DOCTOR OF PHILOSOPHY

The effect of the inclusion of a computer-based interviewing system on patient-clinician communication during the subsequent consultation

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Declaration

I declare that I am the author of this thesis; that, unless otherwise stated in the text, all references cited have been consulted by me; that, except for those parts of work which are declared in this thesis to be based upon joint research, the work which this thesis records is mine; and that it has not been previously presented or accepted for a higher degree.

Signed: _____

Katrina Hands

Date: _____

Certificate

I declare that Katrina Hands has satisfied all the terms and conditions of the regulations made under Ordinances 12 and 39; and has completed the required 9 terms of research to qualify in submitting this thesis in application for the degree of Doctor of Philosophy.

Signed: _____

Dr Karen Petrie

Date: _____

Acronyms and Abbreviations

ACASI – audio computer-assisted self-interviewing

ASP – Active Server Pages

ATM – automated teller machine

BAI – Beck Anxiety Inventory

BDI – Beck Depression Inventory

BMA – British Medical Association

CASI – computer-assisted self-interviewing

CAST – Centre for Applied Special Technology

CIS – computer interviewing system

COPD – chronic obstructive pulmonary disorder

CSS – cascading style sheet

DMAG – Digital Media Accessibility Group

GAD – generalised anxiety disorder

GADD – generalised anxiety and depression disorder

GCC – General Chiropractic Council

HADS – Hospital Anxiety and Depression Scale

HAMD – Hamilton Depression Rating Scale

HAS – Hamilton Anxiety Scale

HTML – Hypertext Markup Language

ISP – internet service provider

LANSS – Leeds Assessment of Neuropathic Symptoms and Signs

MADD – mixed anxiety and depressive disorder

PDW – print dialogue window

PH – pulmonary hypertension

PWS – Personal Web Server

SQL – Structured Query Language

VBScript – Visual Basic Script

WCAG – Web Content Accessibility Guidelines

WWW – World Wide Web

XHTML – Extensible Hypertext Markup Language

ZDS – Zung Self-Rating Depression Scale

Executive Summary

A computer interview has been found to be a valuable tool in eliciting information; this is highly relevant in the clinical setting where it is important to break down communication barriers between patients and clinicians. The consultation rates for anxiety and depression have been increasing steadily over the last few years, but recognition of patients with these conditions is problematic. Patient reassessment is an essential part of any on-going treatment plan; it may be possible to use a computer interviewing system (CIS) to enhance this process.

This thesis describes the development and evaluation of a CIS and its use in two different clinical settings (GP surgery and chiropractic clinic), with the aims of aiding recognition of patients with anxiety or depression and enhancing communication between patient and clinician. The Hospital Anxiety and Depression Scale (HADS) was included in the interview question set to aid in the identification of patients suffering from significant anxiety or depression.

60 patients used the CIS in both settings, 6 GPs and 3 chiropractors were involved in the study. An extremely high level of acceptance of the CIS was found in patients and clinicians in both settings. All but one patient rated the system as either “easy” or “extremely easy to use”. In the GP surgery, 80% of patients felt that they were either “possibly” (68.33%) or “definitely” (11.67%) more focussed for the subsequent consultation. In the chiropractic clinic, 41.7% of patients said they disclosed new information and 33.3% felt better prepared for the following treatment session.

The CIS aided the recognition of some individuals with anxiety or depression, more so within the chiropractic clinic than in the GP surgery. The information in the interview transcript was considered much more useful by the chiropractors than the GPs (85% v 21.67%); this could be partially attributable to the fact that the chiropractors added 15 reassessment questions to be included in the question set, whilst the GPs only added 4, more general, questions. The CIS also helped to highlight communication issues and show trends within the patient populations.

Whilst computer interviews have been used extensively in a clinical setting, this study furthered current knowledge in two main areas; firstly, recording the thoughts and opinions of the clinicians throughout the study enabled their perspective to be analysed; secondly, establishing the benefits of the CIS in a setting where a relationship and trust has already been established between clinician and patient.

Although the inclusion of the CIS was found to be of benefit in both settings, the GPs felt that it was more appropriate for use with more specific patient groups. In the chiropractic clinic, the inclusion of the CIS was an effective addition to the periodic patient reassessment process. It would be possible to deliver other screening interviews using the CIS, the selection of which could be specifically tailored for individual patients. The application of the CIS could be enhanced using modern handheld devices.

Associated Publications

Development of a computer-based interviewing tool to enhance the requirements gathering process, K. Hands, D. R. Peiris and P. Gregor, *Requirements Engineering* (2004), pp.204-216. ISSN: 0947 3602

A computer-based interviewing tool for usability engineering (UsE-IT), K. Hands, P. Gregor, D. R. Peiris and A. F. Newell, *CHINS 2001 Consumer Health Informatics Network Scotland* (2001). 25 October, Glasgow. ISBN: 1 904196 00 4

Use of a computer interviewing system in a chiropractic clinic to enhance patient-clinician communication during periodic patient reassessment, K. Hands, M. Cashley, R. McWilliam and L. Steen, *Journal of Manipulative and Physiological Therapeutics* (2011), 34(7), 468-475. ISSN: 0161-4754

The effect of the inclusion of a computer interviewing system on patient-clinician communication, K. Hands and M. Cashley, *The 24th IEEE International Symposium on Computer-Based Medical Systems CBMS* (2011, accepted) (submission 136)

Introduction

The importance of effective communication between patient and clinician is widely accepted and it is acknowledged that the pressure of time may be a factor adversely affecting this effectiveness, particularly in a GP surgery setting, where appointments are scheduled to last only 10 minutes.

Many studies have been carried out that show people are more likely to tell the truth to a computer than to another person, particularly when being interviewed about a sensitive topic. Additionally, research has been conducted to show the accuracy of data gathered in a computer interview and the acceptability to patients. Little attention has been paid to the thoughts and opinions of the clinicians using the data gathered in a computer interview, in particular whether they find the information useful and how they need the information presented for rapid assimilation. This thesis seeks to extend current research in this particular aspect of clinical computer interviewing.

This study proposes that the inclusion of a computer interviewing system into the consultation process, whereby the patient completes the computer interview directly prior to the consultation and takes the interview transcript to show the clinician at the start of the consultation, could enhance the communication between clinician and patient. The computer interview is to be used as an aid to interpersonal communication and not as a replacement for it. By scanning the computer interview transcript at the start of the consultations, the clinician may be able to utilise the consultation time more effectively and efficiently. Two different clinical settings

were selected, firstly a more general setting of a GP surgery, and secondly a specialised setting of a chiropractic clinic.

Two separate computer interview question sets were developed for use in the differing clinical settings. These were developed in collaboration with the relevant clinicians and both sets of clinicians requested the incorporation of an anxiety and depression screening interview. Anxiety and depression screening was included as mood related disorders consistently rate among the top ten reasons for GP consultations and their rate of occurrence is increasing, as is the level of anti-depressant medication prescription. Also, mood related disorders tend to have an increased prevalence amongst patients with chronic conditions and research has shown increased levels of anxiety and depression in patients with low back pain. Hence the inclusion of anxiety and depression screening was highly appropriate within both the GP surgery and chiropractic clinic.

This thesis documents the background research, requirements analysis, design and testing stages of the creation of a computer-based interviewing tool. It then provides results of the evaluations of the interview tool when used in two different clinical settings. Finally, a full discussion and analysis of these results is presented.

Chapter 1 describes the established advantages and limitations of computer interviewing, including its use in counselling and medical settings. Some general information about anxiety and depression, in particular problems with their recognition, is provided. A number of anxiety and depression screening techniques are identified which are relevant for incorporation into the CIS.

Chapter 2 explores the hypothesis for this research, presents the specific research questions to be answered and introduces the investigations.

Chapter 3 details the design and development process followed in the creation of the CIS and outlines the three different aspects of the CIS, namely the interview delivery interface, the interview authoring interface and the interview analysis interface. Issues of accessibility and usability, and the rationale behind using a web-based environment are also discussed in this chapter.

Chapter 4 discusses the initial user evaluations of all three aspects of the CIS that were conducted prior to working in the clinical setting and outlines changes that were required before the next phase of user testing.

Chapter 5 describes the clinical user evaluations that were undertaken before conducting the main study. These clinical user evaluations were run over three sessions and the results of these are discussed in detail, along with the iterative process used to aid usability and acceptability of the CIS.

Chapter 6 explores the use of the CIS in a GP surgery setting; this is the first part of the main study forming this thesis. This chapter details the methods used, the results found and discusses the implications of these findings and potential future uses of the CIS in a clinical setting.

Chapter 7 explores the use of the CIS in a chiropractic clinic as part of the periodic patient reassessment process; this is the second part of the main study forming this thesis. This chapter provides a background to the rationale for using the CIS in this particular setting, details the methods used, the results found and discusses the

findings and possible future studies within a chiropractic setting that could be beneficial.

Chapter 8 provides a discussion of the similarities and differences in findings between the GP surgery and chiropractic clinic settings and provides some explanation of these. A critique of the research, including strengths and limitations is also presented in this chapter; future research directions are also presented.

Chapter 9 presents the conclusions from the research.

1 Background

This chapter details the background to the work described in this thesis. This includes a description of computer-based interviewing, its advantages and limitations, and its use in a clinical setting. Next some of the issues regarding medical histories and consultations are presented. There follows a discussion of anxiety and depression, problems with recognition of the illnesses and of the different screening instruments available. Finally ethical issues regarding use of computer interviews, particularly in a medical setting are discussed.

1.1 Computer Interviewing

1.1.1 Introduction

Computer interviewing is a process whereby the interviewee is presented with a series of questions by a computer rather than another person, with the interviewee responding directly to the computer. This process has been used as a supplement to a face to face meeting, whereby the transcript from the computer interview is used by the human interviewer as basis for the interview; enabling the human interviewer not only to save time, but also to ask more relevant and meaningful questions. Computer interviewing has also been used instead of a face to face interview, with the interviewee interacting solely with the computer.

Computer interviewing is a technique that has been around since the earliest interactive computers. One of the first computer conversation programs was ELIZA, which was developed by Joseph Weizenbaum in 1966 (Weizenbaum, 1966).

Weizenbaum wrote a number of scripts, each of which enabled ELIZA to play a specific conversational role, such as that of a Rogerian psychotherapist. Weizenbaum found (Weizenbaum, 1966, p371):

> *"…that extremely short exposures to a relatively simple computer program could induce powerful delusional thinking in quite normal people. This insight led me to attach new importance to questions of the relationship between the individual and the computer…"*

ELIZA worked by using rules and keywords to reply to the user with phrases or questions and caused the users to become highly engaged in the conversation (Weizenbaum, 1984). Indeed some subjects were difficult to convince that ELIZA was not human.

It has also been found that computers are remarkable in enabling us to interact with a program in a similar way to that in which we interact with a person. However, the programmer must be aware of the possibility that users may attach human attributes to the computer. Gaines and Shaw say (Gaines & Shaw, 1984, p124):

> *"One of the criticisms often levelled at attempts to create natural language dialog with computers is that it gives a false impression of human intelligence on the part of the machine. This may mislead the user into expecting more understanding and common sense from the computer system than can realistically be programmed."*

Research has continued into the engagement potential of computer-based interviews and this has proved to be significant in the 'enjoyment factor' that users felt during the interview process (Peiris, 1997).

The early work created interest in a number of aspects of the interaction between people and computers but it wasn't until both the cost and size of computers decreased that more research groups began to experiment with different applications for computer interviews. Research was carried out into computer-based psychological and psychiatric testing, survey conducting and the taking of medical histories (Ancill, Rogers, & Carr, 1985; Brownbridge, Lilford, & Tindale-Biscoe, 1988; Butcher, 1994; Carr, Ghosh, & Ancill, 1983; Schulberg, Saul, McClelland, Ganguli, Christy, & Frank, 1985).

The results of this research led the researchers to conclude that computer interviews were widely accepted by the interviewees and generally gathered at least as much information as a human interview. The information was found to be more precise where the setting was specialised (Bingham, Lilford, & Chard, 1984). The research study in this thesis will expand upon this finding by investigating if the information from a computer interview is also perceived as more useful in a specialised setting.

1.1.2 Advantages of computer interviewing

Computer interviewing has been discovered to be a useful means of gathering information of a sensitive nature from people. It has been shown that there is good evidence that when people are interviewed about sensitive topics, they are more

likely to tell the truth to a computer than to another person as they view the computer as unshockable and non-judgemental (Reeves & Nass, 1996). This has also been found to be the case even when interviewees know that the human interviewer will later talk to them about what they have divulged. Indeed, the following, face to face, meetings were often more fruitful after an initial computer interview (Wright, Aquilino, & Supple, 1998).

The discussion of particularly sensitive subjects can also be difficult for the interviewer. A computer will always ask those questions it has been programmed to ask and will not become embarrassed and avoid a difficult topic. So the non-human attributes of a computer can be advantageous, especially when interviewing about sensitive subjects. Studies have been carried out in a variety of settings that deal with particularly sensitive issues, such as sexual behaviour and drug misuse (Butler, Villapiano, & Malinow, 2009; Gribble, Miller, Cooley, Catania, Pollack, & Turner, 2000; Le, Blum, Magnani, Hewett, & Do, 2006; Turner, De Kock, Sebola, Meehan, Blanchard, Hoosen, Coetzee, & Ellertson, 2002; Turner, De Kock, Meehan, Blancharda, Sebolad, Hoosen, Coetzee, & Ellertson, 2009).

Other advantages of computer-based interviewing include the findings that computers can be more reliable than human interviewers (Erdman, Klein, & Greist, 1985; Slack, Hicks, Reed, & van Cura, 1966). A computer will not forget to ask a question and will always follow its programmed routine. Computer interviews are quicker to analyse as the computer can be programmed to calculate results automatically and cheaper to administer as they require less staffing; these benefits

are only of worth if the computer interview is still proven to be reliable (Wolford, Rosenberg, Rosenberg, Swartz, Butterfield, Swanson, & Jankowski, 2008). In computer interviewing, the answers given can be validated as soon as the answer is given and, in case of doubt, the computer interview can immediately ask the interviewee for clarification and/or correction, hence enabling data to be cleaned while the interviewee is still available (Saris, 1991).

A computer interview can be designed to ask certain questions depending upon the interviewee's responses to prior questions. This is a good interviewing technique to employ, as the interviewee will respond more favourably if they feel that each question is important and significant (Garrett, Mangold, & Zaki, 1982). Jones et al have shown that personalising of the information within a computer information system to be of benefit in a group of cancer patients (Jones, Pearson, McGregor, Cawsey, Barrett, Craig, Atkinson, Gilmour, & McEwen, 1999).

During computer interviews, interviewees are in control of the rate of the interview and do not feel the same pressure of time as they feel when being interviewed by a clinician (Slack, 1984). Patients were found to be more relaxed when they learnt that they controlled the rate of the interview (Bevan, Pobgee, & Somerville, 1981). More information is likely to be elicited when the interviewee feels in control of and comfortable with the interview process (Substance Abuse and Mental Health Services Administration, 2008).

Interviewees have also been found to report more information to a computer than that gathered during either a human interview or a paper-based questionnaire. For

example, Lapham et al used a computer interview to assess and inform patients regarding prenatal behavioural risks (Lapham, Kring, & Skipper, 1991). They reported that a much higher percentage of women reported alcohol or drug abuse during the computer interview. They also found that participants who had used the computer system scored more highly on a test measuring knowledge of the effects of various risk factors. More recent studies, in a sexual health setting, agreed with the earlier findings that computer interviews gather more detailed and accurate data than face to face interviews (Kurth, Martin, Golden, Weiss, Heagerty, Speilberg, Handsfield, & Holmes, 2004; Turner et al., 2009).

In addition to gathering data effectively computer interviews have been used to aid efficiency by saving time and improving cost effectiveness, enabling better use of time spent with the human interviewer. Computer interviewing methods are particularly cost effective when a large study or repeated studies are being undertaken (Brown, Vanable, & Eriksen, 2008). Thus the combination of good practice human interviewer techniques with the non-human characteristics of a computer has been shown to produce the most effective computer interviews.

1.1.3 Limitations of computer interviewing

As mentioned previously, there is a danger of interviewees ascribing human characteristics and abilities to the computer (Peiris, Gregor, & Alm, 2000). They may expect a greater degree of “understanding” than the computer has been programmed to provide and may consequently be disappointed in the interview

process (Weizenbaum, 1984). This should be addressed by providing clear information from the outset of the interview.

Interviewees must also be made aware of exactly what information is passed on to the interviewer as the communication process will be hindered if there is a mismatch of what the interviewee expects the interviewer to know and what the interviewer actually knows.

Great care must be taken to ensure that the language used throughout the interview is clear, precise and appropriate to the audience. Confidence will soon be lost if questions are poorly worded and the interviewee does not understand what is expected. Ensuring material of an appropriate reading level for the study population is essential; Kissinger et al used a fourth grade reading level to conduct computer interviews into sexual behaviour, whilst Boekeloo et al used a reading level of seventh grade when conducting interviews regarding HIV risk factors (Boekeloo, Schiavo, Rabin, Conlon, Jordan, & Mundt, 1994; Kissinger, Rice, Farley, Trim, Jewitt, Margavio, & Martin, 1999). Including audio as part of the computer interview can help with understanding and aid independent completion, indeed audio computer-assisted self-interviewing (ACASI) has been extensively trialled in a variety of settings (Estes, Lloyd, Teti, Raja, Bowleg, Allgood, & Glick, 2010; Turner et al., 2002; van Griensven, Supawitkul, Kilmarx, Limpakarnjanarat, Young, Manopaiboon, Mock, Korattana, & Mastro, 2001; Waruru, Nduati, & Tylleskar, 2005).

Some people are not comfortable using computers and they may provide less information during a computer interview due to a desire to complete the process

rapidly. This should be an avoidable problem by ensuring that the interface is simple and intuitive and by following usability guidelines at all stages of the design process. Indeed this is seen to be of vital importance, as the benefits of computer interviewing will be lost very quickly if the interviewee is confused or unsure and feels the need to ask for assistance throughout the interview process.

In the past, a computer has been unable to detect when an interviewee is becoming distressed, or to gather information other than that which is directly entered via the keyboard. Trained interviewers will gather information based on the interviewee's posture, gestures and facial expressions. This could, however, also be viewed as an advantage as the computer will not make judgements based on appearance.

1.1.4 Computer-based interviewing in a medical setting

Some members of the medical profession have used computer-based interviewing fairly extensively. One of the earliest uses was made by Slack et al when a computer-based interview was used to take a medical history (Slack et al., 1966). An allergy history questionnaire was developed whereby the patient responded to the question displayed on a small computer screen by pressing one of four keys – *yes*, *no*, *don't know* and *don't understand*. It was discovered that the patients felt comfortable using the computer and in control of their medical history. One participant in the study, who had impaired hearing, thought the computer interview preferable to some doctors as he found it hard to hear the doctors.

During these first studies, a comparison of doctor and computer questioning was carried out and once again the computer interview was found to be acceptable to

the majority of patients but it was also found to be less accurate than doctor interrogation (Card, Nicholson, Crean, Watkinson, Evans, Wilson, & Russell, 1974). However in other cases, patients divulged more detail during computer questioning. In a study by Holt, patients were found to be more apt to tell about adverse life-style to the computer than to a physician during a clinical interview (Holt, Guram, Smith, & Skinner, 1992). Hence Holt concluded that the computer could provide an acceptable, efficient, and potentially cost-effective way to assess lifestyle.

This research was developed further in the 1990's by using the computer not only to gather information but also to deliver information. Lapham et al used both a computer interview and a paper questionnaire to conduct prenatal behavioural risk screening and to provide information about the effects of such behaviour (Lapham et al., 1991). They found that although self-reported rates of smoking did not differ between the two interview techniques, a much higher percentage of women reported alcohol and drug use during the computer interview. Interestingly, study participants scored significantly higher on a test measuring knowledge of the effects of stress, diet, and substance abuse on pregnancy than did a control group. While computerised patient education is not meant to replace clinicians, it could make better use of clinicians' time and help to improve overall efficiencies and enhance quality of care (Keulers, Welters, Spauwen, & Houpt, 2007; Knee & Jacobs). Reviews have shown the effectiveness of computerised patient education, with particular success in the area of diabetes; again it was emphasised that computerised education is to be used as a supplement to time with the clinician and not as a

substitute (Krishna, Balas, Spencer, Griffin, & Boren, 1997). Positive results have been found in the delivery of computerised medical education but more work is required in this area (D. Lewis, 1999).

Computers have been used in the prediction of suicide risk (Griest, Gustafson, Stauss, Rowse, Laughren, & Chiles, 1973). Not only did patients prefer the computer but it was also found to be more accurate. A computer-delivered questionnaire has also been used to successfully detect the presence of depression. The scores for the severity were found to correlate significantly with assessments made by qualified clinicians (Carr, Ancill, Ghosh, & Margo, 1981). The use of computer-based interviews, in particular their impersonal and non-judgemental nature, seemed to help interviewees answer difficult questions more easily. More recently, a study by Cha et al has shown that using a computer to deliver a modified Stroop test to identify individuals at risk of suicide attempt proved successful (Cha, Najmi, Park, Finn, & Nock, 2010).

Many aspects of medicine and medical interviews cover issues that the majority of people would consider to be of a sensitive nature. Answering a computer has been reported as being easier and less embarrassing than answering another person. In particular, Sanders et al found that the majority of patients interviewed about their HIV risk behaviours preferred to disclose sensitive information to the computer (Sanders, Owens, Padian, Cardinalli, Sullivan, & Nease, 1994). This preference also causes interviewees to be more open and honest about personal or sensitive topics when answering the computer. For example, when interviewing epilepsy sufferers,

Chun et al found that 10% of interviewees reported urinary incontinence to the computer, but it was never reported to a clinician (Chun, van Cura, Spencer, & Slack, 1976). Locke et al found that more HIV risk factors were reported to the computer than during a face to face interview (Locke, Kowaloff, Hoff, Safran, Popovsky, Cotton, Kinkelstein, Page, & Slack, 1992).

There appears to have been little investigation as to whether the transcript from a computer interview can be used specifically to increase both the effectiveness and efficiency of the following GP consultation where pressure of time is often felt by patient and clinician alike. Early research has focussed on the acceptability and ease of use as experienced by the patient, with less attention paid to the usefulness and effectiveness as perceived by the clinician; this forms a novel aspect of this thesis.

In today's time-conscious medical practice, few doctors have enough time to ask every patient all the questions they would like to ask or talk to the patient for as long as they would like. Most doctors believe that the medical interview is the most crucial piece of evidence for arriving at the proper diagnosis. A means to assist the medical interview process would be of benefit to both doctor and patient alike. Research has shown that with a very short interview aided by the results of a computer interview, an experienced clinician can rapidly proceed with the evaluation (Wenner, 2004).

When doctors were asked about the effectiveness of their health care, the concern most commonly referred to was that of time (Freeman, Horder, Howie, Hungin, Hill,

Shah, & Wilson, 2002; Tomlin, Humphrey, & Rogers, 1999). Time was seen as hindering effectiveness across all its dimensions:

> *"Time influences everything. It influences getting a history correctly, engaging with the patient if you don't know them well, building up some sort of rapport, discussing treatment options, examining them properly."*

It has been suggested that when patients present with more than one problem, sometimes acknowledged and sometimes hidden, that it becomes necessary for the doctor to prioritise, even if it means ignoring some of the problems, again due to the pressures of time. In a postal survey carried out with Scotland's GPs, nearly 9 out of 10 GPs (87.3%) felt that a holistic approach was essential to providing good health care, but only 1 in 15 (6.8%) thought the current organisation of primary care services made it possible. The main constraint on holism within the consultation was seen as the time available (Mercer, Hasegawa, Reilly, & Bikker, 2002).

The consultation times for patients with psychological problems has been found to be longer than average (Andersson, Ferry, & Mattsson, 1993 ; Deveugele, Derese, van den Brink-Muinen, Bensing, & De Maeseneer, 2002; Howie, Heaney, Maxwell, Walker, Freean, & Rai, 1999). Also patients in distress and those from a poor socioeconomic status required longer consultations (Stirling, Wilson, & McConnachie, 2001). It is thus perhaps particularly important to develop some sort of tool that could potentially reduce the amount of time required for a consultation.

A feasibility study has been carried out to investigate the effect of asking patients to write lists of issues to discuss directly prior to the consultation. There was an

increase in the number of problems elicited when the patient made a list and the time spent on each problem was reduced (Middleton, 1995). It was concluded that the act of making a list could help to improve communication by helping patients to organise their thoughts. Sharing the list with the doctor might further improve the consultation by making the patient's agenda explicit (McKinley & Middleton, 1999 ; Middleton, McKinley, & Gillies, 2006).

