinical trial.

In summary, while the literature on internet based substance use interventions is sparse and flawed, the potential impact of effective intervention is huge. On the basis of the limited research available, and arguing by analogy from the computer based and general internet intervention literature, it seems reasonable to suggest that a demand for intervention probably exists in Australia and there is a good likelihood that intervention would be effective. Further research in the area is certainly warranted, particularly where there is unmet treatment demand in rural or remote communities.

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