The need to utilise consultation time efficiently and effectively is very apparent. There are a number of illnesses, of which anxiety and depression are two, where it is particularly difficult for the doctor to keep the consultation duration to within the allocated time period; anxiety and depression will be discussed in greater detail below. Not only does the doctor face the difficult task of recognising these individuals but also the need to determine an appropriate treatment plan that is acceptable to the patient. It has been found that patients are more likely to complete a course of treatment if they feel that they have been involved in the decision making process (Donovan, 1995). Consultations where the patient is involved in any decision making also inevitably take a considerable amount of time, with at least 20 minutes suggested as being needed for participatory decision making (Heisler, Bouknight, Hayward, Smith, & Kerr, 2002). Studies of chronic disease show that doctors who involve patients in their own care have better health outcomes than those who do not (Mechanic, 2001).

Research has also been conducted into whether a computer can effectively take a medical history and it was discovered that use of the computer aided the

communication process, with the computer, at times, obtaining more information than the clinician (Bingham et al., 1984; Brownbridge et al., 1988). It was found to be more useful in a specific setting as over reporting occurred more frequently when used in a more general context. Bingham et al also produced a transcript as a result of the interview, which was being used within a specialist gynaecological practice, and found it to be useful if formatted in such a way that the clinician could assimilate the information easily. A program to elicit personal histories from patients in a general psychiatric ward has also been developed; 90% of the histories were found to be correct, most containing several items unknown to the clinicians and of importance in the management of the patient (Carr et al., 1983). Computerised medical history taking certainly has a place in general practice and secondary care (Bachman, 2003), and has been used effectively in the emergency room setting to gather information from patients and from parents of children with considerable success (Benaroia, Elinson, & Zarnke, 2007; Bouamrane, Rector, & Hurrell, 2008; Porter, Forbes, Manzi, & Kalish, 2010). Benaroia et al concluded that a computer interview could form part of the normal patient triage process, such was the speed of completion (5 min and 32s +/- 1 min and 21s) and the patient response rate (97%) that they found (Benaroia et al., 2007).

1.2 Depression and Anxiety

1.2.1 Introduction

Anxiety is an unpleasant emotional state characterised by fearfulness and unwanted and distressing physical symptoms. It is a normal and appropriate response to stress

but becomes pathological when it is disproportionate to the severity of the stress, continues after the stressor has gone, or occurs in the absence of any external stressor. Anxiety can also cause certain individuals to feel increasingly depressed and hopeless (Anxiety Care).

Feeling sadness is part of everyday experience. When doctors speak of depression they mean very much more than the experience of sadness. Depression is a state in which feelings of sadness are accompanied by numerous other related symptoms which impair efficiency and which do not go away by themselves. Depression causes immense suffering and distress and affects different people in very different ways, which is one of the reasons that it can be difficult to detect or diagnose. There is also no internationally agreed set of criteria against which to assess depression. One of the clearest set of criteria is that laid down by the American Psychiatric Association in 1980, updated in November 2010, and this states that the individual requires to have had a prominent and persistent mood disturbance for at least two weeks. In addition, the individual should have at least four out of a list of eight symptoms present nearly every day (American Psychiatric Association, 2010). Most European criteria for depression are less precise than this, with the doctor using their own judgement to a far greater extent.

Current research suggests that up to a quarter of the population will experience an anxiety disorder during their lifetime. It is also the most common mental health disorder occurring in adolescents, with as many as 13% of 9-17 year-olds having the problem in any one year (Anxiety Care).

The World Health Organization's study of mental disorder in general health care screened over 25,000 people in 14 countries worldwide and assessed 5,500 in detail. The most common disorders were depression (10%), generalised anxiety disorder (8%), and harmful use of alcohol (3%) (Craig & Boardman, 1997).

Depressive *symptoms* are fairly common in the population: between 10 and 16% of men, and between 20 and 24% of women, have high scores on symptom scales relating to depression. However, when firm standards are applied for *depressive illness*, such as those described earlier, the rates fall considerably to between 2 and 4% of men, and between 5 and 8% of women (Mental Health Organisation, 2006).

It is estimated, according to the World Health Organization (WHO), that depression will be the second leading cause of death world-wide by 2020. It now affects about 20% of adults and is already thought to be the leading cause of disability world-wide, with 27% of days off work due to mental illness.

Most depressed patients are aware that they feel sad and that they are not enjoying life, but they do not think of themselves as ill. It is common for them to go to see their family doctor if they have a pain that cannot be explained; but the reason for their visit will be the pain, and they often do not mention the other symptoms spontaneously. Up to 50% of depressed persons seen in primary care settings are not recognised as having this disorder (Borus, Howes, Devins, Rosenberg, & Livingston, 1988; Schulberg et al., 1985). Even more alarming are the statistics that show that two thirds of men who commit suicide have seen their GP in the previous month, with half seeking help within the week prior to killing themselves (Appleby,

1991). Tragically these individuals have not been diagnosed as suffering from depression and have not received the necessary help. An opportunity therefore exists for primary care services to help in preventing suicides, and this may be achieved by improved assessment of suicide risk, liaison with mental health services, and more effective treatment and diagnosis of major depression (Craig & Boardman, 1997).

Not only can the failure to detect mental disorders lead to increased suicide risk but it also denies patients potentially effective treatment. Enduring psychological distress has profound effects on patients' capacity to work and enjoy a reasonable quality of life and on their families. Detection of mental disorder has been shown to reduce the number of subsequent consultations, to shorten the duration of an episode, and to result in less social impairment in the long term (Craig & Boardman, 1997; Falloon, 2001).

There are a variety of reasons for the under-recognition of depression and anxiety: patients are reluctant to voice emotional complaints; the stigma attached to mental illness; professionals can be reluctant to inquire (lack of time, lack of skill); attributing somatic symptoms to medical illness; assuming emotional distress is inevitable and untreatable (Barraclough, 1997). Gilbody SM et al found that the recognition of emotional disorders seems to be increased only when there is some form of screening procedure, whereby an instrument is administered by someone other than the clinician, and the results of those with high scores only fed back to the clinician. They also suggested that more "user friendly" formats for

administration, such as computer based self-completed questionnaires, could be particularly useful (Gilbody, House, & Sheldon, 2001).

Focus groups have been used to gather lay attitudes to professional consultations for common mental disorders. The most frequently cited reasons that patients gave for not mentioning psychiatric problems to their GPs were: 'Doctors have insufficient time' and 'That there is nothing the doctor can do'. Most people also felt that the GPs had little time to devote to an analysis of personal problems, and that some suspected that GPs might not be too tolerant of a presentation with emotional symptoms (Pill, Prior, & Wood, 2001).

A computer interview incorporating anxiety and depression screening could help in the identification of some individuals who are at risk. It has been recommended that clinicians should maintain a high index of suspicion for depressive symptoms in adolescents and young adults, persons with a family or personal history of depression, those with chronic illnesses, those who have experienced a recent loss, and those with sleep disorders, chronic pain, or multiple unexplained somatic complaints (Mori, Lambert, Niles, Orlander, Grace, & LoCastro, 2003).

There are other conditions, such as celiac disease and chronic obstructive pulmonary disorder (COPD), where it may be beneficial to screen for anxiety and depression as there has been found to be a correlation between such chronic conditions and the presence of anxiety and/or depression (Akhtar & Zaman, 2010; Cleland, Lee, & Hall, 2007; Häuser, Janke, Klump, Gregor, & Hinz, 2010; Mikkelsen, Middleboe, Pisinger, & Stage, 2004).

Little work has been conducted specifically in a GP setting to evaluate if a computer interview, which incorporates an anxiety and depression screening interview, can be used as an aid to the consultation process. Computer-based tests have been used when conducting psychological assessments as an addition to the practitioner's clinical evaluation and have been found to be valuable as a means of providing thorough, accurate information (Butcher, 1994); they have shown potential as a means of improving the clinical outcome of patients in primary care (G. Lewis, Sharp, Bartholomew, & Pelosi, 1996). Unsurprisingly, it is recommended that any screening be done in combination with clinical judgement (Garb, 2007).

1.2.2 Screening instruments

Computerised self-rating scales for depression have already been compared with conventional observer ratings and a high level of agreement between the ratings was found (Ancill et al., 1985). However, this comparison was conducted with patients already diagnosed as suffering from either mild to moderate primary depressive illness or moderate to severe depression, and little research has been conducted to compare computers with clinicians in the initial diagnosis of individuals who may be suffering from depression. It has been suggested that "*the recognition rate could be dramatically raised in one day*" if physicians started using some type of self-screening instrument in their waiting rooms (Goldberg, 1995).

There are a number of different screening instruments available to assist with the recognition of depression and/or anxiety. There follows a brief description of some of the best-known rating scales.

Beck Depression Inventory (BDI) – The BDI is a 21 item self-report rating inventory measuring characteristic attitudes and symptoms of depression. Each item has four to six statements, one of which is chosen as best describing the symptoms at the time.

Beck Anxiety Inventory (BAI) – The scale consists of 21 items, each describing a common symptom of anxiety. The respondent is asked to rate how much he or she has been bothered by each symptom over the past week on a 4-point scale ranging from 0 to 3. The items are summed to obtain a total score that can range from 0 to 63. It was developed to address the need for an instrument that would reliably discriminate anxiety from depression.

Hamilton Depression Rating Scale (HAMD) – The Hamilton Depression Rating Scale is a 17-item scale that evaluates depressed mood, vegetative and cognitive symptoms of depression, and comorbid anxiety symptoms. The HAMD was originally designed to be administered by a trained clinician using a semi-structured clinical interview.

Hamilton Anxiety Scale (HAS) – The Hamilton Anxiety Scale consists of 14 items, each defined by a series of symptoms.

Hospital Anxiety and Depression Scale (HADS) – The HADS consists of just 14 items, 7 items to measure anxiety and 7 items to measure depression, on the self-report questionnaire, making it quick to complete and score. The most important feature of HADS is the way it enables the researcher to establish the presence and severity of both anxiety and depression simultaneously, while giving a separate score for each.

Zung Self-Rating Depression Scale (ZDS) – The ZDS is one of the most widely used adult depression screening instruments and is recognised by physicians and clinicians world-wide. The 20-item instrument screens for three depression and mood symptoms: affective, psychological and somatic.

1.3 Chiropractic Setting

Patient reassessment is an essential part of any on-going treatment plan and is becoming an increasingly important aspect of patient management (Chang, 2009). It is also an area highlighted within the General Chiropractic Council's (GCC) Code of Practice and Standard of Proficiency (General Chiropractic Council, 2010). It is now an obligation for chiropractors in Britain, to carry out patient reassessment; it is a means of determining whether treatment is appropriate and effective. The study detailed in Chapter 7 focuses on Periodic Patient Reassessment, defined as, "Evaluation of a patient at intervals of weeks or months, for the purpose of assessing the need for continued care, modified care, cessation of care or referral" (Canadian Chiropractic Association, 1993).

Periodic patient reassessment may be necessitated by a particular change in a patient's condition but, as the name suggests, may occur after a given timescale. The clinic involved in this study conducts periodic patient reassessment whenever the patient's progress does not match that which is expected, or after a set number of treatments. It was decided to see if it would be possible to use a CIS to enhance this

process; this also provided an opportunity to quantifiably assess psychosocial influences in the patients.

The contribution of psychosocial factors in spinal problems has been highlighted by Waddell (Waddell & Main, 1988). It is known that patients attending chiropractic clinics are often suffering from chronic conditions, which is particularly likely to be the case with patients who have received 6 or more treatment sessions (Carey, Evans, Hadler, Kalsbeek, McLaughlin, & Fryer, 1995; Haas, Goldberg, Aickin, Ganger, & Attwood, 2004; Martinez, Rupert, & Ndetan, 2009). Studies have shown the usefulness of painscales such as the Bournemouth or the Leeds Assessment of Neuropathic Symptoms and Signs (LANSS) scale in musculoskeletal care (Bennett, 2001; Bolton & Humphreys, 2002). Although the use of HADS has not been reported in a chiropractic setting (Sharma, Lepping, Cummins, Copeland, Parhee, & Mottram, 2004; Terluin, Brouwers, van Marwijk, Verhaak, & van der Horst, 2009; Zigmond & Snaith, 1983), the reliability of HADS seems stable across medical settings and age groups (Spinhoven, Ormel, Sloekers, Kempen, Speckens, & van Hemert, 1997), therefore, including HADS into the regular chiropractic patient assessment could provide a simple method of screening psychosocial factors.

Research has been carried out over the years into computer-based psychological and psychiatric testing, survey conducting and medical history taking (Cohall, Dini, Senathirajah, Nye, Neu, Powell, Powell, & Hyden, 2008; Kurth et al., 2004; Lucas, Mullin, Luna, & McInroy, 1977; Nyitray, Kim, Hsu, Papenfuss, Villa, Lazcano-Ponce, & Giuliano, 2009; Renker, 2008). The results of these studies led previous researchers

to conclude that computer interviews were widely accepted by the interviewees and generally gathered at least as much information as a human interview.

Where the topic was of a particularly sensitive nature, reporting was found to be less susceptible to social desirability during the computer interview than in the face-to-face interview; but would this still be the case in the chiropractic clinic where the patient and clinician have already established trust and rapport over a series of treatment sessions (Ghanem, Hutton, Zenilman, Zimba, & Erbelding, 2005)? The perceived usefulness of the CIS and the effect it has on communication between patient and chiropractor is fully investigated in Chapter 7.

A computerised interviewing system, whilst being an efficient means to record and automatically analyse responses, at the same time as flagging up those answers requiring immediate attention by the chiropractor, may also be useful to enhance the clinician-patient relationship and communication. It is highly advantageous to determine differences in expectations of patient and clinician, to clarify any misunderstandings, for example, exactly what does or does not count as “exercise” and to highlight any areas of concern that the patient may have. The patient may be reluctant to raise concerns or ask questions when they are in a face-to-face situation, or may be embarrassed that they still do not fully understand a particular exercise; the non-judgemental nature of the computer provides an ideal mechanism for identifying these problems. It is novel to study the use of a computer interviewing system in this type of setting, where a relationship has already been built up over a number of treatment sessions.

1.4 Ethical Issues

Whilst a computer can be particularly useful in the elicitation of sensitive information it is also unable to respond if the interviewee becomes upset or distressed, so care must be taken to use computer interviews only where they are appropriate. In this research, the computer interview was used both within the GP surgery and chiropractic clinic and directly prior to a GP consultation or chiropractic treatment session, thus avoiding interviewees being without support. Indeed, in a study interviewing adolescents, depending upon the issue being discussed, 64% to 97% of interviewees thought that the investigator should talk to them about the issue and provide guidance on what help is available (Black & Ponirakis, 2000). Advice sheets on anxiety and depression (see Appendix 8: Anxiety and Depression Information Sheets), which were provided by one of the GPs involved in this research, were readily available to all participants in the study and were placed prominently beside the computer.

There is also the issue of confidentiality. Although researchers may be hesitant to break confidentiality, Fisher et al demonstrated that more than two thirds of 7th (12-13 years of age), 9th (14-15 years of age), and 11th (16-17 years of age) grade students recommended that when investigators suspected sexual or physical abuse, they should facilitate a self-referral or inform a parent or concerned adult (Fisher, Higgins-D'Alessandro, Rau, Kuther, & Belanger, 1996). Thus, for many children, disclosing information about maltreatment may be a way of asking for help (Black & Ponirakis, 2000). It has also been found that some patients expected the doctor to

know what they had said during the computer interview, and to act accordingly (Wright et al., 1998). Due to these issues and the concerns when dealing with the sensitive nature of anxiety and depression it was initially decided to make it clear that, where a score indicating the presence of anxiety or depression was attained or if the interviewee wished to discuss any issues relating to the screening interview, the transcript of the computer interview should be shown to the clinician. This part of the protocol was later altered so that all interviewees gave the transcript of their interview to the clinician at the start of the consultation as it was found that interviewees were not giving the clinician the transcript, even when a high score on the anxiety and depression screening had been obtained; thus enabling the clinician to view/discuss the score for every patient. This is one of the amendments that was made as a results of the clinical user evaluations which were carried out, see Chapter 5.

Disclosure was another issue requiring careful consideration. Good medical practice depends upon patients being able to discuss openly with the doctor wide-ranging aspects of their health on the understanding that such detail will be kept secret. It follows that any disclosure contrary to the individual's interest is also potentially detrimental to the public interest since it may discourage frank exchanges in the future. In the British Medical Association's (BMA) view, all information collected in the context of health care is confidential and the activator of its release is patient consent. Patient Consent forms were signed by all interviewees after they had been given time to read and ask any questions about a Patient Information Sheet. Consent

forms from the TayRen Consortium were used for all subjects involved in this trial. Ethical approval was sought, and gained, from Fife Health Board for the general practice phase of the computer interviewing trial. Ethical approval was also gained from the Ethical Review Committee of the School of Computing, The University of Dundee for both the study in the general practice surgery and the study in the chiropractic clinic.

It was decided to use the interviewing system only with patients over 18 years of age as the wording of the anxiety and depression screening interview was more appropriate for this age range; it also meant there was no requirement to gain parental consent for any patients.

1.5 Summary

Computer interviews seem to have a useful role to play in a medical setting. Doctors acknowledge that pressure of time can be a problem and the potential of using a computer interview to take an initial history has been discussed.

The computer's ability to elicit open and honest responses from interviewees may help in the recognition of individuals suffering from anxiety or depression. There are various rating scales for anxiety and depression screening, which have been used in a number of different settings. The research carried out in this study used a CIS to deliver a screening interview; it was hoped this would prove an effective and efficient means to aid in identification of patients with anxiety or depression.

The use of good interviewing techniques, such as follow up questioning where relevant, has also been highlighted as of great importance. The ability to use such techniques was incorporated into the interviewing software for inclusion whenever possible and appropriate.

The background research described above formed the basis for the development of the research aim and research plan, which are detailed in the following chapter.

2 Research Aim, Plan of Research and Methodology

2.1 Research Aim

The overall aim of the research is: to investigate whether a computer interviewing system can be used in a clinical setting to enhance patient-clinician communication during the subsequent consultation.

Published research activity indicates that, although computer interviews have been used extensively in clinical settings, little is known about the effect of the computer interview on the patient-clinician communication process. Also, the majority of the research has been into the acceptability of the computer interview and the validity of the data gathered using such a system and not into the perspectives and perceptions of the clinicians using the information.

It has been established that inclusion of a screening instrument could potentially be of great use as an aid to the identification of individuals suffering from anxiety or depression; this could effectively be delivered using a CIS. This research will focus on the clinicians' views of the computer interviewing system and the degree of usefulness they feel it has. However good a system is at eliciting information from interviewees, its usefulness is still determined by how easy it is to interpret that information and how complete that information is. If a system cannot present the data gathered in a meaningful way that is quick and easy to interpret then it will not be used, no matter how much useful information it has gathered. It follows that

usability should be of utmost importance for all users of the system (Preece, Rogers, Sharp, Benyon, Holland, & Carey, 2003).

> *"Human-computer interaction (HCI) is concerned with the design of computer systems that are safe, efficient, easy and enjoyable to use as well as functional."*

The studies carried out intend to test the hypothesis that a pre-consultation computer interview can provide the clinician with information that is useful to the consultation process and can enhance communication between clinician and patient. This can be further divided into more specific questions:

1. **Can the patients, regardless of age and computer experience, take the computer interview independently?**
2. **Can the incorporation of an anxiety and depression screening interview aid in the recognition of individuals suffering from anxiety or depression?**
3. **Will the incorporation of the CIS into the consultation process be considered useful and acceptable by the clinicians and their patients?**
4. **Can the CIS be shown to enhance the communication process between clinicians and their patients?**

The first question could be readily answered by recording the number of times the interviewees request assistance in completing the computer interview. The second question could be answered by studying the individual results of the HADS screening interview; the third and fourth questions could be answered by analysing the

opinions of the patients and clinicians who were involved in the study through a series of questionnaires and interviews which sought to explore issues such as ease of use, acceptability and perceived usefulness.

The study involving the GP surgery was relatively general and focussed on the thoughts and opinions of the GPs. The views of the patients were also gathered, as a system that is unacceptable to the patients or difficult to use will be of no benefit to the GP surgery. Full details of this study are reported in Chapter 6, Computer Interviewing within a GP Surgery.

The study involving the chiropractors was more specific, as this was appropriate for the more specific clinical setting. The key questions to be answered during this study were:

1. **Can the computer interviewing system be shown to help identify patients with anxiety or depression in a private chiropractic clinic?**
2. **Can the CIS be shown to enhance the communication process between chiropractors and their patients?**
3. **May the CIS be effectively and efficiently used as part of the periodic patient reassessment process?**
4. **Can the CIS be shown to highlight any trends in the patient population that may or may not reflect current evidence based expectations?**

The first question could be answered by studying the individual results of the HADS screening interview; the second and third questions could be answered by analysing

the opinions of the patients and chiropractors who were involved in the study through a series of questionnaires and interviews which sought to explore issues such as ease of use and acceptability; if new issues were raised or revealed due to use of the CIS; if patient management was altered due to information arising from the CIS. The fourth question may be judged against the perceived clinical expectations of the chiropractors using data gathered from the CIS, especially the HADS scores. The chiropractic clinic study is detailed in Chapter 7, Computer Interviewing within in a Chiropractic Clinic.

2.2 Plan of Research and Methodology

In order to answer the main research question "can a pre-consultation computer interview provide the clinician with information that is useful to the consultation process and enhance patient-clinician communication during the subsequent consultation", a series of experiments were planned to be run in different clinical settings: the more general setting of a GP surgery, and the more specialised setting of a chiropractic clinic.

The CIS had to be designed to ask both general health questions and specific questions about a health problem that may be difficult to address in a normal surgery situation i.e. depression and anxiety. The potential added value of the computer interviewing technique could then be assessed using questionnaires for both the patient and the clinician.

Quantitative results were to be gathered to determine if the CIS could be used by patients independently and also to ascertain if the incorporation of an anxiety and

depression screening interview could aid in the recognition of patients suffering from anxiety and/or depression. Having quantitative figures for the number of patients with anxiety and/or depression would then enable the clinicians to see if their patient population followed expected trends based on current research for mood related disorders.

It was decided in consultation with the project partners to use the Hospital Anxiety and Depression Scale as it enables both anxiety and depression to be measured in one short self-report questionnaire. Extensively researched and validated, it has gained a high reputation amongst psychiatrists, clinical psychologists and doctors alike. It is also:

- Relatively unaffected by any concurrent physical illness
- Phrased in such a way that makes it non-threatening to clients
- Designed for repeat administration

It was felt important to screen for both anxiety and depression as the co-morbidity between anxiety and depression is so high that debate continues as to whether they are categorically separate disorders or part of a continuum (Ellen, Norman, & Burrows, 1998).

Zigmond and Snaith's Hospital Anxiety and Depression Scale has been widely trialled in a variety of settings including primary and secondary care, although not in a chiropractic setting, and has been included in The Global Mental Health Assessment Tool (Sharma et al., 2004; Terluin et al., 2009; Zigmond & Snaith, 1983). Additionally,

studies have shown that HADS meets the recommendation of having Cronbach's coefficient α of at least 0.8 for a screening instrument; with HADS-A (sensitivity 0.89, specificity 0.75) and HADS-D (sensitivity 0.80, specificity 0.88) (Herrmann, 1996; Mykletun, Stordal, & Dahl, 2001; Olssøn, Mykletun, & Dahl, 2005). By including a short screening questionnaire into regular patient assessment, it could provide a simple method of tracking psychosocial factors.

By incorporating the HADS screening tool into the computer interview it was possible to determine the possibilities of aiding recognition of individuals experiencing anxiety and/or depression, firstly within a GP surgery, as detailed in Chapter 6, and secondly within a chiropractic clinic, described in Chapter 7. The reason for trialling a CIS to deliver the screening questionnaire is that using such a protocol may save time and get more accurate results because research has shown that people are more likely to tell the truth to a computer than to another person, particularly when being interviewed about a sensitive topic (Bingham et al., 1984; Butler et al., 2009; Ghanem et al., 2005; Gregor, 1991; Gribble et al., 2000; Kurth et al., 2004; Le et al., 2006; Reeves & Nass, 1996; Turner et al., 2002; Turner et al., 2009).

It was decided to gather largely qualitative data regarding the perceptions of whether the CIS was useful and acceptable, enabling detailed thoughts, comments and impressions to be gathered from all study participants: patients, clinicians and reception staff.

During the initial non-clinical user evaluations, a systematic qualitative technique known as protocol analysis or think aloud was used, whereby the users were encouraged to verbalise what they were thinking and doing during each stage of the computer interview. The process of verbalisation reveals the assumptions and problems that the users face while performing tasks (Benbunan-Fich, 2001). This technique has been widely used for usability studies of computer interfaces and is recognised as one of the most efficient methods to identify specific usability issues (Carroll, Mack, Lewis, Grischkowsky, & Robertson, 1985; Henderson, Smith, Podd, & Varela-Alvarez, 1995). Advantages of this technique are the richness of the data gathered, thus negating the need for large numbers of users (Ericsson & Simon, 1984). Criticisms of the technique include the presence of the researcher, which may influence comments made by the user, and the need for concurrent verbalisation, which may increase the time taken to complete a given task (Benbunan-Fich, 2001). Notes were made by the author during these sessions, which were then analysed using a thematic approach and the common usability issues were subsequently identified.

The degrees of usefulness and acceptability were recorded using ordinal variables, namely either a 4-point or 5-point Likert scale, thus enabling analyses of non-parametric data to be carried out. This scale was developed by Rensis Likert in 1932 (Likert, 1932), and requires the individuals to make a decision on their level of agreement, generally on a 4-point or 5-point scale (i.e. Strongly Agree, Agree, Disagree, Strongly Disagree) with a statement. It has been suggested that “this is the

most commonly used question format for assessing participants' opinions of usability" (Dumas, 1999).

A combination of quantitative and qualitative data was to be used to assess whether the CIS did indeed enhance communication between clinician and patients. In the GP study, it was decided to focus on qualitative data and it was planned to ask GPs to comment when any alterations in the consultation were perceived to be as a result of including the CIS in the consultation process, a quantitative measure of the number of times they altered patient treatment due to information gathered with the CIS was also to be recorded. In the chiropractic study, an additional quantitative measure of how many times the CIS highlighted communication difficulties was introduced; with the chiropractors also being asked to expand upon the numerical nature of this data by providing a description of the communication difficulty in a separate comment box.

After discussions with the GP surgery staff, it was deemed unfeasible to ask the patients to complete a further questionnaire after their GP consultation and, given the particularly focussed questions within their computer interview question set; this was felt to be the appropriate course of action. It was, however, possible to conduct a post-consultation interview of the patients within the chiropractic clinic setting; thus allowing additional questions to be asked, again using a Likert scale. Thus it enabled further evidence of whether the CIS enhanced communication to be gathered.

A focus group was run with the chiropractors to determine their opinions regarding the interview analysis interface. Focus group research involves organised discussion with a selected group of individuals to about their views and experiences of a topic and is particularly suited for obtaining several perspectives about the same topic (Gibbs, 1997; David L Morgan, 1997). Focus groups can be quick and efficient to run and the group interaction can provide insights into participants' views; furthermore focus groups have been found to generate more ideas than individual interviews (Fern, 1982; D. L. Morgan & Krueger, 1993). Limitations of this method are that the researcher's presence may influence the group's interaction, but there is no evidence to suggest that researcher's impact is any greater in this context than in observation or individual interviewing methods (David L Morgan, 1997).

Before it was possible to run these experiments, a suitable computer interviewing tool was required. Previous work by the author on the use of a CIS in a software engineering environment, whereby the tool was used to enhance the requirements gathering process for a new piece of software, was used as a starting point for creation of the computer interviewing tool. The design of this tool is described in Chapter 3. Once a suitable tool was developed it was necessary for it to be validated; this validation was required so that any problems could be addressed before the full experiment began. Initial validation occurred first and was in a non-clinical setting, which is described in Chapter 4; then further validation was conducted in a clinical setting, which is described in Chapter 5. Any necessary improvements were made

and the validation repeated with a small number of patients, this process was repeated until the CIS was deemed suitable for conducting the main studies.

3 Design and Development of the Computer Interviewing System

This chapter describes the process of designing and developing a computer interviewing system to deliver a question set specified by the clinician that could be personalised for individual patients and would gather information that would aid the clinician and enhance the consultation. The use of this computer interview will enable the research aims and questions detailed in Chapter 2 to be answered.

3.1 Introduction

To address the research questions and provide a computer interviewing tool that could be used for evaluation in additional research areas, it was decided to design and develop a generic tool that could potentially be used in a variety of subject areas.

The initial requirements were gathered through a combination of brain storming sessions and interviews with departmental staff with a particular interest in computer-based interviewing. They were then further refined following interviews with potential users of the system and usability testing of existing systems. The interviewing of potential users gave a clear idea of what they expect the system to do.

The requirements gathering process was considered from the viewpoint of two different user groups, the interviewees and the clinicians. The two groups would

interact with the system through different interfaces so it was essential to consider the requirements from the differing perspectives, and the views of each were considered equally important.

Both the functional and non-functional requirements were split into two categories:

Generic: covering all aspects of any computer-based interviewing tool, which is to be run over the Internet.

Specific: covering only those aspects that are relevant to the specific interview being developed for use in a clinical setting.

The initial focus was on the generic requirements and then the specific requirements were gathered after further consultation with members of the medical practice.

As part of the requirement analysis it was decided that the interview delivery interface, the interview authoring interface and the interview analysis interface should be extremely easy to use by both experienced and inexperienced computer users and should be highly accessible, so both usability and accessibility were core considerations throughout the entire design process.

3.2 Required Attributes of a Computer Interviewing System

3.2.1 Interviewing Delivery Interface

After the initial requirements gathering tasks had been carried out, a list of the required attributes of an interviewing delivery system was drawn up. The main points listed were:

- The ability to use different question types such as multiple-choice, free text or drop-down list
- Need to be able to present only relevant questions to each interviewee
- The ability to ask follow-up questions after certain responses
- The interviewee may need to be able to review their answers
- The ability to select different interviews for presentation
- The ability to "interpret" answers may be required, such that only answers that are understood by the computer will be accepted
- A means to gather feedback from the interviewee regarding the computer interviewing system

3.2.2 Interview Authoring Interface

In order to be able to create an interview, and related question set, it is necessary to have some sort of interview authoring tool. This would have a completely different set of users from in the interview delivery interface, and a largely different set of requirements. The main requirements of the interview authoring interface were initially determined to be:

- The ability to use different question types such as multiple-choice, free text or drop-down list
- The ability to create a new interview
- The ability to edit or delete an existing interview

- The ability to add, edit or delete questions
- The ability to add, edit or delete answer choices
- A means to associate questions to one or more interview

It was initially anticipated that users of the interview authoring interface would be experienced computer users; but it was subsequently decided to ensure that the authoring tool could be used by users with varying computer abilities and experience.

3.2.3 Interview Analysis Interface

The creation of an interview analysis interface was felt to be vital as it would enable a major benefit of computer interviewing to be utilised; that of automatic interpretation of data entered by the interviewees. The initial requirements outlined included:

- The ability to select which interview to view the results of
- Text and graphical presentation of interview results
- Numerical analysis of the number of answers/answer choices
- Clear format that can be easily and rapidly assimilated

3.3 Methodology

UML methodology was utilised in the design stage of the project (Bennet, McRobb, & Farmer, 1999; Quatrani, 2000). An object-oriented approach was taken and importance was placed upon good database design (see section 3.6 Database

Design). The different database tables were likened to different classes, with their relationships seen as interactions. It was decided that the life cycle would follow the Hix and Hartson “Star” view of system development (Hix & Hartson, 1993), which has a continual focus on evaluation throughout every stage and hence provides for early and continual user evaluation through prototyping.

An integrated design strategy was implemented which incorporated a top down approach, in order to fully understand the user’s requirements, and a bottom up approach, in order to address specific needs.

The universal principles of design were referred to throughout the development cycle, with the CIS following the four stages of creation: requirements, design, development, and testing. An iterative process was used to try to ensure the production of a truly usable interviewing system (Lidwell, Holden, & Butler, 2010).

3.4 Design Tools and Techniques

Select Enterprise version 6.0 CASE tool was utilised for the production of the Use Case Diagram. The Use Case Diagram for the system was developed to model the interaction between the users of the system and the system itself.

A paper storyboard was used to develop a prototype for the interview structure and flow. It was considered important to implement a system that allows for an interactive process with the interviewee.

The most skilful interviewing gives the appearance of being a smooth and spontaneous interchange between interviewer and the interviewee (Garrett et al.,

1982). This interaction between interviewee and interviewer is intended to be demonstrated by asking the interviewee certain questions and then immediately asking follow-up questions directly related to the answer(s) just given, as appropriate.

A computer-based interview can be programmed to ask only those questions that are relevant to the interviewee. This is a good interviewing technique to employ, as the interviewee will respond more favourably if they feel that each question is important and significant (Garrett et al., 1982).

It was vital to ensure that the structure of the interview was correct during the design stage of the project thus considerable time was taken at this paper prototype stage in the project lifecycle. The interview process went through several iterations of the design and evaluation process at this early stage in its development in an attempt to avoid major restructuring during the development phase.

The paper prototype was also beneficial in the process of designing the database, as it helped to clarify which tables were required and how these tables would interact (see Section 3.6 Database Design).

3.5 Development Environment

It was identified early in the requirements gathering process that they system would have to be available to users in a variety of geographic locations; for example the general practitioners had clinics in two locations in Fife and the chiropractors had one clinic in Dundee and one in Forfar. Another requirement was for all the

information to be stored in one place, thereby enabling analysis to be carried out on a number of interviewee responses. It was consequently decided to develop a Web-based system.

3.5.1 (X)HTML and ASP

Due to the interactive process required to conduct an effective computer-based interview the number of suitable web technologies available is somewhat restricted. It was decided to use a combination of HTML (Hypertext Markup Language), or XHTML (Extensible Hypertext Markup Language), with active server pages (ASP).

HTML is the common language used to publish documents on the web. HTML provides the ability to format documents, include hyperlinks, create tables, embed graphical images and include interactive features that involve the user. XHTML is a family of current and future document types and modules that reproduce, subset, and extend HTML 4 (World Wide Web Consortium, 2002). The XHTML family is seen as the next step in the evolution of the Internet and is thus the language of choice for the project. It provides a strict structure that the documents must conform to, and hence helps to ensure that they are all well formed. Also, XHTML is backward compatible provided certain guidelines are followed, and will display on browsers right down to the old version 2.0 browsers (Boumphrey, Greer, Raggett, Raggett, Schnitzenbaumer, & Wugofski, 2000).

The issue of browser compatibility is an extremely important consideration when implementing software to be run over the Internet. It was essential to view the interface in as many different web browsers as possible in order to ensure that

accessibility and usability problems did not occur as a result of this limitation. This was another reason to utilise XHTML as documents would be interpreted the same way by all the browsers.

ASP is a mix of (X)HTML, scripts and ASP code that enables the user to build dynamic and database-driven web sites (Kauffman, Willis, & Spencer, 1999). Microsoft describes it as "a server-side scripting environment that you can use to create and run dynamic, interactive, high-performance web server applications." While standard HTML is only a display language, ASP allows the developer to tailor the information displayed on the page based on user interaction (Web Savant). Hence, ASP is ideal for the implementation of an interactive interviewing tool. The scripting is server-side, which helps to reduce browser compatibility problems that arise with client-side scripting (Buser, Kauffman, Llibre, Francis, Sussman, Ullman, & Duckett, 1999).

There are also a number of other advantages to using server-side technology that are particularly relevant to the field of computer interviewing:

- Enables programming of dynamic Web applications, without the use of client-side programming features, which are browser specific. This is essential in computer interviewing as it is a dynamic and interactive process.
- Can provide the client (browser) with data that does not reside at the client. This enables the presentation of the most up-to-date data and the incorporation of data provided from different clients or interviewees, which is essential for accurate interview analysis.

- Often makes for quicker loading times than with client-side dynamic technologies. Fast Web page loading times are essential if the interview is to have a feeling of continuity and flow.
- Provides improved security measures. Security is obviously an important issue when data are being transferred, some of which may be of a sensitive nature.

This method also enabled both the questions and the interviewee responses to be stored in an Access database, as described above, with the relevant questions being accessed through use of SQL (Structured Query Language) in VBScript (Visual Basic Script) code. Using ASP allowed the creation of Web pages that are sensitive to factors such as time and place, and the user's identity and previous choices and actions. Hence, it was possible to produce a computer interviewing system that enabled the interview to be personalised and to ask only questions that were directly relevant to any particular interviewee.

3.5.2 Personal Web Server

Whilst the ability to conduct the computer interviews over the Internet, and hence in a wide variety of locations, was deemed important, the initial studies were conducted using a web server on the laptop. It was decided to use Personal Web Server (PWS), a Microsoft product, as it enables web pages to be run but without the need to use a phone line. It was important to cause minimal disruption to the members of the medical and chiropractic practices and so taking up a phone line was deemed to be impractical. PWS was considered an ideal tool for the

development of the CIS as it is useful in developing web applications on a localhost before deploying to a production web server; it also enables ASP scripts to be run and data to be saved to and retrieved from a database.

At the stage of designing the system, the ability to enable mobile Web access was not common-place, as it is now. Had this been the case, the CIS would have been run from the School of Computing, University of Dundee server for all of the user trials. The CIS was uploaded onto the server for use in other related areas, but all of the testing and trials undertaken as part of this research thesis were conducted using the laptop running PWS.

3.6 Database Design

Microsoft Access was chosen as the database system as it is readily available and provides sufficient functionality scope for this research project. The OLEDB connection to the database was used to ensure that no errors occur should more than one user attempt to complete the interview at the same time. The option of using SQLServer was considered, as it would enable multiple users to access the system simultaneously. However, as it was thought unlikely that simultaneous multi-user access would be required, and because of cost considerations, Microsoft Access was deemed the most appropriate choice for this investigation.

The rules of normalisation were followed in the database design, as is good practice (Whitehorn & Marklyn, 1998). This also helped to ensure that the ASP code utilised the database tables efficiently, thus avoiding the need for hard-coding and making the interview process smooth and seamless.

The implementation of good database design and careful coding meant that any alterations to the database tables, such as the addition of questions, became visible on the Web pages without the need to modify any code (ASP or HTML). The tables and their relationships are shown in Figure 1, with a full explanation of the tables given in Appendix 1: Database Design.

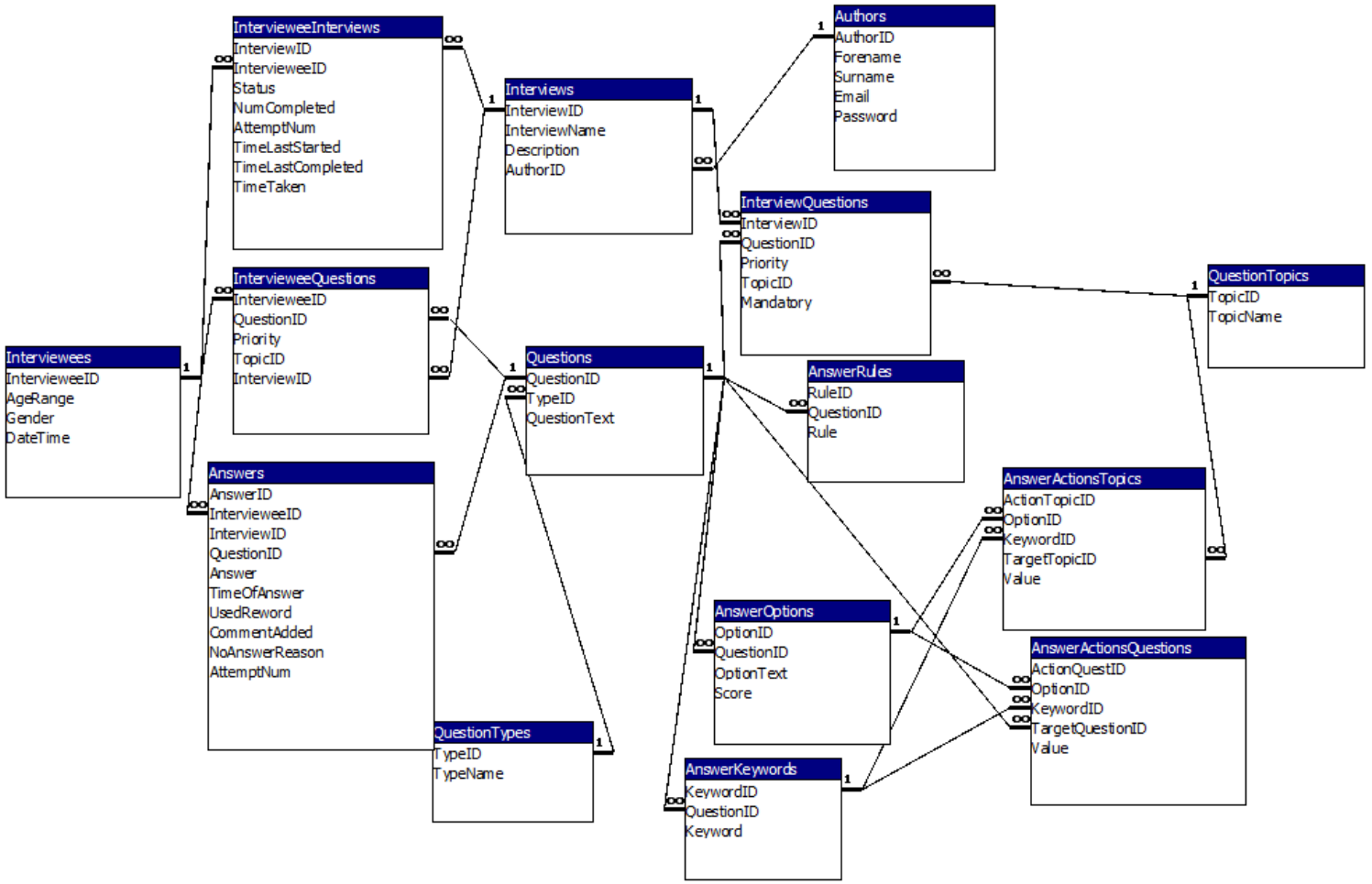

Figure 1: Database Table Relationships

All processing, such as adding an interviewee, answer interpretation, answer saving and question priority alterations were carried out such that the interviewees were unaware of it. A number of queries were also used to ensure that processing occurred rapidly and efficiently, thus making the interview process flowing.

3.7 Interview Structure

A computer interview structure that allowed for dynamic question ordering was developed. It was considered essential that interviewees were only asked relevant questions. The questions to be included in the interview and their order are determined by the interview author. During this research study both the general practitioners and the chiropractors provided details of the questions to be included in their specific interviews and the author input the questions into the computer interviewing system. The system was designed, however, such that it should be a simple process for others to set up and create their own interview question set using the Interview Authoring Interface detailed below in section 3.9.

When setting up an interview, questions are assigned a priority value as they are added to the database and this determines the order in which they are presented to the interviewee. Certain rules are used to alter question priorities as necessary during the actual interview process, for example:

Q: Did you find it easy to select an answer during the computer interview?

A: Yes – the interviewee will not be asked any more questions about selecting an answer and the interview will move on to the next question.

OR

A: No – any questions relating to selecting an answer will have their priority value raised, ensuring that these questions are asked next.

The answer interpretation described is shown in pictorial format below.

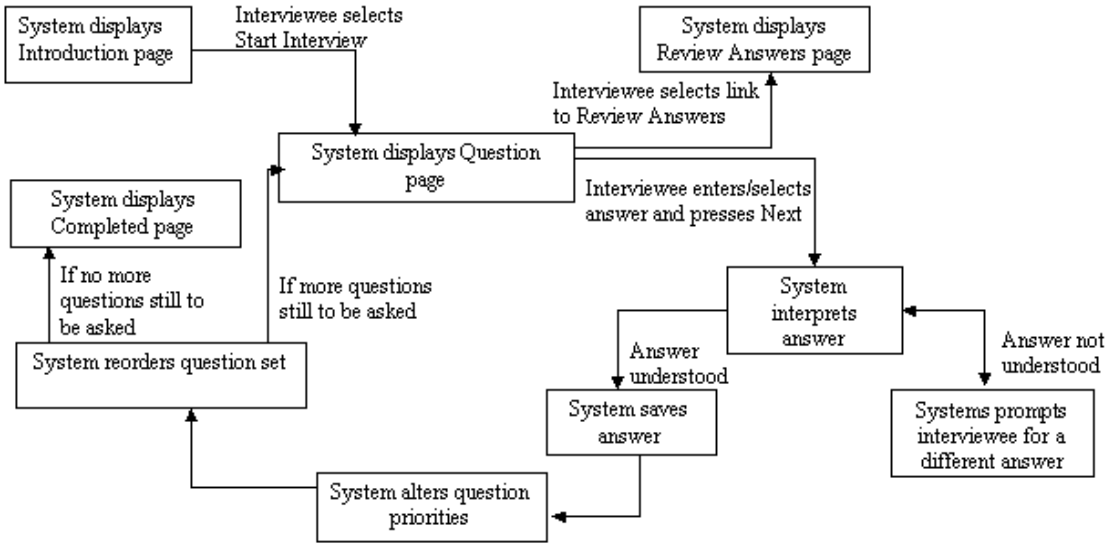

Figure 2: Dynamic question ordering

3.8 Interview Delivery Interface

In this study, the area considered to be of most importance was the interview delivery interface. The clinicians involved in the study had extremely limited time available so it was agreed that the author would input the interview details using the Administrator Options and the clinicians would be involved solely in utilising, reporting on and evaluating the incorporation of the CIS into their normal consultation process. The author spent considerable time working on the paper prototype and hence a clear format was determined before initiating the

development stage of the project. It was apparent that a number of key pages were required for the interview process:

- Introduction Page – to provide an introduction to the interview that is about to be run
- Question Page – to display the current question
- Review Answers – to review all the answers given during the interview thus far
- Results Page – to display the results of the computer interview, including a score for screening interviews (as appropriate)
- Completed Page – to inform the interviewee that the interview is completed and to ensure that no sensitive information is left on the screen (i.e. don't finish on results page)

After consultation with the clinicians involved in this study, the Review Answers page was deemed unnecessary, and likely to cause patient confusion; also the patients' initial responses to the interview questions, particularly those in the HADS screening interview, were deemed to be essential. As mentioned above, all of these pages required ASP technology and involved data being both saved to and pulled from an Access database.

Prior to starting development of the aforementioned pages, the author had completed a number of tutorials and exercises using ASP. This enabled the author to implement most aspects of the interview pages relatively easily. The main difficulty

encountered at this early stage was how to pass the unique Interviewee ID number from one page to the next. This was required in order to ensure that the correct details were displayed for all sections of the interview and that the answers were associated with the correct interviewee, and also to enable the interview process to be personalised. It was discovered that there were two possibilities for passing information between pages, use of hidden fields and use of query strings. Hidden fields have the advantage that the process is invisible to the user whereas the query string can be seen in the address section of the browser window. Query strings were used initially, as it was not possible to use a hidden field from the New Interviewee page. It was subsequently decided to use query strings in order to pass the Interviewee ID number, and hidden fields to pass any other information. It was possible to avoid any potential usability issues related to the inclusion of the query string in the Web address by customising the browser window and removing the address section.

The questions and their related answer options were all displayed through the use of loops, so the addition or deletion of any questions from the database tables, or alteration of the answer options, became evident when the page loaded, without the need to modify the code in anyway. This was an important aspect of the development as it enabled the CIS to be more efficiently maintained and updated. The looping was relatively simple to implement from a display point of view, however it created additional challenges at the stage of recording the interviewee's responses into the relevant database table. It was necessary to utilise a counter,

which was incremented with each iteration of the loop, thus enabling each radio button or text box to be uniquely identified. This unique identification was necessary in order to be able to save all the given information to the database table.

When developing the generic interviewing tool, text boxes, memo fields, radio buttons – for both multiple choice and Boolean (yes/no) questions, check boxes and drop down lists were implemented for receiving the answers to the interview questions in order to give maximum flexibility for the type of questions asked during the computer interview.

After discussion with the clinicians involved in the project, and after agreeing on a purely touch screen interface, see section 3.13, it was decided to use mainly radio buttons to deliver a multiple choice interview/questionnaire, with some use of check boxes and drop down list.

During early testing of the prototype by the author, it became apparent that some means of validating the user input was required. The form validation action provided by Dreamweaver was used to provide this facility. The author then modified the code produced in order to meet Error Message Guidelines (Nielsen, 2001). The form validation was implemented to ensure that mandatory fields were completed, thus avoiding uninformative Microsoft error messages from which the interviewee could not recover, and that any e-mail addresses were of a valid format.

In order to further minimise potential error messages, a controlled browser window was used to deliver the computer interview. The browser window was set to a size that would minimise the need for scrolling (Bailey, Barnum, Bosley, Chaparro,

Dumas, Ivory, John, Miller-Jacobs, Koyani, Lewis, Page, Ramey, Redish, Scholtz, Wigginton, Wolfson, Wood, & Zimmerman, 2003; Nielsen, 2010), and without the usual navigation buttons, thus ensuring the interviewees used only the navigation buttons provided within the interview interface. It was established during early testing that errors would occur if the interviewee used the standard “back” navigation button when carrying out the computer interview, hence the need to remove additional navigation buttons through control of the browser window. BrowserBob Freeware Edition 2.1, from BrotherSoft, was used to create the customised browser window; the final Interview Delivery Interface is shown below.

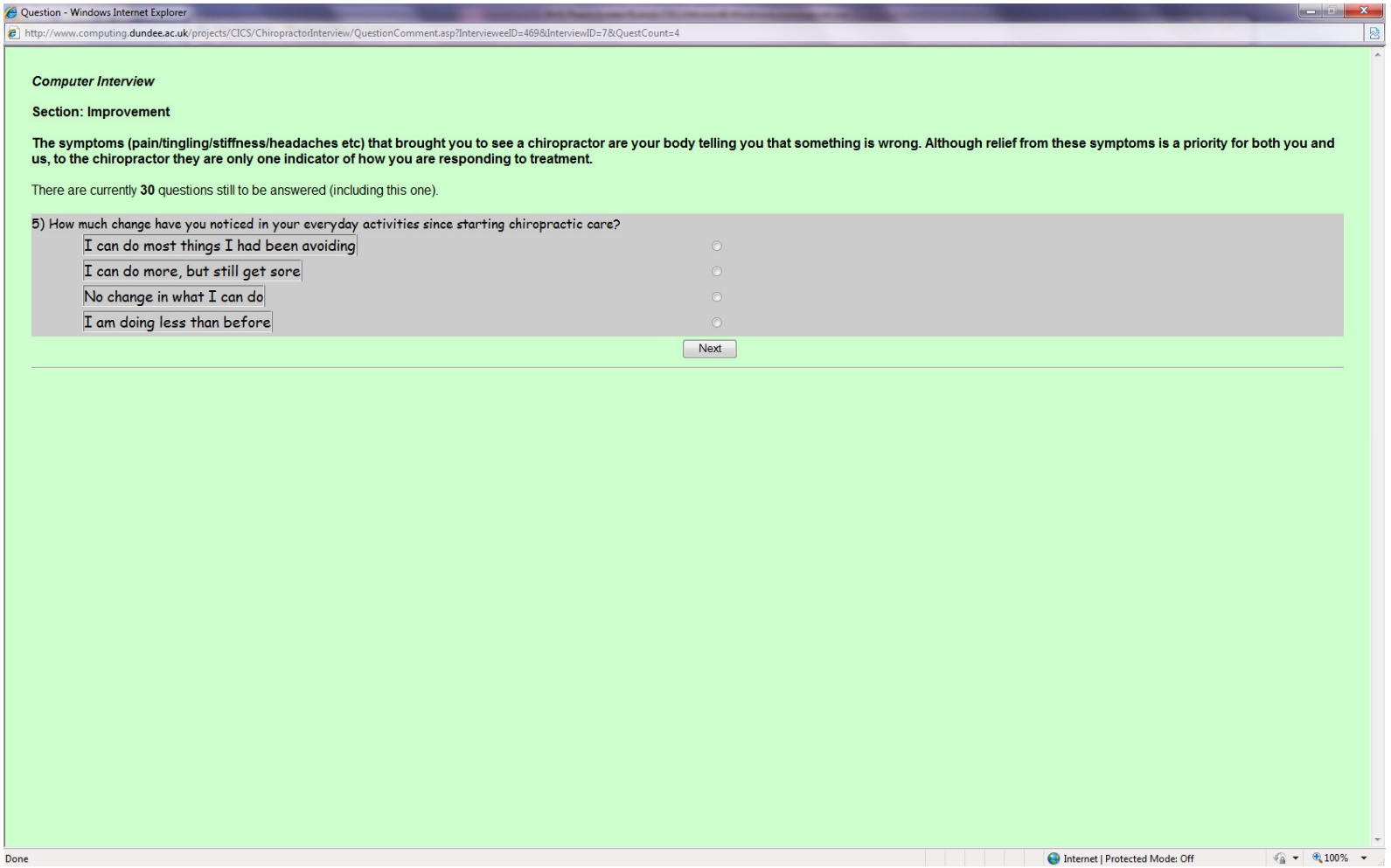

Figure 3: Screenshot of Interview Delivery Interface

3.9 Interview Authoring Interface

The administrator options were added to enable an authorised administrator to enter and maintain a set of questions and to select from the question set to create an interview. As with the interview process, care was taken at the paper prototype stage and so the development stage progressed smoothly. A number of core tasks were identified as being required:

- Add an interview
- Edit an interview
- Add a question
- Edit a question
- Link questions to form groups within an interview

Pages were developed to enable these tasks to be carried out by a relatively inexperienced computer user without any training. The interview authoring interface is discussed only in Chapter 4, Initial User Evaluations, and not in the specific GP surgery and chiropractic clinic settings, as all interview and question entry was carried out by the author and not by any other study participants. As mentioned previously, the clinicians involved in the research had extremely limited time and were not interested in entering details of the interviews but were happy to provide a paper or electronic copy for the author to enter into the database.

On the Web pages developed to enable questions to be added, drop-down lists were implemented for the selection of question type and a text box was used for the entry of the question text and the related answer options.

3.10 Interview Analysis Interface

Another aspect of the complete CIS was the ability to query the database in order to see how interviewees have responded to different questions. A specific site, the interview analysis interface, was created in order to enable the clinicians to see the results of their interviews. A personalised analysis page was created specifically for each set of clinicians, which provided a list of all question sets pertaining to them. For example, on the chiropractors' interview analysis page, the list included HADS, Expectation/Satisfaction, Improvement, Education, General Health and Computer Interview Feedback. These then linked to a graphical presentation of interviewees' responses to each question, which is shown below.

The interview analysis interface was utilised by the clinicians as a part of this research.

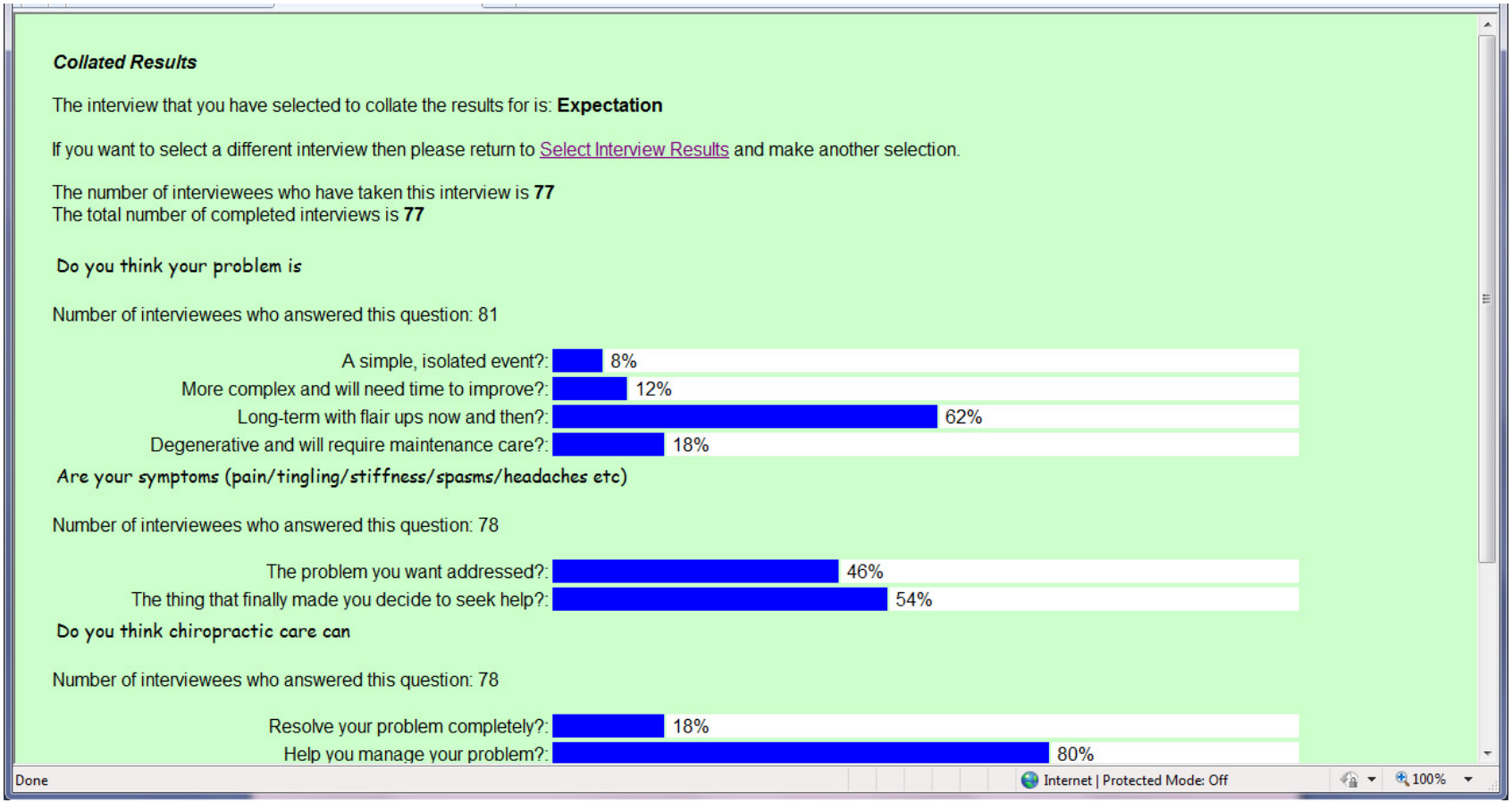

Figure 4: Screenshot of Interview Analysis Interface

3.11 Web Design

Accessibility and usability were central considerations when designing the web pages.

3.11.1 Usability

Two main user groups of the computer interviewing system were identified:

- The interviewers: this group would include anyone wishing to create their own computer interview; they would also interpret the results of the computer interview(s). This group would include users with varied levels of computer experience.
- The interviewee: this group includes users of varying ages, social backgrounds and also with varied levels of computer experience.

In this particular study the author created all the interviews to be used by inputting and ordering the question sets provided by the general practitioners and chiropractors. The GPs and chiropractors did, however, use the interview analysis interface.

The system was designed around the main principles of usability (Nielsen, 1993):

- Ease of learning
- Ease of use
- High speed of task performance
- Low user error rate

- Subjective user satisfaction
- User retention over time

Issues specific to user-centred web development were also considered, as it known that users want web sites to be easy to use, have a minimum download time and allow them to complete their tasks in a minimal amount of time with a minimal amount of frustration (Lazar, 2001).

Users were consulted at the beginning and throughout the project using an iterative process (Cato, 2001), and a number of specific user evaluations were carried out. During the early stages of the design process use was made of storyboards, paper-based and web-based prototypes. These were discussed with users from the relevant user group.

A very simple interface was used for the delivery of the computer interview. A cascading style sheet (CSS) was used to give consistency of appearance throughout the interview system and to draw the interviewees' attention to important information on the screen. The use of a linked, rather than an embedded, CSS also served to improve page loading times since a linked CSS need only be downloaded once for the entire site. Similar style sheets were also used for the interview authoring and interview analysis tools, as this gave a feeling of continuity across all aspects of the computer interviewing system. A CSS recommended by World Wide Web Consortium (W3C) was used as a starting point and was then modified by the author to suit the needs of the project. The CSS was used, not only to control the appearance of the site, but also because it is a recommendation of the Web

Accessibility Initiative (WAI) Guidelines (World Wide Web Consortium, 1999). The colours chosen for the site were from the browser compatible range, ensuring consistency of style across different browsers. Guidelines as to recommended colour combinations were followed and users tested three different colour schemes, detailed in Chapter 4, before deciding upon the one that has been utilised (Boumphrey et al., 2000).

Speed of loading was considered particularly important in the development of a computer interviewing system where having a continuity of flow is essential to the interview process. It has been found that advice regarding response times has changed little since Robert B. Millar presented a paper on the topic at the Fall Joint Computer Conference in 1968 (Nielsen, 1993):

- 0.1 s is about the limit for the user to feel that the system is reacting instantaneously
- 1.0 s is about the limit for the users' flow of thought to remain uninterrupted

Care was taken to ensure that the loading time for each page in the interview system, particularly in the interview delivery tool, was less than 0.1 s, and this was tested using different routers and broadband speeds. It should be noted, however, that this cannot be totally controlled due to varying performance of different internet service providers (ISPs).

All user groups were provided with a controlled set of navigation tools. Clear and consistent buttons were used to give the users the confidence that they knew what action should be taken next (Lynch & Horton, 1999). The navigation choices were

consistently positioned at the bottom of the page, as it is common practice to have navigation options either at the bottom or left hand side of the page (Boumphrey et al., 2000); thus helping the user to rapidly become familiar with the site and hence increase in confidence and in the speed with which they navigate through the site. Also, by placing the buttons to the bottom or left of the page, it was possible to take suitable consideration of Fitts' Law: *The time required to move to a target is a function of the target size and distance to the target*. Positioning the buttons as described above significantly reduces the homing movements required, resulting in fewer errors and faster acquisitions (Lidwell et al., 2010).

By controlling the navigation options it was possible to ensure that interviewees would proceed through the computer interview in the correct order; navigation was through a means of clearly marked buttons on the page, with the usual Web navigation buttons removed from the browser window. Limiting the navigation options also follows the universal principles of design, where it is suggested that beginners do best with reduced amount of control, and that when designing a complex system, which the CIS is, it is best to "*use a method that is equally simple and efficient for beginners and experts*" (Lidwell et al., 2010).

It was vital for the computer interviewing system to be quick and easy to use; otherwise there would be a high number of incomplete interviews. It was also important for the interview authoring and interview analysis tools to be easy to use; otherwise the interviews would not be created in the first place and no interpretation of analysis would be carried out on the results, making the entire

system redundant. Again, extensive prototyping was carried out to ensure a system that was acceptable to all user groups was developed. A sub-set of the post-test questionnaire, as used by Spool et al (Spool, Scanlon, Schroeder, Snyder, & DeAngelo, 1999), was used after the user evaluation sessions in order to measure the users' satisfaction with the developing product.

An interface that delivered only one interview question at a time helped to keep the interview process clear and simple and also served to minimise the need for the interviewee to scroll (Nielsen, 2010). The need for a suitable target area for selection was an important consideration for usability, hence an answer choice could be selected either by clicking on the radio button or the answer text; the **Next** navigation button was also large, clearly marked and located suitably, as described above (C. A. Lin, Neafsey, & Strickler, 2009).

3.11.2 Accessibility

Accessibility can be considered a subset of usability, and there is a considerable overlap between the processes of designing for usability and designing for accessibility (Thatcher, Bohman, Burks, Lawton Henry, Regan, Swierenga, Urban, & Waddell, 2002). Accessibility was considered throughout the research as a guiding principle rather than focussing purely on the technical aspects.

The Web Content Accessibility Guidelines (WCAG) checklist was used to measure the accessibility of the computer interviewing system Web pages (World Wide Web Consortium, 1999), and care was taken to ensure that all priority-one and priority-two checkpoints were met. Extensive use was also made of the information and

recommendations available on the Digital Media Access Group (DMAG) Web site (Digital Media Access Group, 1999).

The system Web pages were also tested with an on-line tool, which provided valuable information on potential accessibility problems. The specific tool used was Bobby from the Centre for Applied Special Technology (CAST) (CAST). The underlying HTML of the site was also validated to accepted standards using the World Wide Web Consortium's HTML Validator (World Wide Web Consortium, 1994) as non-standard HTML frequently creates accessibility barriers. A final check was made using the Vischeck Web site (Vischeck), where it is possible to view the developed Web pages whilst simulating certain conditions of colour-blindness.

Care was taken to ensure that users could work with the computer interviewing system using a mouse, a touch screen or the keyboard; this was later narrowed to focus on touch screen interaction. Care was also taken to remain aware that addressing accessibility issues and implementing good practice in the design and development of the computer interviewing system would also serve to improve the universal usability. It was essential that interviewees, in particular, could carry out the computer interview independently, as privacy is important in eliciting the most honest and open answers.

3.12 Web Authoring Tools

A variety of web authoring tools were investigated, particularly with regard to the facilities offered for interactive processing of data. These included: Macromedia

Dreamweaver 3.0, Microsoft FrontPage, Allaire Cold Fusion and EvrSoft 1stPage 2000.

It was decided not to use Microsoft FrontPage as it is known to generate large amounts of its own code. It has also been commented that it can be difficult to directly edit the source code with this package.

The remaining packages were evaluated as to their suitability against the following criteria:

- Ability to edit (X)HTML code directly
- Compatibility with ASP
- Ease with which user can generate a usable interface
- Enable user to create accessible, as well as usable, interface

It was decided to use Macromedia Dreamweaver as it provides all the functionality required for this study.

3.13 Touch Screen Interface

When considering the interview delivery interface, the ability to interact through a touch screen was felt to be important. Whilst the ability to add comments and review answers were thought to be important aspects of the generic computer interview, this was not the case for the specific computer interviewing system for use in the clinical setting. The discussions with the medical staff indicated that the priority was to be on creating the simplest possible interface that was usable, in order to minimise possibilities of patients having to request assistance.

Some GP practices were starting to introduce touch screen interfaces for patients to check themselves in upon arrival at the surgery; hence it was felt appropriate to focus on the touch screen interface. Also, touch screens have been found to be highly usable and an effective way of optimising user interfaces: they are easy to learn and require little thinking; are the fastest pointing device; have easier hand-eye coordination than mice or keyboards; are durable in public-access and in high-volume usage (Shneiderman, 1991).

Relatively recent research has shown touch screen interfaces to have high degrees of ease of use and acceptability. Using a touch screen rather than paper and pen to answer quality of care questionnaires was perceived to be easier to use and to take less time to complete; data can also be stored and analysed automatically (Larsson, 2006). Indeed touch screen interfaces have proved to have high acceptance in populations with limited computer experience. Edwards et al developed a touch screen self-interviewing tool for use by American Indians; 96.0% reported the interface as enjoyable to use, 97.2% found them easy to use, and 82.6% preferred the touch screen interface for future questionnaires (Edwards, Slattery, Murtaugh, Edwards, Bryner, Pearson, Rogers, Edwards, & Tom-Orme, 2007).

Touch screen have also proved successful in patient groups with reduced mobility. Greenwood et al showed that in patients with rheumatoid arthritis the touch screen was acceptable, and in many cases a preferable, option to paper, regardless of age and previous experience of computers (Greenwood, Hakim, Carson, & Doyle, 2006). Not only that, in the same study, the touch screen technology was also found to

"*offer the potential to facilitate the collection of data, saving time on administration, scoring and data entry and increasing utility by allowing immediate access to results*". In patients suffering from low back pain, many of whom had low levels of computer experience (45% had no experience with computers and 66% had no experience with the internet), 66% preferred the touch screen to paper and pen and 55% found it easier to use (Schaeren, Bischoff-Ferrari, Knupp, Dick, Huber, & Theiler, 2005). In a subsequent study, again in patients with chronic low back pain, 96.7% reported that the touch screen was easy to use, with comments that it was more comfortable than using paper and pen "[I like the] touch screen because it's hard to find a comfortable writing position" (Koestler, Libby, Schofferman, & Redmond, 2005).

Touch screen technology has also proved beneficial to the communication between patients and their healthcare team, serving as an avenue to open lines of communication. This enhanced communication could help to reduce patient concerns and enhance perception of being heard and understood (Clark, Bardwell, Arsenault, DeTeresa, & Loscalzo, 2008). As was consistent with previous studies, although over half of the patients (64.5%) rated themselves as beginner or intermediate level computer users, the majority (96%) rated that the instrument was very easy or easy to use.

When using the touch screen technology in areas of sensitivity, similar findings occurred, with high levels of usability and reduced levels of embarrassment; this was still the case when the printout generated by the computer interview was available

for discussion with their care provider (Skeels, Kurth, Claused, Severynen, & Garcia-Smith, 2006). Cooley et al found that combining touch screen technology with audio-computer assisted self-interviewing (CASI) proved to enhance the ease of use of conventional audio CASI systems while simultaneously providing the privacy of self-administered questionnaires. For subjects who reported a mode preference, 51% preferred the touch screen audio-CASI, compared with 26% who preferred the keypad audio-CASI, and 23% who preferred the interviewer-administered mode. When comparing the two computer interviewing modes, over two-thirds of respondents (69.6%) reported that touch screen was easier to use then traditional keypad audio-CASI (Cooley, Rogers, Turner, Al-Tayyib, Willis, & Ganapathi, 2001).

3.14 Hardware

Having established the need for a touch screen interface, at the time of development, the choice of laptop was considerably limited. A Fujitsu Siemens Lifebook Series B was decided upon as it provided all the features that were required, namely the correct operating system to run PWS, enough memory to enable the CIS to run rapidly and smoothly, a touch screen that could be operated by a finger-touch. As mentioned previously, at the stage of developing the CIS touch screen technology was relatively rare and few laptops provided this facility; were the CIS being developed now, there would be many more options available, including handheld devices such as tablets. Handheld devices are proving popular within the computer interviewing and medical research areas (Cheng, Ernesto, & Truong, 2008; Gravlee, 2002; Lottridge & Chignell, 2006).

The initial user testing, including that prior to working in a clinical setting and the first phase of testing in the GP practice used the Fujitsu Siemens Lifebook Series B to both run the computer interview and to act as the touch screen interface; this had an active screen area of 10.5 inches diagonally. The later testing was carried out using a robust, large touch screen, with the Lifebook hidden from view and used solely to run the interviewing program. This touch screen monitor was a Dolch Computer Systems Inc (USA) device, Model: Shark SL-15-R15, with an active area of the screen measuring 15 inches diagonally.

A portable printer was also used to enable the interviewees to quickly and easily print their interview summary if they desired. A compact printer that could fit safely on a table immediately adjacent to the laptop was selected. The printer was connected to the laptop using Bluetooth technology, thus negating the need for additional cables. Two different printers were used; both of which had identical functionality. The change in printer was due to the initial printer, used in the GP surgery, being required for a different project at the time of conducting the chiropractic clinic part of the study.

Having designed and developed the CIS, the next phase was to carry out user evaluations. These were initially conducted out with the clinical setting, which are detailed in Chapter 4, and then later within the clinical setting of a GP surgery, the results of which are presented in Chapter 5.

4 Initial User Evaluations

4.1 Introduction

Initial user evaluations were carried out prior to any testing within the clinical setting. The aim of this testing was to focus on the usability of the interviewing interface and to test the question ordering system. It was specified that the users must be able to use the interface independently and that it should be intuitive to use, so there would be no need for extensive instructions and help documentation. Initial testing of the Interview Authoring Interface and the Interview Analysis Interface were also carried out at this point.

4.2 Method

4.2.1 Interview Delivery Interface

The initial working prototype was developed with a general question set gathering personal details such as name, age, qualifications, etc. This interview question set was produced by a member of the School of Computing for use in a different research project that was developed for Windows and DOS environments (Peiris, 1997). By using an existing interview it was possible to test that the newly developed question ordering system presented the questions in their correct order. A group of ten users of varied age and levels of computer experience were used for this initial phase of user testing, and each user was asked between 20 and 45 questions, depending on the responses given throughout the interview. The author was

present throughout the testing sessions to respond to any requests for help and to record any additional comments that were made during the session.

The users were asked to adopt a “think aloud” strategy, as detailed in Chapter 2, Research Aim, Plan of Research and Methodology. Additionally, the time taken to complete the interview, the number of questions answered, the number of requests for help and the reason for any help requests were recorded, as was each users’ estimation of their level of computer expertise (on a 5-point scale).

These users were also asked to vote for colour choices for text and background colours from a set of three, all of which met usability and accessibility guidelines.

4.2.2 Interview Authoring Interface

Initial user testing was carried out with ten users of varied levels of computer experience. They carried out a number of specified tasks:

- Log on using ID and password
- Create interview – set up interview name and add questions of different types
- Edit an existing interview – alter the questions included in an existing interview

An observational method was used at this stage to determine what aspects, if any, caused difficulties; additionally, the users were asked to adopt a “think aloud” protocol when undertaking the tasks outlined above so that the author could record

the comments made. The recorded comments were later analysed thematically to determine the usability issues.

The interview authoring tool was then tested by a commercial group who run training session and workshops about all aspects of Web accessibility. One member of this team created an interview to ask clients about their requirements and expectations of a forthcoming training session, and another member of the team created an interview to gather feedback from workshop participants. These users were asked to create the interviews independently and to rate the interview authoring tool for ease and speed of use and whether it met their functionality expectations.

4.2.3 Interview Analysis Interface

The commercial team that tested the interview authoring tool also tested the interview analysis interface. They examined the interface to determine:

- Accuracy and clarity of results
- If it contained all the details that they required
- If it was quick and easy to interpret

They tested the interview analysis interface using the data gathered from the two interviews described above, one of which was to gather information about requirements of a forthcoming workshop, the other to gather feedback from a workshop that had recently been run. Again, the users were asked to “think aloud”

whilst using the interview analysis interface, thus enabling a rich set of data to be gathered from a small number of users (Ericsson & Simon, 1984).

4.3 Results

4.3.1 Interview Delivery Interface

Three colour choices were given, as detailed in the table below. Of the three colour choices given, that of a pale green background with lilac to highlight certain areas of the page was clearly favoured by the users.

Colour combination	Number of users who preferred the combination
Pale green background, dark green highlights	0
Lilac background, pale green highlights	2
Pale green background, lilac highlights	8

Table 1: Initial User Testing Colour Combination Preferences

The results of this early testing were recorded in a tabular format by the author with both quantitative and qualitative results being generated.

The comments made during this user testing can be summarised as:

- Enable a comment to be added at the same time as entering an answer.
- Include “practice” questions at the start of the interview.
- Alter the format of the Review Answers page to be easier to interpret.
- Any error messages were felt to be helpful and informative.

- The timed prompt, which was displayed if the user had not answered the question within 40 seconds, was felt to be shown too quickly.
- Inform the interviewee how far through the interview they are.
- Add a facility to print answers

Overall the feedback was positive, and the users indicated that they enjoyed using the computer interviewing system. The main area requiring alteration was the Review Answers page: topic headings were included in order to make the list more meaningful, read-only questions were removed from the list, and an indication of where a comment had been added was included. A full table of results is given below.

User no.	**No. of questions answered**	**Time taken (min.sec)**	**No. of help requests**	**Help reasons**	**Level of computer expertise**[1]	**Comments**
1.1	26	19.01	0		4	Increase font size and button size
1.2	36	36.39	0		5	Made extensive and detailed comments throughout
1.3	42	06.30	0		5	Did not like font
1.4	31	08.15	1	How to edit a comment	5	Only allow review answers at end of interview
1.5	26	03.22	0		2	Found system quick and easy to use
1.6	41	05.24	1	Confused when answer was not understood	3	Liked being able to review answers at any stage of the interview

[1] 1, low expertise, to 5, high expertise

1.7	37	03.49	0		4	Thought answer choices were not always appropriate
1.8	24	28.12	0		1	Took a while to decide which answers to select
1.9	42	04.47	0		4	Did not like timed prompt at all
1.10	38	04.24	0		5	Particularly liked colours used

Table 2: Results of Initial Interview Delivery Interface User Evaluations

4.3.2 Interview Authoring Interface

The users were all able to log on successfully, they were able to add a new interview and add questions of varying types (multiple choice, check list, free text). The users were also able to delete interviews that they had previously created, but that were now no longer required. Qualitative data were gathered from the "think aloud" testing sessions, from which the main comments included:

- Include a link to a screen to enable the password to be altered.
- Amend the order of tasks involved in creating a new interview to allow for more flexibility.
- Add a link at the end of creating an interview to run the interview as an interviewee would see it.

The members of the commercial team that tested the interview authoring interface rated it positively. The two different interviews were created successfully and both users rated the interface as 2 – fairly easy to use, 2 – quite quick to use, 2 – closely met their functionality expectations, on a 5-point Likert scale (with 1 being the best and 5 being the worst).

4.3.3 Interview Analysis Interface

The interview analysis interface was found to accurately present the results of the two different interviews. Having collated results manually in order to check for accuracy of the system, it was commented that it saved considerable time having the system produce the analysis automatically. The commercial team had previously used a paper-based questionnaire; they found it very time consuming to enter the data from each questionnaire into a database and then carry out queries to extract the information that they required. It should be noted, however, that direct comparisons of time taken for interview analysis were not included as part of this study.

The interview analysis interface included full details of all interviewee answers for any given interview; it was suggested that interviewers may wish to select only certain aspects/questions from an interview for specific analysis. The use of a combination of text and graphical presentation was felt to be appropriate and aided in the speed and ease with which the interview results could be interpreted. One of the users indicated that a means to highlight the question text would help it to stand out from the answer options.

4.4 Modifications Made

4.4.1 Interview Delivery Interface

The colour choice of black text on a pale green background, using lilac to highlight or draw attention to certain areas was confirmed and was incorporated into the CSS for

all interfaces in the CIS. A simplified interface was used for the computer interview process in the clinical setting. By restricting the question types to multiple choice, check list and drop-down list and by having only one question, with its associated answer options, displayed at a time, it was possible to create a much simplified interview screen. It was felt that the options to Add Comments and to Review Answers were not required and were likely to confuse the less experienced computer users within the study population. As the interviewees were to see the clinicians directly after carrying out the interview, they could discuss any answers that they wished to modify or expand upon during the consultation.

After experimenting with different timings, it was decided to remove the timed prompt completely as it was felt to be rather obtrusive and unnecessary.

The facility to print was added on the Results page to enable the interviewees to print a complete interview transcript. The format of the transcript was modified during the clinical testing and will be described below in the chapters pertaining to both the GP setting and chiropractic setting.

4.4.2 Interview Authoring Interface

A direct link to enable the interview author to test run an interview as an interviewee would see it was introduced at the end of the interview creation process. Minor alterations were made to allow a greater degree of choice in the order of carrying out the various tasks involved with creating an interview; for example, it was made possible to add all the questions and later add any answer options, rather than having to add answer options for multiple choice, drop-down

list and checkbox questions at the time off adding the question, as was initially the case. Similar amendments were made to enable interviews to be more easily edited after original creation.

4.4.3 Interview Analysis Interface

Only one formatting modification was made to the interview analysis interface at this stage, to include bolding for the question text.

4.5 Conclusion

These early user testing sessions proved valuable in the development of the CIS. Not only did they test the accuracy of the question delivery and interview analysis, they also enabled the author to make improvements to the functionality and, perhaps more importantly, the usability of the system.

There were some limitations in the means in which the user evaluations were conducted. Although care was taken not to influence the user in any way, the author is aware that the use of “think aloud” protocol and her consequentially required presence may have had some affect on the outcome of the evaluation process. It is still believed to have been an effective strategy to gather the most detailed feedback from a limited number of users.

Whilst it is not possible, or appropriate, to include all requests from users, gathering feedback reduces the likelihood of omitting requirements.

By testing all aspects of the CIS prior to initiating the trials in the clinical setting, and making the subsequent modifications, it was possible to deliver a CIS that should

cause minimal disruption to the GP surgery and chiropractic clinic. It was anticipated that the modified system would be suitable for independent use, by interviewees and clinicians alike; thus increasing confidence in the system in both user groups. If there is confidence in a system, it thereby follows that acceptance of the system should also increase.

Due to the novelty of including a computer interviewing device into the GP surgery and the need to familiarise the surgery staff, in particular the reception staff, with the study protocol, it was decided to conduct further user evaluations within the clinical setting. This enabled further adjustments to the CIS and the protocol to be made as required prior to conducting the main study; the details of which are given in Chapter 5, Formative Clinical User Evaluations.

5 Formative Clinical User Evaluations

5.1 Introduction

In order to ensure that the CIS could be run in the GP surgery without causing disruption, it was necessary to conduct further user evaluations, this time in the clinical setting. These evaluations tested both the interviewing interface and the study protocol. It was agreed that the lead GP would trial using the CIS for three sessions prior to the study being extended to include other GPs from within the practice. By reviewing the feedback from the GP and the patients after each session, it enabled any required changes to the protocol or the CIS to be made in an iterative manner.

5.2 Method

All GPs within the study GP surgery were happy for the study to take place and Ethical Approval was gained from both the Fife Local Research Ethics Committee and the Ethics Committee of the School of Computing, University of Dundee.

The very first questions in the CIS were “practice questions” regarding the weather conditions and whether the patient could drive; thus enabling the patients to ask for help, if required, prior to any questions of a sensitive nature being presented. GPs requested the inclusion of questions about the patient’s reason for the visit; if the patient answered that they had already been seen about the same condition then they were asked follow up questions regarding how long the condition had been present and whether it was improving or not. The GPs were interested to see if

including the HADS questionnaire could aid in the recognition of patients suffering from anxiety and/or depression that they had not previously identified. Finally, patients were asked five questions about their experience of using the CIS.

The CIS was set up in a spare GP consulting room to ensure patient privacy. This need for a spare room determined which sessions were assigned to be “computer interviewing clinics”. Patients were informed at the point of booking an appointment if it was within a “computer interviewing clinic” and were asked if they would be happy to participate. Those patients who agreed were asked to arrive 15 minutes prior to their GP appointment time.

On arrival at the GP surgery, the patients were presented with the Patient Information Sheet (Appendix 6: Patient Information Sheet (GP Surgery)) and Consent Form (Appendix 5: Patient Consent Form (GP Surgery)) by the author, who also answered any questions about the study. For the formative clinical user testing sessions, the author was present, either in the room with the CIS or directly outside, so as to be readily available should the patient require assistance in using the CIS and to record any comments made by participants. The patients were advised before commencing the computer interview that they could ask the author for assistance or clarification at any point during the interview process and were informed as to where the author would be located (either in a corner of the room or directly outside). During the last session of the formative clinical user evaluations (Session 3), the interviewees were encouraged to use the CIS independently but were still told that help would be available from the author should it be required.

After completing the computer interview, the patients took the printed interview transcript to show to the GP at the start of the consultation. Initially only patients with clinically significant HADS score were instructed to print their transcript but this was later changed to make the protocol clearer and to enable the GPS to view all patient interview transcripts.

The GP completed a simple, tabular record sheet for each patient seen during the formative clinical user evaluation sessions; this recorded if the information gathered by the CIS was useful to the consultation (yes/no) and if they were surprised by the HADS score for the patient (yes/no). This data enabled the author to gain a quantitative value for the number of consultations where the CIS was perceived by the GP as being useful and for the number of consultations where the GP was surprised by the patient's HADS score.

Given the sensitive nature of some of the questions included within the computer interview being delivered, it was not considered appropriate to use the think aloud protocol used in the initial, non-clinical user testing. Instead a set of feedback questions regarding the patients' views of using the CIS were included within the computer interview. These feedback questions used a Likert scale, thus enabling analyses of non-parametric data to be carried out; which is a commonly used question format for assessing users' opinions of usability (Dumas, 1999).

5.3 Results

5.3.1 Session 1

The computer interview was delivered using the small touch screen laptop, which meant that the keyboard was available to the patients; they were instructed to use either the touch screen or the mouse during the interview process. Seven patients used the CIS during Session 1. The author was seated in the corner of the room where the CIS was carried out for all participants. The patients were only prompted to print off their HADS scores from the CIS if they scored outwith the normal range.

5.3.1.1 GP

The GP completed a simple, single line in a record table for each patient that had used the CIS prior to the consultation. These provided the results which are shown below.

<table>
<tr><td></td><td colspan="3">GP Responses</td></tr>
<tr><td rowspan="2">Useful aid to consultation Yes/No</td><td colspan="2">Y</td><td>N</td></tr>
<tr><td colspan="2">1</td><td>6</td></tr>
<tr><td rowspan="4">Were you surprised by the HADS results?</td><td colspan="2">Yes</td><td>No</td></tr>
<tr><td colspan="2">1</td><td rowspan="3">6</td></tr>
<tr><td>Higher than expected</td><td>Lower than expected</td></tr>
<tr><td>1</td><td>0</td></tr>
</table>

Table 3: GP Responses during Clinical User Evaluation Session 1

The GP did not specifically ask the patients about the use of the CIS; she found the inclusion of the CIS useful for one patient, who had scored higher for both anxiety and depression than expected.

5.3.1.2 Patients

The patients in the first session of clinical user evaluations were asked to comment on the CIS and to let the author know if there were any aspects of the system that they would like changed in any way.

Gender	Age range	HADS Score A	HADS Score D	Comments	GP Surprised by HADS
F	41-50	6	2	Managed easily and didn't require help	N
M	51-60	7	2	Did not like the HADS interview questions; larger radio buttons would be easier; make it clear when it has moved on to the next question; use a different colour to draw the eye to the questions; have larger text; have help to explain the answer options; use a button to link to the Feedback section and make it more obvious.	N
M	>60	2	3	The patient needed to be told how to select an answer option. A couple of times the interviewee thought that he had clicked on Next but then had to try again. Also occasionally didn't realise that the interview had moved on. Did not like the wording of the HADS questions. Also questioned two of the feedback questions: take interview again – Yes, No, **Maybe**; enjoyable is the wrong word to use.	N
F	51-60	3	0	Thought that she had finished at the Scores page otherwise no problems	N
M	51-60	5	2	Never used a computer before. Use the touch screen. The author explained, "select answer" and then "Next" and then he managed to complete the interview without further assistance. Thought that he was	N

				finished at the Scores page.	
F	>60	1	0	Needed assistance as to which mouse button to use to select and also how to add a comment (click in comment box). Also questioned one of the HADS questions (slowed down) and one feedback question (enjoyable).	N
F	>60	18	15	Had never used a computer before. Author explained how to use the touch screen to select and answer option and then click on Next. She then managed very well but stopped often to discuss the questions being asked. She scored highly for both anxiety and depression and discussed this with the author. The author encouraged her to discuss these issues with the GP in the subsequent consultation.	Y – HIGH

Table 4: Results of Clinical User Testing, Session 1

One patient scored significantly for anxiety, the same patient also had a significant score for depression. Four of the seven patients requested help in completing the CIS; three needed help with how to select an answer and one thought they had completed the interview at the HADS Scores page.

No patients printed their HADS scores to show to the GP; one patient, with elevated anxiety and depression, should have printed the scores page to show to the GP.

The average time taken to complete the interview process was 10 minutes; most patients took in the range of 5-10 minutes, with one patient taking over 40 minutes.

As part of the computer interview, the patients were asked to rate different aspects of the CIS using a 4-point scale, with 1 being most positive and 4 being most negative. The results of which are presented below.

1. How enjoyable did you find the computer interview, on a scale of 1 (very enjoyable) to 4 (very unenjoyable)?

The patients' responses were split, with 4 answering positively (1 or 2 on the rating scale) and 3 responding negatively (3 or 4 on the rating scale). It should be noted that three patients commented that enjoyable seemed an inappropriate term to use here.

2. How would you rate your level of computer experience, on a scale of 1 (very inexperienced) to 4 (very experienced)?

Three patients felt that they were very inexperienced (rating 1) and two rated themselves as very experienced (rating 4).

3. How easy did you find the computer interview to use, on a scale of 1 (very easy) to 4 (very difficult)?

Six patients responded positively, with four of those rating the CIS as very easy.

4. What aspects, if any, of the computer interview did you find a problem?

Three patients said that they had no problems. Of those that indicated a problem, the areas selected included: understanding questions, selecting an answer, and using the keyboard.

5. Do you intend to discuss the computer interview and/or your results with the GP?

Four patients selected "No, definitely not" and three selected "Possibly".

5.3.1.3 Issues Arising

Although the patient who should have printed their HADS scores to show to the GP did not do so, she did still discuss her results with the GP, and this proved beneficial to the consultation.

Whilst one patient took a very long time to complete the computer interview, most patients completed the interview in less than 10 minutes, so it was decided to continue to ask patients to arrive 15 minutes before their GP consultation and not to increase this time.

It was felt that it would be better for the author to be seated outside the room containing the CIS. While it was helpful to be in the room for this first session to be able to observe the patients using the CIS, it was felt to be a distraction to the patients. The least experienced computer users were hesitant to start to interact with the CIS, however, with minimal instruction they were able to use the touch screen with little or no further assistance.

5.3.1.4 Modifications Agreed

A number of modifications were undertaken after Session 1:

- Increase the size of the radio buttons for selecting an answer
- Use a colour block to draw attention to the question text
- Make link to the Feedback section of the interview more clear
- Alter wording of question regarding the computer interview being "enjoyable"

- Consider author location during computer interviewing clinics

5.3.2 Session 2

The computer interview was again delivered using the small touch screen laptop, with the patients instructed to use either the touch screen or the mouse to complete the interview process. Ten patients used the CIS during Session 2. The author was seated in the corner of the room where the CIS was carried out for all participants but was facing away from the patients. The patients were prompted to print off their HADS scores from the CIS only if they scored out with the normal range.

5.3.2.1 GP

The GP completed the same record table as that in Session 1 for each patient that had used the CIS prior to the consultation. These provided the results which are shown below.

	GP Responses	
Useful aid to consultation Yes/No	**Y**	**N**
	1	9
Were you surprised by the HADS results?	**Yes**	**No**
	0	10

Table 5: GP Responses during Clinical User Evaluation Session 2

The GP asked patients about the use of the CIS, which resulted in varying comments; one patient thought it was very easy and felt that it prompted discussion, another was pleased to have completed the interview as they were nervous of computers

and didn't think they'd manage, however, another patient felt that the surgery was running late due to the computer interview and thought it was too time consuming. The GP found the inclusion of the CIS useful for one patient, who had scored significantly for anxiety.

5.3.2.2 Patients

The patients were asked to complete the CIS independently, if possible. The author noted when any problems were encountered and also recorded any comments made by the patients either during or after using the CIS.

Gender	Age range	HADS Score A	HADS Score D	Comments	GP Surprised by HADS
F	41-50	4	1	Managed easily and didn't require help	N
F	21-30	11	6	Didn't see the link to Feedback questions	N
F	51-60	19	8	Asked about the HADS questions "right now, this instance?" Also asked to confirm that they should now do the Feedback questions.	N
F	51-60	15	4	Didn't see the link to Feedback questions; printed results and said that she thought that the elderly would find the computer difficult to use.	N
F	41-50	6	2	Checked to confirm that they should submit the form.	N
F	51-60	9	13	Never used a computer before. Needed shown how to select. Printed results - the print dialog box caused some confusion. Did not like the HADS questions/answers options. Pleased to have managed to use the CIS.	N
F	>60	6	1	Had to be shown how to scroll on the "No Answer Given" page. Found the mouse quite difficult to use.	N
F	41-50	6	2	Managed easily and didn't require help.	N

F	>60	2	6	Was very reluctant to try the CI but then decided to give it a go, to the surprise of the author. Explained about select/next. Had some problems getting the touch screen to work (pressing too hard and too long). Had to be directed to feedback questions. Said doesn't use a computer or ATM. Ended up saying that it was a simple survey – not a computer, just a machine to point to.	N
F	>60	10	3	Never used a computer before. Showed select/next and then managed well. Needed shown how to link to the feedback questions. Printed the results off.	

Table 6: Results of Clinical User Testing, Session 2

Three patients scored significantly for anxiety; one patient had a significant score for depression; no patients had a significant score for both anxiety and depression. Eight patients requested help whilst using the CIS; the majority of problems were in continuing to the Feedback section of the interview.

Of the five patients who were instructed to print off their HADS results, only three did so.

The average time taken to complete the interview process was 6 min 36 sec; all patients took in the range of 5-10 minutes.

In the Feedback section of the computer interview, the patients were asked to rate different aspects of the CIS using a 4-point scale, with 1 being most positive and 4 being most negative. The results of which are presented below.

1. How easy did you find the computer interview, on a scale of 1 (very easy) to 4 (very difficult)?

The patients' responses were positive, with 9 answering positively (1 or 2 on the rating scale) and 1 responding negatively (3 on the rating scale). Eight patients said

they found it very easy, which is surprising given that 8 patients required assistance during the interview process.

2. How would you rate your level of computer experience, on a scale of 1 (very inexperienced) to 4 (very experienced)?

Five patients felt that they were very inexperienced (rating 1); one rated themselves as very experienced (rating 4).

3. How engaging did you find the computer interview to use, on a scale of 1 (very much) to 4 (very little)?

All patients responded positively, with eight of those rating the CIS as very engaging.

4. Would you be prepared to do a computer interview again?

Eight patients said that they would definitely do a computer interview again; one selected possibly and one said they would not. The patient who was not prepared to use the CIS again said that she was “beyond the computer age”; this patient had completed the CIS with only a little assistance.

5. What aspects, if any, of the computer interview did you find a problem?

Five patients said that they had no problems. Of those that indicated a problem, the areas selected included: text size, selecting an answer, and using the keyboard.

6. Do you intend to discuss the computer interview and/or your results with the GP?

Three patients selected “No, definitely not” and seven selected “Possibly”.

5.3.2.3 Issues Arising

Some patients followed the on-screen guidance to print their HADS results (only those scoring above the normal range were asked to print); however, two patients who should have printed did not do so. The GP requested that all patients print their result as it could be useful to see those who scored particularly low on the HADS scale as well as those scoring highly. It was decided to alter the print page to make the directions clearer and to link to the print for all patients (not only those with elevated HADS scores, as had previously been the case).

All patients completed the computer interview in less than 10 minutes, indicating that the CIS could potentially be included in the consultation process without causing great disruption and delay to the surgery.

It was decided that the author should be seated outside the room containing the CIS. Whilst it would mean that the author couldn't observe the patients using the CIS, it would, however, encourage the patients to try using the CIS on their own.

Given the number of patients requesting help with the CIS, it was clearly not usable enough to enable independent use by users with varying computer experience. In order to aid usability, the font size was further increased, the target area for selecting an answer was increased and the Feedback section of the computer interview was changed to so that it was displayed automatically without the patients having to follow a separate link.

5.3.2.4 Modifications Agreed

The following modifications were undertaken after Session 2:

- Increase the font size and increase target area for selecting an answer text
- Use a solely touch screen interface for the interview; remove access to the keyboard
- Link seamlessly to the Feedback section of the interview
- Locate author outside the room containing the CIS

5.3.3 Session 3

The computer interview was delivered using a large, robust touch screen interface, with the laptop used to run the computer interview hidden from view. Eleven patients used the CIS during Session 3. The author was seated directly outside the room where the CIS was carried. All patients were prompted to print their HADS scores from the CIS.

5.3.3.1 GP

The GP completed the same record table as that in Session 1 for each patient that had used the CIS prior to the consultation. These provided the results which are shown below.

	GP Responses	
Useful aid to consultation Yes/No	**Y**	**N**
	6	5
Were you surprised by the HADS results?	**Yes**	**No**
	3	8

Table 7: GP Responses during Clinical User Evaluation Session 3

Having all the patients show their interview transcript to the GP seemed beneficial. The GP found the inclusion of the CIS useful for over half of the patients, a great difference from the previous two sessions.

Two of the patients were currently undergoing treatment for anxiety or depression and it was helpful to patient and GP alike to have a score for their current levels; the GP commented that it would be useful to use the CIS at regular intervals with these patients, and others already identified as suffering from anxiety or depression.

One patient commenced treatment for mood during this surgery; the GP stated that the inclusion of the CIS prior to the consultation directly affected this decision. One patient presented with mild anxiety, which the GP felt may be affecting their presenting complaint, so made the time to discuss the patient's concerns and fears.

The GP was surprised by the HADS scores for three patients, two of whom had higher scores than expected.

5.3.3.2 Patients

The patients were again asked to complete the CIS independently. The author noted when any problems were encountered and also recorded any comments made by the patients.

Gender	Age range	HADS Score A	HADS Score D	Comments	GP Surprised by HADS
F	31-40	13	8	Unsure when the computer interview was finished but commented that it was "very easy one you are used to it."	Y - LOW
M	41-50	9	6	Mentioned that some HADS questions were unusually worded, particularly "slowed down"	Y - HIGH
F	>60	9	13	Asked for help, once shown to press Next they managed well.	N
F	>60	4	1	No help required.	N
F	>60	2	2	Needed Select and Next explained, then completed with no further assistance until the print dialogue window (PDW) appeared.	N
F	21-30	11	3	Asked for help at PDW	N
F	>60	2	1	Asked for help at PDW; commented made "great screen, very easy to see".	N
F	31-40	13	11	Completed independently	N
F	51-60	5	2	Completed independently	N
F	51-60	12	8	Completed independently	Y - HIGH
F	21-30	16	12	Completed independently	N

Table 8: Results of Clinical User Testing, Session 3

Five patients scored significantly for anxiety; three patients had a significant score for depression; two patients had a significant score for both anxiety and depression.

The average time taken to complete the computer interview was 5 min 4 sec.

Four patients requested help whilst using the CIS; two required help with selecting an answer or moving to the next questions; three were confused by the print

dialogue window (PDW). The larger screen size and font size seemed to have helped with selecting answers, however, two patients still required assistance with this, both of whom were in the >60 age range. Having modified the computer interview order to progress smoothly to the Feedback questions, no patients experienced any difficulties with this aspect of the CIS. The problem of confusion with the PDW is difficult to address as it is the standard PDW that is displayed; it is not possible to avoid the PDW as there is no means to force a webpage to print without some confirmation from the user.

All patients did print their interview transcript, although, as mentioned above, three required assistance to do so.

Again, the patients were asked to rate different aspects of the CIS using a 4-point scale, with 1 being most positive and 4 being most negative. The results of which are presented below.

1. How easy did you find the computer interview, on a scale of 1 (very easy) to 4 (very difficult)?

The patients' responses were positive, with all 11 answering positively (1 or 2 on the rating scale); 10 patients said they found it very easy.

2. How would you rate your level of computer experience, on a scale of 1 (very inexperienced) to 4 (very experienced)?

There was a fairly even split of responses to this questions, with two patients selecting that they were very inexperienced (rating 1) and three patients selecting each of the other options.

3. How engaging did you find the computer interview to use, on a scale of 1 (very much) to 4 (very little)?

All patients responded positively, with six patients rating the CIS as very engaging.

4. Would you be prepared to do a computer interview again?

Ten patients said that they would definitely do a computer interview again and one selected possibly.

5. What aspects, if any, of the computer interview did you find a problem?

Five patients said that they had no problems. Areas selected as causing difficulty were: moving to the next question and selecting an answer.

6. Do you intend to discuss the computer interview and/or your results with the GP?

Two patients selected “Yes, definitely”, one patient selected “No, definitely not” and eight selected “Possibly”.

5.3.3.3 Issues Arising

The difficulty experienced with the PDW is a problematic one as there is no alternative to having it displayed. It is essential that a webpage cannot automatically print itself without confirmation from the user; it is hoped that by providing clear

and simple instructions directly prior to the appearance of the PDW, the number of requests for assistance will be reduced.

As in Session 2, all patients completed the computer interview in less than 10 minutes, with some patients taking less than 5 minutes.

Locating the author directly outside the room where the CIS was being used enabled the patients to have privacy when completing the computer interview but meant that the author was readily available should help be required.

Having made the transfer to the Feedback section of the computer interview automatic and implementing a purely touch screen interface served to increase usability and reduce the number of requests for assistance. It is noted that two patients still found it difficult to select an answer; perhaps a more sensitive touch screen monitor could help to alleviate this issue.

5.3.3.4 Modifications Agreed

The following modifications were undertaken after Session 3:

- Include more detailed instructions about how to print the interview transcript, particularly include instructions for what to do when the PDW appears.
- Update GP record sheet to gather more detail about usefulness of CIS from GP and patient perspectives.

5.4 Discussion

Although a similar protocol was used for each of the three formative clinical user evaluation sessions, slight changes occurred after each session in order to aid the smooth running of the inclusion of the CIS in the consultation process. Also, modifications were made to the GP record sheet and to the Feedback questions that the patients were asked, thus helping gather more detailed information from both user groups. For these reasons, direct comparisons cannot be made between the three sessions; however, it is possible to make more generalised comparisons.

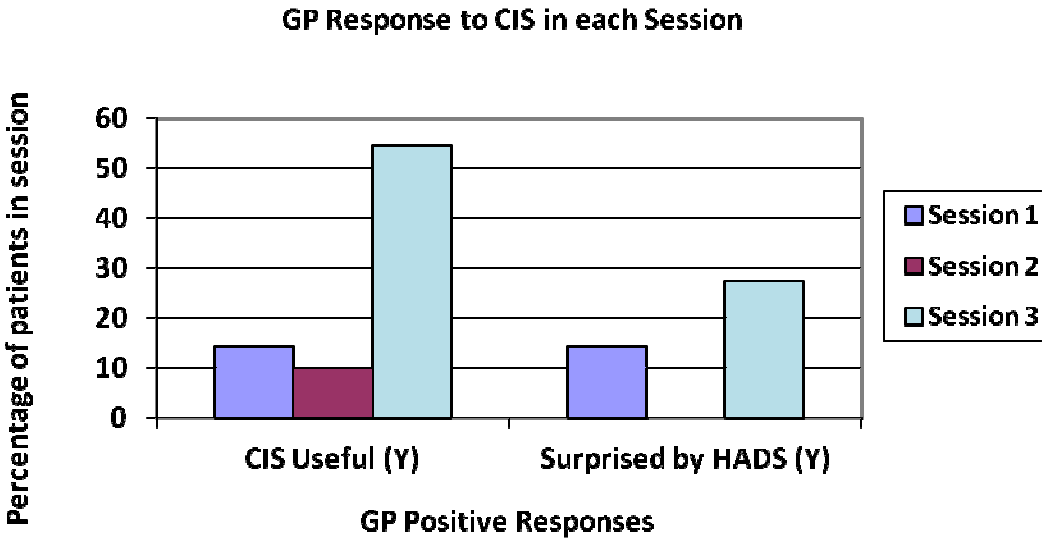

Figure 5: GP Response to use of CIS

Across all the sessions, the GP was surprised by the HADS result for four patients (14.3%) and found the inclusion of the CIS useful for eight patients (28.6%). Although the cumulative results for the three formative clinical user evaluation sessions are not particularly positive, in terms of the degree of usefulness of the CIS, the results from Session 3 indicate that the CIS could potentially enhance communication

between clinicians and their patients. The GP rated the CIS as useful for 54.5% of patients and specific comments included:

- Positive discussion with patient who was pleased and motivated by good scores.
- CIS helped to identify mild anxiety, which would affect the presenting complaint, so it was beneficial to address this issue.
- A score for already identified depression was useful for monitoring purposes and for discussing continuation of medication with patient.
- CIS discovered previously unidentified significant score for anxiety and hence treatment for mood was commenced.

These comments indicate that the CIS did enhance communication between patient and clinician and that the CIS was indeed considered useful by the clinician. Clearly the inclusion of the CIS helped in the identification of a number of patients with anxiety and/or depression, as the GP was surprised by the HADS results of 27.3% of the patients during Session 3, what remains to be determined is if the frequency of patient identification is high enough to warrant the regular inclusion of the CIS, with the HADS questionnaire, within the routine patient consultation process. Changing the protocol to ask all patients to print the interview transcript and show it to the GP appears to have increased the potential usefulness of the CIS and increased the possibilities of it aiding communication between patient and clinician. This should become more apparent following the next phase of testing, in which six GPs trial the system, and is described in Chapter 6.

Looking at the overall patient responses to the CIS, it can be seen that it was positively received (see Figure 6: Patient Responses to use of CIS 1). There is an obvious contradiction between the percentage of patients requesting help, 57.1% in Session 1, 80% in Session 2 and 36.4% in Session 3 and the patient rating for ease of use; 92.9% of patients rated the CIS as either easy or very easy to use. The patients were asked to rate the ease of use at the end of the computer interview experience so they perhaps rated how easy they found it to use after being given a small amount of help, indeed one patient commented that the system was “very easy once you are used to it”; further patient interviews would be required to confirm this. Another patient was clearly impressed by the large touch screen that was introduced during Session 3 “great screen, very easy to see” and went on to add that they found automated teller machines (ATMs) difficult to read but that this touch screen was very clear.

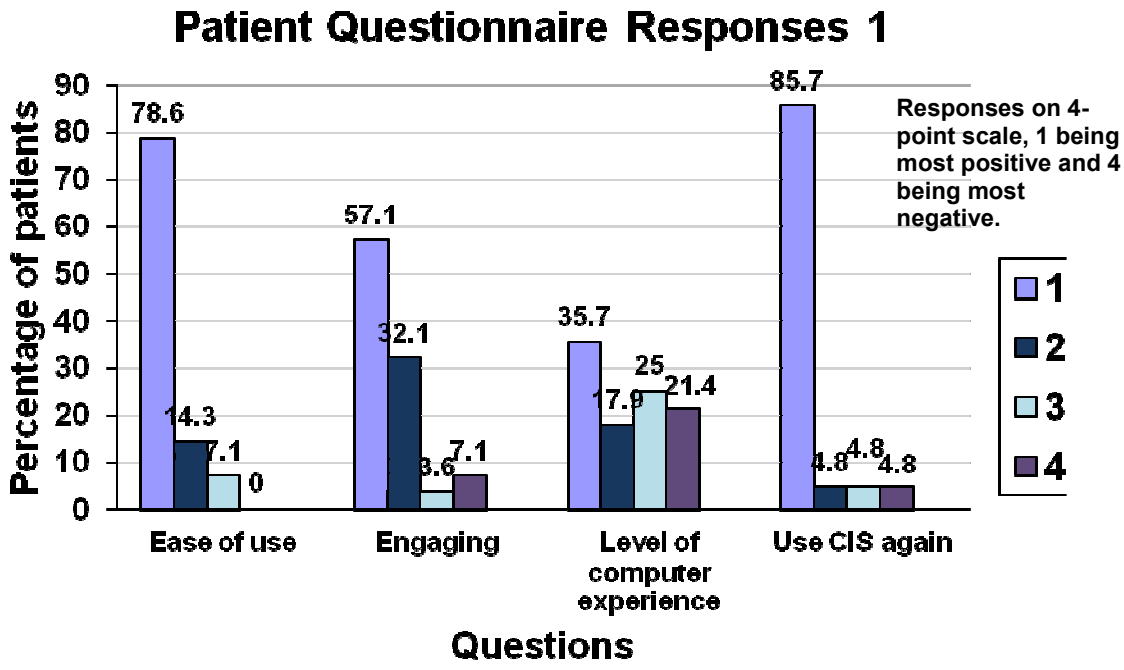

Figure 6: Patient Responses to use of CIS 1

Given the level of patients requiring assistance, it can be said that the CIS clearly cannot be used by patients independently and that further simplification and enhancements to usability are required in the Interview Interface. The amount of assistance required could also have been partially due to the fact that the majority of patients rated themselves as either inexperienced (17.9%) or very inexperienced computer users (35.7%); this doesn't negate the need to improve the CIS such that it can be used independently.

Whilst not a novel finding in this field of research, it was encouraging that over 85% of patients would definitely use a computer interview again and almost 80% felt it was very easy to use.

During Sessions 1 and 2 of these clinical user evaluation sessions, patients were given the choice of whether to discuss the interview transcript and HADS scores with the GP, with only those scoring significantly on the HADS scale directed to show their scores to the GP. It cannot be clearly shown, at this stage, that the inclusion of the CIS enhanced communication during the consultation process from the perspective of the patient, as is shown below.

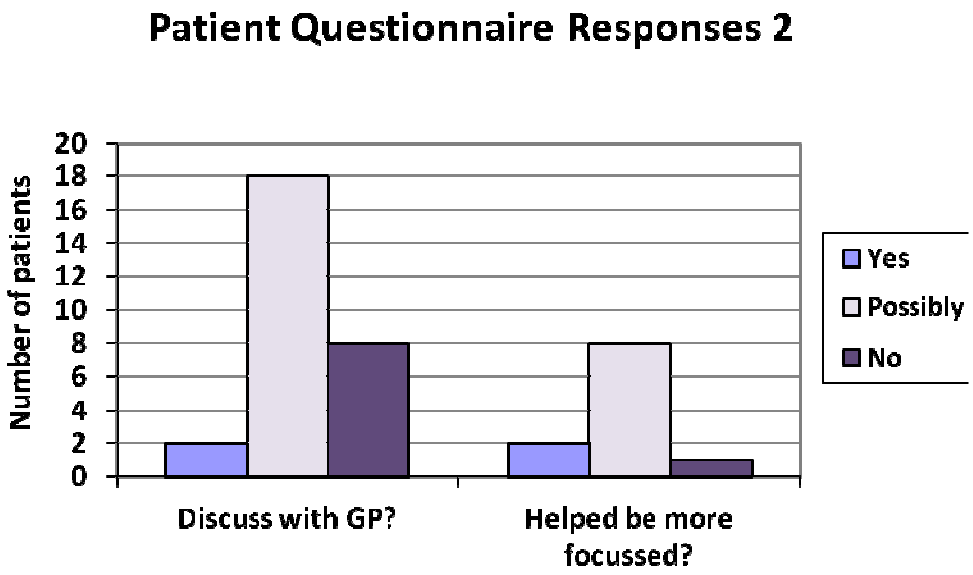

Figure 7: Patient Responses to use of CIS 2

All patients were asked if they intended to discuss the interview transcript with the GP, but only the patients in Session 3 (n=11) were asked if using the CIS helped them to be more focussed for the following GP consultation. The majority of patients were non-committal, with "Possibly" selected as the most frequent answer choice. Only two patients said they would definitely discuss the interview transcript with the GP

and two patients said that using the CIS definitely helped them to feel more focussed.

5.5 Conclusion

These clinical user evaluation sessions showed that there is potential for a CIS to aid in the recognition of individuals suffering from anxiety or depression within a GP surgery. Having all patients show the interview transcript to the GP increased the usefulness of the system and further investigation is warranted to determine if this will continue to enhance the communication between patient and clinician.

Acceptability of the CIS by the patients was extremely high; however, improvements are required to increase the number of patients using the CIS without assistance. To this aim, it is intended to clarify the print instructions. Whilst user testing had been carried out prior to commencing work in the clinical setting (Chapter 4), it still proved necessary to conduct further evaluations within the clinical setting to enable the protocol and the interview interface to be improved. Next the system and protocol were ready to implement within the GP surgery with other GPs involved, which is presented in Chapter 6, Computer Interviewing within a GP Surgery.

6 Computer Interviewing within a GP Surgery

6.1 Introduction

The overall research question examines the effect of a computer interview conducted prior to the GP consultation on the consultation process itself, in particular whether it affects the communication process between clinician and patient. This stage of the research concentrates on the implementation of a CIS within a GP surgery that is acceptable to patients and clinicians alike and produces results in a format that is easy for both the patients and clinicians to read and understand.

As explained in Chapter 1, Background, the reason for trialling a CIS in the GP surgery setting is that using such a protocol may enhance the patient-GP consultation process. It has been widely reported that the issue of time, or lack thereof, during a GP consultation can be problematic (Mechanic, 2001). This lack of time could be one of the reasons for the under-recognition of patients with anxiety and/or depression. Including the widely trialled HADS within the CIS could aid the recognition of these patients (Gilbody et al., 2001; Mori et al., 2003; Terluin et al., 2009; Wilkinson & Barczak, 1988). A computerised interviewing system can automatically analyse the results of a screening interview and present these for the immediate attention of the GP with no need for manual handling and scoring by surgery staff.

Patients may feel better prepared for the consultation having been asked questions to help them focus on the issues that they wish to discuss with the GP (Smith & Grasmick, 2004).

The key questions to be answered during the GP surgery study were:

1. Can the patients, regardless of age and computer experience, take the computer interview independently?
2. May the incorporation of an anxiety and depression screening questionnaire aid in the recognition of individuals with anxiety or depression in a GP surgery?
3. Can the incorporation of the CIS into the consultation process be considered useful and acceptable by GPs and patients?
4. May the CIS be shown to enhance communication between GPs and their patients?

The first question could be answered by recording the number of patients requesting help when using the CIS; the second could be answered by studying the individual results of the HADS screening interview; the third and fourth could be answered by analysing the opinions of patients and GPs who were involved in the study through questionnaires which sought to explore issues such as ease of use, usefulness of interview transcript, if patient management was altered due to information arising from the CIS.

As the GPs involved in this study felt that the short timescale allocated for each patient consultation was at times difficult to adhere to, particularly for those patients presenting with a psychological issue, it was decided to also ask the GPs if they perceived the inclusion of the CIS within the consultation process to affect the duration of the consultation.

6.2 Methods

A cross-sectional study was carried out, which is a recognised observational method, whereby the CIS was used to augment the usual GP consultation within the GP surgery (Mann, 2003). Cross-sectional studies are a good means to test prevalence, hence this was an appropriate method to determine prevalence of anxiety and/or depression amongst the study populations (Mann, 2003). The protocol used was based on the clinical user evaluations described above. All patients completed the computer interview prior to seeing the GP; all patients were instructed to print the interview transcript and to show it to the GP.

The CIS consisted of questions drawn up by the GPs regarding the main reason for the patients' visit to the surgery today, how long they have been suffering from this complaint and whether they have previously seen a GP about the complaint. It was also decided to include the HADS questionnaire within the computer interview question set, as anxiety and depression have been reported to be difficult to recognise in a primary care setting (Borus et al., 1988; Gilbody, Whitty, Grimshaw, & Thomas, 2003). Five feedback questions were also asked about the usability and the acceptability of the CIS; these used a Likert scale.

The author was able to use the ordinal data generated from the Likert scale feedback questions to carry out non-parametric analyses of the usability and acceptability of the CIS from the patients' perspectives.

Patients were partially self-selecting; all patients who were over 18 years of age and were willing to come 15 minutes early for their appointment were considered eligible for inclusion within the study. A total of 60 patients were included in the study.

On arrival at the surgery, the patients were presented with the Patient Information Sheet (Appendix 6: Patient Information Sheet (GP Surgery)) and Consent Form (Appendix 5: Patient Consent Form (GP Surgery)) by the author, who also answered any questions about the study, showed the patients to the room where the CIS was set up and ensured that the patients were happy to proceed. After completing the CIS, the patients took their interview transcript with them and returned to the waiting area. The patients presented their interview transcript to the GP at the start of the consultation.

All six GPs working at the GP surgery were involved in the study. The GPs completed a record sheet (Appendix 4: GP Record Sheet and Questionnaires) during each "computer interviewing surgery", with one line to be filled in for each patient seen. This GP record sheet was used to record if the GP was surprised by the HADS results; if the information from the CIS was useful to the consultation; if they altered management due to information from the CIS; if they felt that including the CIS altered the time taken for the consultation. This data enabled some quantitative

measures to be made of the GPs' perceptions regarding the usefulness of the CIS and of the number of instances that the GPs were surprised by the HADS results and altered management of the patients. Additional space was available should the GPs wish to add any specific comments. The GPs also completed a short questionnaire at the end of the "computer interviewing surgery" which sought their views regarding additional screening tools they felt would useful to include in the CIS; which patient groups the CIS could benefit most and if they would be happy to use the CIS again. These questionnaires were assessed thematically, looking for commonality between the GPs' suggestions.

6.3 CIS Design for use in a GP Surgery

6.3.1 Computer System

The computer interview was delivered using a large touch screen interface. The patients moved through the interview by touching different options or answers on the screen with a finger. This meant that the system was simple to use and should enable patients to complete the interview without requiring assistance. A large, readable font was used and the answers could be selected by touching either the answer text or the answer radio button or check box.

6.3.2 Questionnaire/Interview

The patients were first asked two "practice questions" about the weather and about ability to drive a car. The GP-specified interview was presented next, which included between 2 and 6 questions, depending upon the patients' responses; for example, if

they answered “Yes” they had seen a GP about their presenting complaint previously; they were then asked how long ago they had previously been seen. Next, the patients completed the 14-item HADS questionnaire, and the final 6 questions gathered the patients’ opinions regarding the CIS.

6.3.3 Interview Transcript

The GPs requested a transcript containing the HADS scores and full details of the patients’ responses to the initial questions regarding the main reason for their visit. These fitted easily onto one side of A4 paper. The HADS scores were presented at the top of the page so that they could be readily scanned by the GPs.

6.4 Results

6.4.1 GPs

The GPs completed a simple, single line in a record table for each patient that was seen during the computer interviewing surgery. These provided detailed results, which are shown below.

	Combined GP Responses			
Did CIS cause you to alter management?	**Y**		**N**	
	3 (5%)		57 (95%)	
Useful aid to consultation using 1 (very useful) to 4 (not useful)	**1**	**2**	**3**	**4**
	6 (10%)	7 (11.67%)	16 (26.67%)	31 (51.67%)
Were you surprised by the HADS results?	**Y**		**N**	
	7 (11.67%)		53 (88.33%)	
	Higher than expected	**Lower than expected**		
	3 (5%)	4 (6.67%)		
Did it alter the time for the consultation?	**Y**		**N**	
	11 (18.33%)		49 (81.67%)	
	Increased	**Decreased**		
	6 (10%)	5 (8.33%)		

Table 9: Combined GP Responses from the Record Sheets

The GPs altered the management of the patient 3 times (5%); they felt that the consultation time was increased on 6 occasions (10%) and decreased on 5 occasions (8.33%). They were surprised by the HADS results on 7 occasions (11.67%), with the HADS result higher than expected for 3 patients (5%) and lower than expected for 4 patients (6.67%); they rated the interview transcript as useful (1 or 2) for 13 of the patients (21.67%).

The six GPs saw differing numbers of patients:

	Male Patients (n=21, 35%)	**Female Patients (n=39, 65%)**	**Total Patients (n=60)**
GP 1	5	11	16

GP 2	6	3	9
GP 3	2	7	9
GP 4	2	7	9
GP 5	3	4	7
GP 6	3	7	10

Table 10: Number of Patients seen by the Individual GPs

A total of 60 patients were included in the study population. The following graph looks at the experiences and opinions of the six GPs and percentages are given as a percentage of the number of patients that each GP saw.

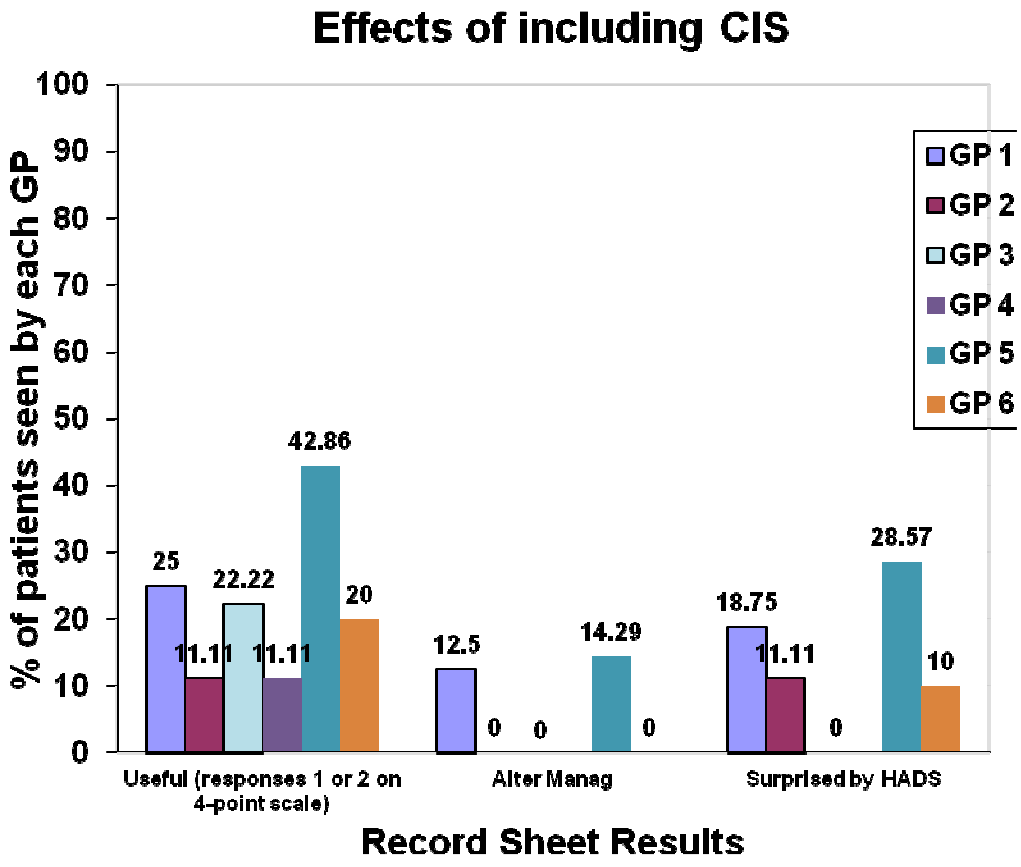

Figure 8: GPs' Responses to use of the CIS

This graph shows that there was considerable variation between the experiences and opinions of the six GPs.

Patient management was altered as a direct result of information given in the interview transcript for between 0% and 14.29% of patients seen, with GPs 2, 3, 4 and 6 indicating they did not alter management of any patients. The reasons for altering managements included:

- Reduction in medication that the patient was currently on for a mood related condition
- Commencement of medication to treat mood
- Discussion of patient anxiety regarding current condition; patient given management strategies to assist with this

The GPs rated the inclusion of the CIS as useful (rating 1 or 2 on a 4-point scale) for a total of 21.67% of patients, with individual GPs rating it useful for between 11.11% and 42.86% of their particular patient group. Examples given of when having the interview transcript proved particularly beneficial included:

- Having a quantified score for anxiety and depression levels helped to support the discussion
- Very useful to reassure patients when the scores were lower than expected
- Transcript helped to initiate discussion regarding patient anxiety about presenting complaint, where relevant

- Aided confirmation that patients' physical conditions were largely due to anxiety
- Transcript led to a more in-depth discussion of problems that the patient was experiencing with day-to-day life
- Useful to have an insight into the patient's mental state and using the CIS helped to realise than anxiety was not a contributing factor

The GPs felt that the consultation duration was affected on 11 occasions (18.33%), with it increased for 6 patients (10%) and decreased for 5 patients (8.33%). Reasons cited for the consultation taking longer included: more issues were discussed; more in-depth discussions were had with the patient; anxiety and the relevance to the patient's condition was raised. Reasons given for the consultations taking less time were: using CIS helped patient identify the "main" presenting complaint so aided explanation of problem; having the HADS result for patients already know to be suffering from anxiety and/or depression focussed the discussion of medication levels. Measurement of consultation duration was not a part of this study, merely the GPs impressions of whether the CIS affected the consultation time were gathered. These impressions gave a valuable insight into the future possibilities of the CIS. The qualitative nature of this study also enabled very specific details to be recorded, for example, the GP felt that the consultation time was shortened for one patient who had a tendency to present with multiple complaints, completing the CIS prior to seeing the GP enabled them to identify and focus on the main reason for

their visit and hence made this particular consultation more effective and time-efficient.

Over all, the GPs were surprised by the HADS results of 11.67% of patients, with 5% scoring higher than expected and 6.67% scoring lower; GPs 3 and 4 were not surprised by any HADS results; GP 5 was surprised by the results of over 28% of their patients.

The HADS scoring is based on a range:

Score	**Classification**	**Colour**
0-7	Normal	
8-10	Mild	
11-15	Moderate	
16-21	Severe	

Gender	**Age Range**	**HADS Score A**	**HADS Score D**	**GP Number**	**Surprised by Result**
F	51-60	6	5	1	
F	71-80	1	1	1	
F	51-60	5	1	1	Y - LOW
F	41-50	16	11	1	
M	31-40	11	6	1	
F	31-40	18	7	1	Y- HIGH
F	21-30	9	1	1	
M	61-70	3	1	1	
F	41-50	9	6	1	
F	41-50	8	6	1	
F	31-40	13	4	1	
F	41-50	4	8	1	
F	61-70	6	1	1	

M	21-30	10	3	1	
M	71-80	8	4	1	
M	51-60	14	8	1	Y - HIGH
M	31-40	6	4	2	
M	41-50	15	13	2	
F	61-70	6	1	2	
F	61-70	7	1	2	
M	51-60	4	3	2	
M	71-80	3	2	2	Y - LOW
M	61-70	8	6	2	
F	21-30	0	0	2	
M	41-50	0	0	2	
F	61-70	2	1	3	
F	31-40	7	9	3	
F	71-80	4	5	3	
F	<21	2	1	3	
F	61-70	4	5	3	
M	21-30	13	6	3	
F	41-50	8	7	3	
M	21-30	4	1	3	
F	31-40	4	1	3	
M	71-80	6	4	4	
F	31-40	20	20	4	
F	31-40	10	6	4	
M	61-70	13	16	4	
F	21-30	7	1	4	
F	<21	12	4	4	
F	81-90	2	4	4	
F	51-60	8	9	4	
F	31-40	21	18	4	
F	61-70	1	0	5	Y - LOW
M	51-60	3	0	5	
M	51-60	3	0	5	Y - LOW

F	21-30	3	3	5	
M	71-80	2	2	5	
F	51-60	2	3	5	
F	31-40	4	2	5	
F	41-50	3	4	6	
M	31-40	12	14	6	
F	31-40	10	7	6	
F	21-30	5	1	6	
F	61-70	2	1	6	
M	31-40	4	4	6	
F	51-60	1	0	6	
M	41-50	14	7	6	
F	31-40	9	4	6	
F	41-50	8	7	6	Y - HIGH

Table 11: HADS results for all GP patients

The HADS results showed that 4 patients scored in the severe range for anxiety, 9 were in the moderate range and 12 in the mild range. So the overall percentage of patients with clinically significant anxiety was 21.67% (those scoring in the moderate or severe range).

The scores for depression were lower, with 3 patients scoring in the severe range, 3 in the moderate range and 4 in the mild range. So the overall percentage of patients with clinically significant depression was 10% (those scoring in the moderate or severe range).

The GPs all completed a short questionnaire at the end of the computer interviewing surgery to gather their overall impressions of using the CIS and suggestions for possible areas in which the CIS could prove useful. All the GPs were willing to use a CIS again, with 4 “very willing” and 2 “quite willing”; all rated the potential of CIS as

either “very useful” (n=3) or “quite useful” (n=3). Suggestions for particular groups of patients who might benefit from a pre-consultation computer interview included:

- those in age range 20-40 (as they are likely to be computer literate)
- females
- any patients with chronic illness, e.g. diabetes, asthma, hypertension
- patients known to have anxiety or depression

Three GPs suggested that the CIS could be beneficial to use with patients with anxiety or depression and three suggested patients with a chronic condition.

The GPs were also asked if there were other screening tools that they felt would be useful to include within the CIS; suggestions included:

- Quality of Life Index
- Diabetic diet compliance questionnaire
- Drug regimen adherence questionnaire
- Family history questionnaire

Three GPs felt that a question set regarding drug adherence would be particularly useful within their GP surgery patient group.

6.4.2 Patients

The patients were asked 6 questions regarding the CIS during the computer interview process. The detailed results of which are presented below.

1. How easy did you find the computer interview, on a scale of 1 (very easy) to 4 (very difficult)?

All patients responded positively (1 or 2 on the rating scale) to the ease of use of the CIS (100%), with patients rating the CIS as either “very easy” (81.67%) or “easy” (18.33%) to use.

> *“I thought it would be too difficult for me, but once I got started it was really easy.”* Patient

2. How engaging did you find the computer interview, on a scale of 1 (very much) to 4 (very little)?

The patients found the CIS engaging to use, with 96.67% responding positively (1 or 2 on the rating scale); the majority of patients rated the CIS as “very engaging” (65%).

3. How would you rate your level of computer experience, on a scale of 1 (very inexperienced) to 4 (very experienced)?

Most patients rated themselves as inexperienced computer users (58.33%), with “fairly inexperienced” (33.33%) as the most common answer. Equal numbers rated themselves as “very experienced” and “very inexperienced” (25%); 16.67% rated themselves as fairly experienced.

4. Would you be prepared to do a computer interview again, on a scale of 1 (definitely) to 4 (definitely not)?

All patients responded positively (1 or 2 on the rating scale) about using a CIS in the future (100%), with most patients indicating that they would "definitely" be prepared to do a computer interview again (88.33%).

5. Do you think that the computer interview has helped you to be more focussed on issues you want to discuss during the consultation with the GP?

The patients selected their answer from three options: "Yes, definitely", "No, definitely not", and "Possibly". As may be expected, most patients selected "Possibly" (68.33%). More patients felt that the CIS did not help them to be more focussed (20%) than those who felt it did help (11.67%).

6. What aspects, if any, of the computer interview did you find a problem?

The patients selected their answers from a checklist, meaning they could select more than one answer option if they found several aspects of the CIS caused difficulties. One patient (1.67%) thought the text size was a problem, 3 patients (5%) found it unclear as to how to move to the next question and 8 patients (13.33%) thought selecting an answer caused difficulties. No other difficulties were selected.

> *"There was a bit of a delay between selecting my answer and the next question appearing so I wasn't sure if I'd done it right."* Patient

The time taken to complete the computer interview was recorded by the CIS and ranged from 4 minutes and 2 seconds to 10 minutes and 26 seconds, with the average time taken being 6 minutes and 32 seconds.

The results of the patient responses are presented graphically below, with the answer options chosen for each question given.

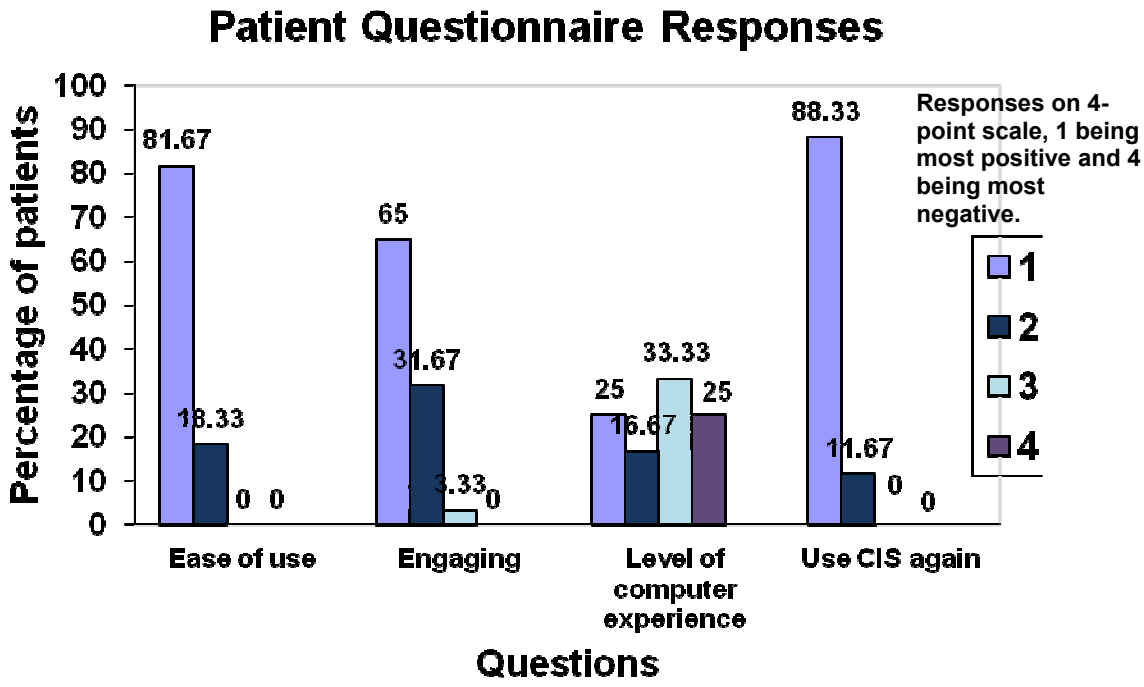

Figure 9: GP Patient Responses to Inclusion of CIS

There was a disparity between the patients' rating of ease of use and the number of requests for help. All patients rated the CIS as either "very easy" or "easy" to use, yet a total of 13 patients (21.67%) requested assistance in completing the computer interview. The main area that patients required help with was printing, with 9 patients seeking assistance with this. Of that 9, 3 patients did not notice the Print button, this was subsequently altered to increase the size, give it a 3-dimensional appearance and the colour was changed to make it stand out from the rest of the page; no further patients required help with this aspect of printing. The other 6 patients who requested help with printing were confused by the print dialogue

window (PDW), with which they were clearly unfamiliar. There was no means of avoiding the PDW so an instruction page was introduced to help to instruct patients on what to do when the PDW appeared. This did not completely eliminate requests for help at this stage of the computer interview process. The printing instruction page is shown below.

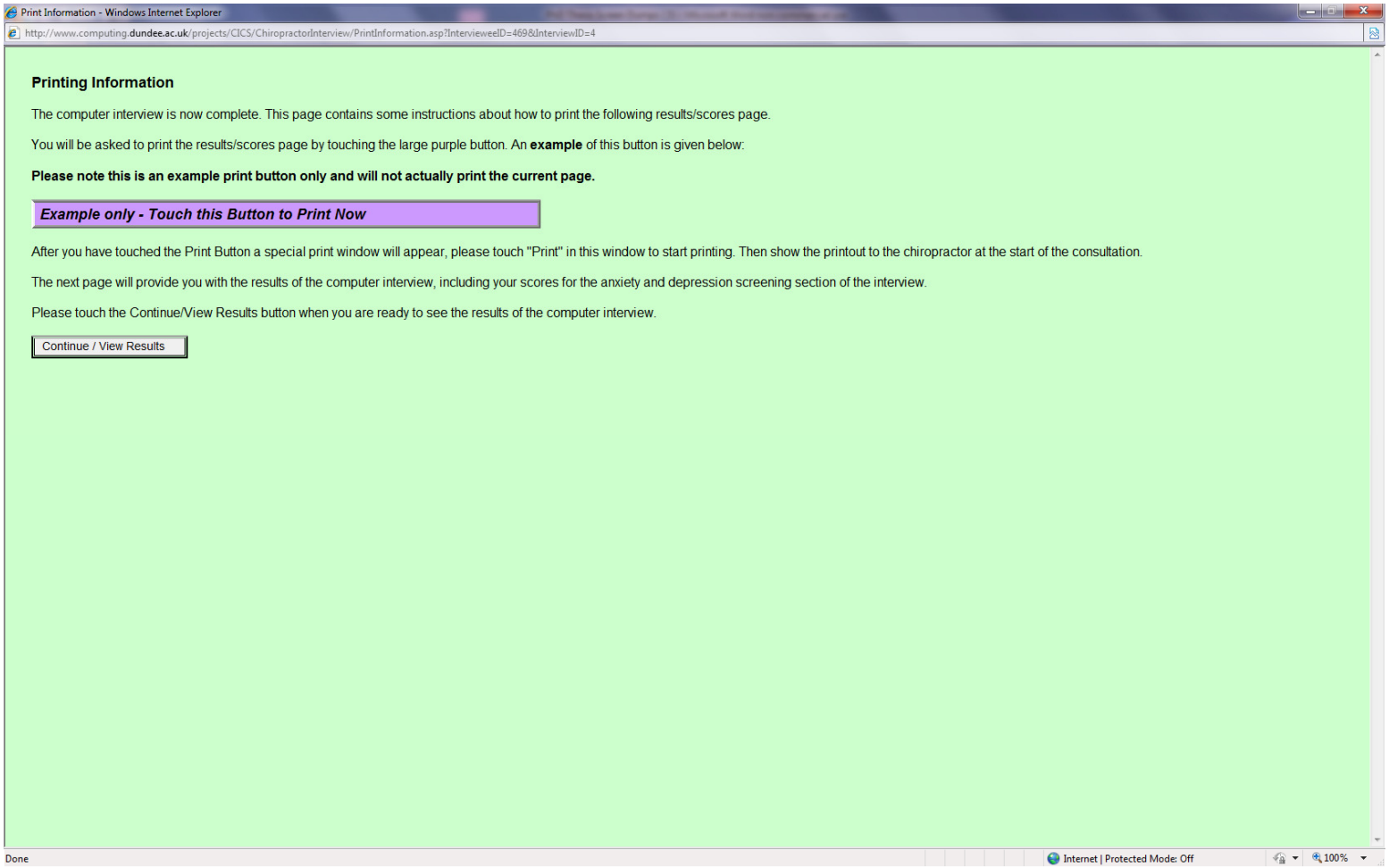

Figure 10: Screenshot of Print Instructions Page

3 patients (5%) had difficulty in selecting an answer; the size of the answer option text and the radio buttons were increased, after which no further requests for help were made. One patient did not recognise the button to move to the next question; once this was pointed out they completed the interview process with no further difficulties.

All patients who had difficulties with the CIS rated themselves as "1, extremely inexperienced", for level of computer experience and all were over 50 years of age; 4 were in the 71-80 age range, 5 in the 61-70 age range and 4 in the 51-60 age range. One of these patients said that they never use computers and felt that they wouldn't be able to use the CIS, however they did complete the process and said at the end *"That wasn't so bad!"*. Another patient, who had cerebral palsy, initially had difficulty in selecting an answer; they were able to select an answer when given a stylus to use rather than their finger and commented "*this is easy now*".

6.5 Statistical Analysis

An investigation on the GP surgery data was carried out to establish whether a correlation may exist between a patient's level of anxiety and/or depression and GPs perceived usefulness of the inclusion of the CIS. A similar investigation was used to establish if a relationship could be seen between patients' condition type (chronic or acute) and GPs perceived usefulness of the CIS.

Then analysis was conducted to determine if a correlation may exist, firstly between patients requesting help with the CIS and the patients' self-rated level of computer

experience, and secondly between patients requesting help with the CIS and their age range.

Non-parametric statistical significance tests were performed for each investigation detailed above to assess whether there was any significant difference.

6.5.1 Patient HADS score and GP perception of CIS usefulness

Given that the GPs rating of usefulness was identified by an ordinal value, the Fisher Exact Probability Test was used. The patients were grouped into those with clinically significant HADS scores (anxiety or depression score of ≥11) and those without (anxiety or depression score of <11); thus generating the following table.

	Useful (rating 1 or 2)	Not Useful (rating 3 or 4)	Total
Patients with significant HADS scores	6	7	13
Patients without significant HADS scores	7	40	47
Total	13	47	60

Table 12: GP Ratings of Usefulness of CIS Based on HADS Scores

The hypotheses were as follows:

H0 – There is no significant difference in the GPs' perceived usefulness of the CIS between patients with raised HADS scores and those without;

H1 – There is a difference in the GPs' perceived usefulness of the CIS between patients with raised HADS scores and those without;

The H0 is rejected as Fisher Exact Probability gives p=0.025. Additionally, the odds ratio was calculated to establish the degree of difference in usefulness. This test

gave the result that OR=4.898. Hence, we accept H1. This means it can be said that the CIS proved almost 5 times more useful for those patients with clinically significant HADS scores than for those without.

6.5.2 Patient condition type (acute or chronic) and GP perception of CIS usefulness

The data types involved in this analysis were ordinal and nominal; hence Fisher Exact Probability was used. The patient's condition type was recorded by the GPs and was based on the patient's main reason for their visit at the time of using the CIS.

	Useful	Not Useful	Total
Chronic	6	16	22
Acute	7	31	38
Total	13	47	60

Table 13: GP Ratings of Usefulness of CIS Based on Patient Condition Type

The hypotheses were:

H0 – There is no significant difference in the GPs' perceived usefulness of the CIS between patients with chronic conditions and those with acute conditions;

H1 – There is a significant difference in the GPs' perceived usefulness of the CIS between patients with chronic conditions and those with acute conditions;

The results of Fisher Exact Probability were inconclusive (p=0.520), this could be attributed to the fact that the data was skewed. It was subsequently decided to calculate the odds ratio to further investigate any difference in the usefulness of the CIS. This test gave the result that OR=1.66, hence it can be said that the CIS was

perceived as useful 1.66 times more frequently for patients with chronic conditions than for those with acute conditions.

6.5.3 Patients requesting help and their level of computer experience

Fisher's Exact Probability was again used. The hypotheses were as follows:

H0 – There would be no significant difference in the number of patients requesting help with the CIS and those completing it independently based on the patients' levels of computer experience;

H1 – There would be a significant difference in the number of patients requesting help with the CIS and those completing it independently based on the patients' levels of computer experience;

Fisher's Exact Probability Test is customarily run using a 2x2 grid, however additional grids (2x3 and 2x4) are available through the VassarStats Website for Statistical Calculation (Lowry, 2011).

Level of computer experience (1, low to 4, high)	Help	Independent	Total
1	13	2	15
2	0	10	10
3	0	20	20
4	0	15	15
Total	13	47	60

Table 14: Number of Patients using CIS Independently or with Help based on Computer Experience

The H1 is accepted as Fisher Exact Probability gives p=2.032e-11.

6.5.4 Patients requesting help and their age range

It was anticipated that there would be a significant difference between interviewees who completed the computer interview independently and those who requested help. The hypotheses were:

H0 – There is no significant difference between interviewees who used the CIS independently and those who required help based on the patients' age range.

H1 – There is a significant difference between interviewees who used the CIS independently and those who required help based on the patients' age range.

Age Range	Help	Independent	Total
>71	4	3	7
61-70	5	5	10
51-60	4	5	9
41-50	0	10	10
31-40	0	14	14
21-30	0	8	8
<21	0	2	2
Total	13	47	60

Table 15: Number of Patients using CIS Independently or with Help based on Age Range

Two different tests were run to establish which hypothesis to accept. Using the Mann-Whitney U-Test, a marginally significant difference was found between the groups of patients who needed help and those were able to use the CIS independently ($p=0.025$, Mann-Whitney U-Test). Fisher-Exact Probability was not used as the table has too many cells; chi square was not used as too many cells contain 0 for this test to be valid.

Given that only patients who were 51 years or older requested help, it was decided to also analyse the data using the Fisher Exact Probability Test, using a 2x2 format.

Age	Help	Independent	Total
>50	13	13	26
≤50	0	34	34
Total	13	47	60

Table 16: Number of Patients using CIS independently or with help based on Age (over 50, 50 or less)

A more statistically significant difference was seen using this test; hence, the H0 is rejected as Fisher Exact Probability gives p=0.000002.

6.6 Discussion

The use of a CIS within a GP surgery was received positively by both patients and GPs, with potential benefits indicated from its use.

It was found that 78.33% of patients were able to use the CIS independently; this showed a marked improvement from the clinical testing phase where between 36.36% and 80% of patients requested assistance at some point during the computer interviewing process. This shows the benefit of using an iterative development process, with the system evaluated after each user session and modifications made as appropriate. Whilst 21.67% of patients required help, they were all able to complete the computer interview process with only a little assistance and the CIS was perceived overall to be extremely easy to use by 81.67% of patients. One of the study aims was to investigate whether the CIS could be used by patients independently, irrespective of age and computer experience. It was

shown that the CIS used during this study was partially successful in achieving independent patient use, with close to 80% of patients completing the computer interview independently.

At the time of the study, regular computer use amongst over 60s was less prevalent than now, with around 20% of over 65s having used the internet (Dickinson, Arnott, & Prior, 2007); although even recently, a survey by the Office for National Statistics in 2010 found that the majority (60%) of those aged 65 and over still had never used the Internet (Office for National Statistics, 2010). The OxIS Report of 2009 showed Household Internet access in Britain had increased from 58% in 2003 to 70% in 2009. Moreover, in 2009, 34% of retired people used the Internet; with the main increase in their Internet usage being from 22% in 2003 to 30% in 2005 (Dutton, Helsper, & Gerber, 2009).

Almost 70% of requests for assistance with the CIS came from patients who were 61 years of age or older, all of whom rated themselves as being very inexperienced computer users; the CIS was not simple enough for users with this demographic. Indeed, a statistically significant difference was found between patients who completed the computer interview independently and those who requested help, when based on computer experience and when based on age range (see section 6.5). It is hard to determine ways in which the web-based CIS could be further simplified, so perhaps it would be more realistic to expect that certain patients, especially older patients with extremely limited or no prior computer experience, are likely to require some instruction in the use of a CIS.

The inclusion of the CIS in the consultation process helped in the recognition of some patients with anxiety or depression. The GPs were surprised by the HADS scores for 11.67% of patients, with 5% of patients having higher scores than expected. A total of 13 patients (21.67%) scored in the clinically significant range for either anxiety, depression or anxiety and depression, of these 13 patients, the GPs found the CIS information useful for 7 patients (53.85% of patients with elevated HADS scores, 11.67% of the overall patient study population). This was not a high enough percentage of the overall patient study population to warrant the continued inclusion of the CIS for HADS screening of all patients attending the GP surgery, rather the GPs felt it would be better to target more specific patient groups.

One of the groups suggested for routine use of the CIS was patients known to be suffering from anxiety and/or depression; this suggestion is substantiated by the results showing that the GPs found the CIS useful for over half of the patients with clinically significant HADS results and the statistical analysis which found the CIS to be perceived as almost 5 times more useful for those patients with significant HADS scores than for those without (see section 6.5). Depression and anxiety continually feature among the top 10 GP consultation rates (ISD Scotland, 2009), and the estimated daily use of anti-depressants drugs by the population aged 15 to 90 has risen sharply, from 1.9% in 1992/93 to 10.4% in 2009/10 (The Scottish Government, 2011). Research into frequent attendance at primary care has found that mental disorders show a stronger association with frequent consultations (Foster, Jordan, & Croft, 2006). It could be beneficial for GPs to use the CIS regularly for this particular

patient group to aid in assessing their anxiety and/or depression levels over a specified time period. Screening for conditions such as depression are considered to be high burden (Nease & Malouin, 2003), however, by utilising a tool such as the CIS, screening could be largely automated and would not be time-consuming for GP surgery staff.

Whilst the inclusion of the CIS was considered useful for only 21.67% of all patients, the GPs stated that they found it extremely useful and interesting to see the overall rates for anxiety and depression within the study patient population. Anxiety disorders are prevalent among the general population and in general practice, with prevalence rates of between 8 and 14% reported (M. Ansseau, Dierick, Buntinkx, Cnockaert, De Smedt, Van Den Haute, & Vander Mijnsbrugge, 2004; Marc Ansseau, Fischler, Dierick, Mignon, & Leyman, 2005; Heideman, van Rijswijk, van Lin, de Loos, Laurant, Wensing, van de Lisdonk, & Grol, 2005). In this study, 21.67% of patients scored in the clinically significant range for anxiety, this is considerably higher than previous research has found.

Depression is the top reason for GP consultations in Scotland (ISD Scotland, 2009), and is predicted to be ranked second in terms of the world's disabling diseases by the year 2020 (Murray & Lopez, 1997). Depression is experienced by between 8 and 10% of the population in any given year (Mental Health Foundation, 2011). A recent study into the treatment decisions for patients with depression in primary care used HADS to screen patients for depression, and found between 4 and 6% of patients with clinically significant scores (Kendrick, King, Albertella, & Smith, 2005). In the

study conducted as part of this thesis, 10% of patients scored in the clinically significant range for depression, which is slightly higher than expected from current research.

This study does not purport to suggest reasons for this apparent increased incidence of anxiety and depression amongst the study population, rather seeks to assist GPs in the recognition of these trends. However, after discovering these differing levels from current evidence based expectations, the GPs checked back to establish the main reason for the GP visit of those patients with clinically significant anxiety and/or depression scores. It was found that of the 13 patients with elevated scores for anxiety and/or depression, 8 (61.54% of patients with significant HADS results) had some form of chronic condition: a chronic condition is defined by U.S. National Center for Health Statistics as one lasting 3 months or more (National Center for Health Statistics, 2007). Hence, patients with a chronic condition were suggested by the GPs as another target group for which the CIS could prove particularly useful. Although the Fisher Exact Probability Test did not show there to be a significant difference in the usefulness of the CIS for patients with chronic conditions and those with acute conditions, calculating the odds ratio showed the CIS to be 1.66 times more useful for patients with chronic conditions (see section 6.5).

It is known that mental health problems are prevalent in patients with long-term physical problems; with mixed anxiety and depressive disorder (MADD) more strongly associated with several physical conditions than single mental disorders (Scott, Bruffaerts, Tsang, Ormel, Alonso, Angermeyer, Benjet, Bromet, de Girolamo,

de Graaf, Gasquet, Gureje, Haro, He, Kessler, Levinson, Mneimneh, Oakley Browne, Posada-Villa, Stein, Takeshima, & Von Korff, 2007). A study by Katon et al showed that patients with chronic medical illness and co-morbid depression or anxiety reported significantly higher numbers of medical symptoms compared to those with chronic medical illness alone (W. Katon, Lin, & Kroenke, 2007). Indeed, the authors concluded that:

> *"Accurate diagnosis of comorbid depressive and anxiety disorders in patients with chronic medical illness is essential in understanding the cause and in optimizing the management of somatic symptom burden."*

Stordal et al also advocates the importance of the identification and treatment of co-occurring mental disorders, and concurred with Scott et al's findings of MADD being more prevalent than either anxiety or depression alone (Stordal, Bjelland, Dahl, & Mykletun, 2003).

The CIS did prove acceptable to both clinicians and patients, with 100% of GPs and 100% of patients willing to use a CIS again. The GPs all felt that the CIS had great potential to be of use to them as part of the consultation process. As mentioned previously, the GPs suggested specific patient groups for whom the inclusion of the CIS could prove to be particularly beneficial. In addition to those patients known to have existing anxiety and/or depression, and those with a general chronic health issue, asthma, diabetes and hypertension were also mentioned specifically.

Anxiety and depression are frequent in patients with pulmonary hypertension (PH) and have been found to increase as the severity of disease progresses; indeed a

study by Löwe et al found 35% of patients with PH were suffering from mental disorders, with only 24% of these receiving treatment for the mental disorder (Löwe, Gräfe, Ufer, Kroenke, Grünig, Herzog, & Borst, 2004). A simple screening interview, delivered using a CIS, could aid in their recognition and subsequent implementation of appropriate treatment.

Asthma patients appear to have a high co-morbidity of anxiety disorders, with both adult and child/adolescent populations with asthma showing a high prevalence of these disorders (W. J. Katon, Richardson, Lozano, & McCauley, 2004). A co-morbidity of depression with asthma has also been found, with depression having an adverse effect on quality of life (Goldney, Ruffin, Fisher, & Wilson, 2003; Kullowatz, Kanniess, Dahme, Magnussen, & Ritz, 2007). Richardson et al also found this to be true, youths with anxiety or depressive disorders and asthma reported a significantly greater amount of asthma symptoms over a given period than those without anxiety or depressive disorders (Richardson, Lozano, Russo, McCauley, Bush, & Katon, 2006). Not only is there is a close correlation between anxiety and depression, and worsened quality of life in asthma patients, but also between anxiety and depression, and poor asthma control. It has therefore been suggested that the presence of anxiety and/or depression should be investigated in patients with poorly controlled asthma (Di Marco, Verga, Santus, Giovannelli, Busatto, Neri, Girbino, Bonini, & Centanni, 2010). All these findings strongly support the suggestion that routine screening for depression in patients with asthma should be considered in hospital and primary care (Kullowatz et al., 2007).

Patients with diabetes were also highlighted by the GPs as a patient population where the CIS with anxiety and depression screening could prove beneficial. Current research has shown that patients with diabetes have an increased likelihood of suffering from anxiety and/or depression. Collins et al used the HADS screening tool and found that patients with diabetes were almost twice as likely to suffer from anxiety and depression as the general population (Anderson, Freedland, Clouse, & Lustman, 2001; Collins, Corcoran, & Perry, 2009). They also found that patients with depression tended to have poorer glycaemic control and that female gender was associated with higher anxiety scores. Other studies have also found an increased incidence of anxiety disorders in diabetic patients compared to the general population, with a higher prevalence of anxiety disorders in female diabetic patients (Huang, Chiu, Lee, & Wang, 2011); and a significant association between poor glycaemic control and depression was seen in men but not women (Lloyd, Dyer, & Barnett, 2000). Indeed, Lloyd suggests that there is a significant percentage of individuals with diabetes who require psychological support, which might improve glycaemic control and thus overall wellbeing (Lloyd et al., 2000). Not only is there a link between diabetic patients, depression and poor glycaemic control, but strong associations between depressive illness and increased reporting of diabetes symptoms has also been shown (Paschalides, Wearden, Dunkerley, Bundy, Davies, & Dickens, 2004). It has consequently been recommended that the recognition and management of depressive illness should form an important part of high quality diabetes care (Ludman, Katon, Russo, Von Korff, Simon, Ciechanowski, Lin, Bush, Walker, & Young, 2004).

Research by Lin et al was conducted into some of the potential reasons for depression affecting diabetic patients. Major depression was associated with less physical activity, unhealthy diet, and lower adherence to oral hypoglycemic, antihypertensive, and lipid-lowering medications (E. H. B. Lin, Katon, Von Korff, Rutter, Simon, Oliver, Ciechanowski, Ludman, Bush, & Young, 2004). They concluded that:

> *"Further research is needed to evaluate whether integrating depression screening and treatment into comprehensive care of diabetes could enhance self-management, adherence, and patient outcomes."*

The inclusion of the CIS could prove an ideal means of delivering a screening interview for anxiety and/or depression but could additionally be used to gather other information from the patients that they may be less willing to share in a face-to-face interview, such as whether they have adhered to their treatment regime.

The inclusion of the CIS as part of the consultation process was highly acceptable to patients and clinicians alike, with all members of both groups being happy to use a CIS again in the future. Moreover, the patients found the CIS both easy to use (100%) and engaging (96.67%). Hence it can be said that the incorporation of the CIS into the consultation process was considered useful, to a degree, and was found highly acceptable by clinicians as well as patients. In addition, future potential areas of use for the CIS were identified.

This study showed some effect on the communication process between clinician and patient, with the interaction between GP and patient affected in a number of ways.

Specifically, GPs altered the management of 3 patients (5%), they thought the consultation length was increased on 6 occasions (10%) and decreased on 5 occasions (8.33%). Three GPs cited that they had altered the treatment for mood related conditions as a direct result of the information gathered using the CIS. GP comments also demonstrated that the interview transcript helped to initiate discussion of anxiety issues associated with a chronic condition, led to more in-depth discussion of known problems, resulted in a previously un-disclosed problem being shared and was useful in the reassurance of patients with known anxiety and/or depression. 11.67% of patients definitely felt more focussed on issues they wanted to discuss with the GP after having completed the computer interview, with another 68.33% stating that they were “Possibly” more focussed.

These findings, whilst showing some positive effect of the CIS on communication, were not specific enough to make any firm conclusions regarding whether the CIS truly enhanced communication between patient and clinician. Further investigations are required and it would be beneficial to include a post-consultation questionnaire for patients to ascertain whether they perceived a difference in the consultation and communication process after presenting the computer interview transcript. Including a post-consultation questionnaire was not deemed possible in the GP setting, however, would be feasible in a more specific setting, perhaps at a specialist clinic.

All GP surgery staff agreed that running the computer interview on some form of handheld device would be far easier to implement on a long-term basis. There were

several occasions during this study when the author arrived, as arranged, to find that the room designated for the CIS was still occupied or had to change rooms after setting up; this obviously led to delays. This was the main difficulty encountered when conducting the study. Using a tablet-type of device would enable the patients to complete the interview in relative privacy but without taking up a separate treatment room.

Several limitations in the design of the study should be acknowledged. First, the selection process of GP was not randomised and could have included GPs particularly interested in patients with anxiety and/or depression. Therefore, the sample of patients could eventually have been biased. Only one GP practice was involved, although the study was run across two locations, and that the patients were partially self-selecting. More female patients were included in the study population than males (females, n=39, 65% v males, n=21, 35%); this may have increased the incidence of mood related disorders in this study as current research has shown these conditions to be more prevalent in females than males. The findings were largely qualitative and descriptive rather than quantitative so only generalised observations can be made, however this did enable more detailed observations to be made and facilitated the possibility of recording comments from patients and GPs alike. Although 6 GPs were involved in this study, each GP saw only small numbers of patients (n=7-16), hence limiting the ability to expand the findings. The technology, and the use of it, has progressed greatly since the study was initiated, therefore the potential benefits of using CIS may not be truly reflected. A

particular strength of the study was the inclusion of the HADS screening tool, which is widely trialled in a variety of settings, including a GP setting.

6.7 Conclusion

The use of a CIS within a GP surgery was trialled and shown to be partially efficient and effective in enhancing patient clinician communication. In terms of efficiency, the HADS scores were calculated automatically and this was valued by the GPs; however, it would have been more efficient to deliver the computer interview on a smaller device that did not require a separate room. In terms of effectiveness, the GPs indicated that the inclusion of the CIS did result in more occasions when mood disorders were discussed. It highlighted potential, more specific, areas in which the CIS could enhance current practice by estimating anxiety and depression levels in patients. There is some need to improve the technical delivery of the CIS but recent advances in handheld devices should make this readily possible. Future studies may include using a CIS in routine clinics for diabetes, asthma and mood related disorders, thus enabling their HADS scores to be tracked throughout treatment. The greatest potential for use of the CIS was suggested by the GPs to be a more specialised setting; hence the next stage of this thesis is to further investigate this. A chiropractic clinic was selected as, not only was it an appropriate setting for inclusion of the CIS and the anxiety and depression screening, but it also provided the opportunity to determine if the inclusion of the CIS could be shown to enhance communication between patient and chiropractor. Additionally, the CIS was to be used with patients who had been seen by the chiropractor on at least 6 occasions

and whose condition was considered to be chronic. Thus it was hoped to further current research into the possibilities of identifying anxiety and/or depression in patients with a chronic condition. Another novel aspect of the research was to investigate the use of computer interviewing when clinician and patient have already established some degree of rapport and relationship. The details are reported in Chapter 7.

7 Computer Interviewing within in a Chiropractic Clinic

7.1 Introduction

This stage of the research focuses on the implementation of a CIS within a chiropractic clinic. As detailed in Chapter 1, Background, the reasons for trialling a CIS in the chiropractic clinic setting are that using the CIS as part of the periodic patient reassessment process may: enhance communication between patient and chiropractor, enable chiropractors to identify issues that need to be addressed instantly (by means of a flagging system on the interview transcript), enable chiropractors to see trends within their patient population, prove an efficient means of recording and providing evidence of periodic patient reassessment.

Periodic patient reassessment is an important part of any on-going treatment plan and is considered an essential aspect of patient management (Chang, 2009). It was decided to see if it would be possible to use a CIS to enhance this process as it is novel to investigate the use of a CIS in a setting where a relationship and trust has already been established between clinician and patient.

The inclusion of the HADS screening questionnaire within the CIS for this patient population was appropriate as a contribution of psychosocial factors in spinal problems has been highlighted by Waddell (Waddell & Main, 1988). Including HADS into the regular chiropractic patient assessment could provide a simple method of screening psychosocial factors.

Incorporating the CIS into the patient reassessment process may help to determine differences in expectations of patient and clinician, to clarify any misunderstandings, for example, exactly what does or does not count as “exercise” and to highlight any areas of concern that the patient may have. The patient may be reticent about raising concerns or asking questions when they are in a face-to-face situation, or may be embarrassed that they have difficulty in undertaking a particular exercise; the non-judgemental nature of the computer provides an ideal mechanism for identifying these problems. As mentioned above, it is novel to study the use of a computer interviewing system in this type of setting, where a relationship has already been built up over a number of treatment sessions; will the computer interviewing system prove beneficial and enhance the patient-clinician communication during the treatment session and periodic patient reassessment process?

There were a number of key questions to be answered during this study.

1. Can the computer interviewing system be shown to help identify patients with anxiety or depression in a private chiropractic clinic?
2. Can the CIS be shown to enhance the communication process between chiropractors and their patients?
3. May the CIS be effectively and efficiently used as part of the periodic patient reassessment process?
4. Can the CIS be shown to highlight any unexpected trends in anxiety and/or depression levels in the patient population?

The first question could be answered by studying the individual results of the HADS screening interview; the second and third questions could be answered by analysing the opinions of the patients and chiropractors who were involved in the study through a series of questionnaires and interviews which sought to explore issues such as ease of use and acceptability; if new issues were raised or revealed due to use of the CIS; if patient management was altered due to information arising from the CIS. The fourth question may be judged against the perceived clinical expectations of the chiropractors using data gathered from the CIS, especially the HADS scores.

7.2 Methods

A cross-sectional study was carried out, which is a recognised observational method, whereby the CIS was used to augment the usual patient reassessment routine in a chiropractic clinic (Mann, 2003). Cross-sectional studies are a good means to test prevalence, hence this was an appropriate method to determine prevalence of anxiety and/or depression amongst the study populations (Mann, 2003). An earlier study that was conducted in a GP practice, using a very similar format, was approved by the Fife Local Research Ethics Committee. This study was discussed in detail by all chiropractors within the Alba Clinic and it was agreed that as the protocol was very similar to the GP study, and that all participants would be seen by a chiropractor after using the computer interview, that it would be ethically sound to conduct the study. Both the GP and chiropractic studies were approved by the Ethics Committee of the School of Computing, University of Dundee.

A sample size calculation was carried out. As this study would largely involve non-parametric testing it was not appropriate to make the restrictive assumptions concerning shape or size of the sampled population. The decision on sample size was based on including the greatest numbers possible, given the numbers of patients attending the chiropractic clinic and the duration of the study. The formula used was based on "normal approximation methods" (Howell, 2002). Based on the study conducted in the GP surgery, which included patients with acute conditions as well as chronic conditions, a "best guess" of expected percentage was made at the CIS being useful for 50% of patients.

The desired width of confidence of 95% and confidence interval 30% (i.e. +/- 15%, or 35% to 65%): $n = 15.4 * 0.50 * (0.50)/0.30^2 = 43$

To allow for an 80% response rate, a total of 53 patients required to be targeted. As the initial study included 60 patients, it was decided to target 60 patients rather than the required 53 as this would enable some discursive comparisons to be made between the two study populations, whilst being aware of the limitations of these comparisons due to unmatched patient populations and differing environments.

A CIS was developed using a chiropractic patient reassessment questionnaire which consisted of 15 questions that had been drawn up by the chiropractors: 4 questions about Expectation/Satisfaction, 2 questions about Progress, 5 questions about Education and 4 questions about General Health, were used to help re-evaluate patients (Appendix 9: Chiropractic Clinic Computer Interviewing System Questions).

It was also decided to include the well trialled HADS questionnaire within the reassessment questions, as anxiety and depression have been reported to be an underlying aspect of many chronic conditions (Fishbain, Cutler, Rosomoff, & Rosomoff, 1997; McWilliams, Cox, & Enns, 2003; Scott et al., 2007). Additionally, feedback questions regarding the usability and acceptability of the CIS were included. All of the aforementioned questions used a Likert scale, thus enabling non-parametric calculations to be carried out using the gathered data.

Patients, who had seen the chiropractors for at least 6 previous visits, were over 18 years of age and who were willing to come 15 minutes early for their appointment, were considered eligible for inclusion within the study. A total of 60 patients were included in the study.

All three chiropractors working at the chiropractic clinic were involved in the study. The study was conducted over a 2-month period, with between two and ten patients completing the computer interview during each session that it was used for periodic patient reassessment. The chiropractors completed a short questionnaire after the first ten sessions in which the CIS was used in order to establish the feasibility of continuing using the CIS for the entire cohort of 60 patients.

After completion of the sessions using the CIS, a focus group was conducted with the chiropractors to gather their opinions regarding the interview analysis interface. This was an organised discussion with the chiropractors, the analysis of which enabled a conformity of view to be generated (Bertrand, Brown, & Ward, 1992; Sim, 1998).

On arrival at the clinic, the patients were presented with the Patient Information Sheet and Consent Form by the clinic receptionists, who also answered any questions about the study, showed the patients to the room where the CIS was set up and ensured that the patients were happy to proceed.

After completing the CIS, the patients took their interview transcript with them and returned to the waiting area. The patients presented their interview transcripts to the chiropractor and these formed a focal point for the discussion during the treatment session, with answers requiring immediate attention highlighted using asterisks. An example of the transcript, complete with answer flagging, is shown below.

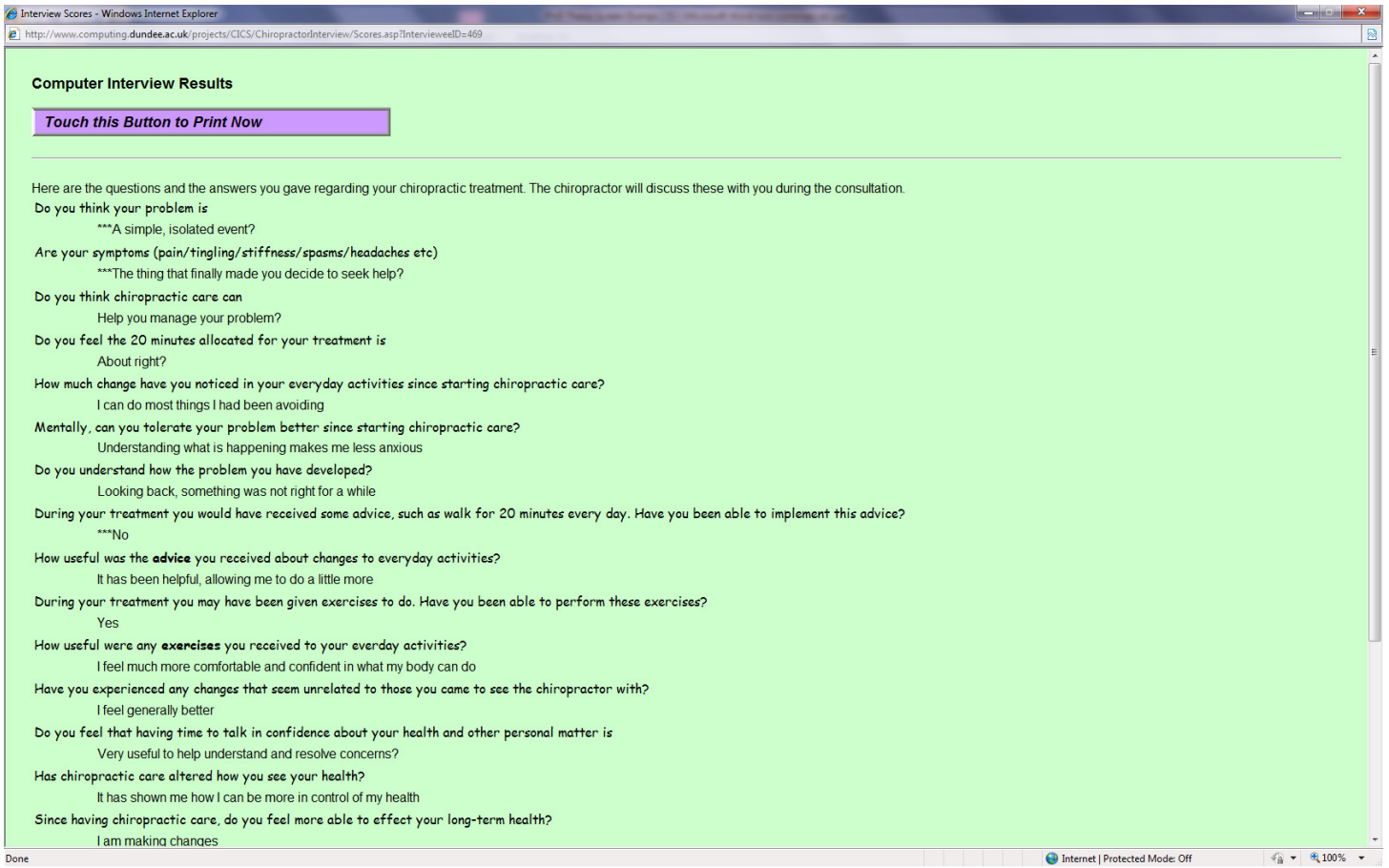

Figure 11: Screenshot of Computer Interview Results/Transcript

Following the treatment session, the patients were asked to complete a short questionnaire regarding whether they felt that the inclusion of the pre-consultation computer interview had affected their treatment session in any way.

The chiropractors completed a simple patient record sheet, with a tabular layout, during the course of the CIS session to provide some feedback for each individual patient as to the perceived benefits, or not, of including the CIS.

7.3 CIS Design for use in a Chiropractic Clinic

7.3.1 Computer System

The computer interview was delivered using a large touch screen interface as this has been found to be an acceptable and usable means of interview delivery (Edwards et al., 2007; Larsson, 2006; Wilkie, Judge, Berry, Dell, Zong, & Gilespie, 2003). The laptop running the interview was positioned out of view of the patients. The patients moved through the interview by touching different options or answers on the screen with a finger. This meant that the system was simple to use and the patients did not require any assistance to complete the interview but did limit the type of questions to multiple-choice or check-boxes only (Hands, Peiris, & Gregor, 2001; Nielsen, 1993; Preece et al., 2003). A large, readable font was used and the answers could be easily selected by touching either the answer text or the answer radio button or check box.

7.3.2 Questionnaire/Interview

The chiropractic patient reassessment questionnaire consisted of 15 questions; 4 questions about Expectation/Satisfaction, 2 questions about Improvement, 5 questions about Education and 4 questions about General Health (Appendix 9: Chiropractic Clinic Computer Interviewing System Questions). In total the patients answered 35 questions, the 15 questions specified above, 14 questions in the HADS interview and the remaining 6 questions gathered the patients' opinions regarding the CIS.

7.3.3 Transcript

The chiropractors requested a transcript containing the HADS scores and full details of all sections of the patient reassessment questionnaire. On initial trial it was decided that this was a considerable amount of information to rapidly assimilate, therefore, an answer flagging system was introduced. The three chiropractors reviewed the questionnaire and decided which answers would need to be immediately addressed clinically, and these were incorporated into the CIS. Various flagging systems were trialled, but in the end, it was decided to insert three asterisks before the answer to be highlighted as this stood out clearly to the chiropractor but was not considered obtrusive to the patient. An example of how answer flagging was used is given below, also see Figure 11:

Mentally, can you tolerate your problem better since starting chiropractic care?

****Still worried, I don't understand what is happening*

This answer requires the attention of the chiropractor to address the patient's worries.

7.4 Results

7.4.1 Chiropractors

The chiropractors completed a brief questionnaire at the end of the first ten sessions in which the CIS was used (Appendix 10: Chiropractic Clinic Record Sheet and Chiropractor Questionnaires) to find out if and how the inclusion of the CIS and resulting transcript had affected the treatment session. Thus it was possible to establish an initial impression of the successfulness of the inclusion of the CIS in the periodic patient reassessment process.

The results of these initial questionnaires are given below:

Did the pre-consultation computer interview alter the style of your treatment sessions in any way?

The chiropractors answered "Yes" for 7 of the CIS sessions ("No" 3). Examples included discussion of anxiety and how this might affect the chiropractic condition, how to manage anxiety, clarification of the aims of the chiropractor and patient, and discussion of degenerative spinal conditions. So the initial impression suggested that the CIS could prove highly beneficial to the chiropractors and could directly cause them to alter their treatment session.

Did the pre-consultation computer interview highlight any communication difficulties?

The chiropractors answered “Yes” for 7 of the clinics (“No” 3). Examples included differences between patient’s understanding of pain and its relevance to the treatment, lack of understanding of the aims of the treatment and clarification required of the exercises to be undertaken. Again, this result suggested that the CIS could indeed enhance the communication process between the chiropractors and their patients. The chiropractors felt that the CIS helped to clarify queries raised by their patients and enabled them to elaborate on areas of uncertainty.

Did you deal with any extra issues today due to the computer interview?

The chiropractors answered “Yes” for 5 of the clinics (“No” 5). Examples included aiming to improve patient functionality, anxiety, and more detailed explanation of exercises and lifestyle advice to be followed by the patient. The CIS was seen to aid the communication process by eliciting more issues from the patient that they felt the need to discuss with their chiropractor.

Are there any other areas/issues that you feel would be useful to screen for using standard screening tools?

Suggestions included cerebrovertebral accident (CVA), lifestyle changes, and any chronic conditions. These suggestions provide a basis for investigating more avenues for the use of the CIS in the chiropractic setting.

Which particular patients do you think would be most likely to benefit from a pre-consultation interview using a computer?

Suggestions included patients with chronic conditions, patients suspected of suffering from anxiety and/or depression. The suggestions given here are not surprising and serve to confirm that it is probably beneficial to target those with chronic conditions, as is the case in this study.

How willing would you be to use a pre-consultation computer interview in the future?

Answers options were on a scale of 1 to 4, with 1 (very willing) to 4 (very unwilling)

This chiropractors selected 1 twice and 2 eight times, with no selections of 3 or 4. This was a positive response and indicated that it was feasible to continue with the study as the chiropractors were positive about the use of the CIS.

How do you rate the usefulness of computer decision-support systems where data input is done directly by the patient?

Answers options were on a scale of 1 to 4, with 1 (very useful) to 4 (not at all useful)

This chiropractors selected 1 twice and 2 eight times, with no selections of 3 or 4. This again shows a positive response from the chiropractors as to the use of the CIS and the possibilities of extending the use of the CIS into other areas beyond periodic patient reassessment.

Are there any changes that you would like to see?

Suggestions included making the CIS more transportable, making the computer interview quicker/shorter, inclusion of an explanation of the restricted choice of answers in the HADS section, extending the range of answers that could be selected

(all had a choice of 4 or less) and possibly omit the HADS interview. There was only one suggestion to omit the HADS interview and this came from the chiropractor who was not surprised by any of their patients' HADS results; however, the HADS results were found to be very useful for the other 2 chiropractors so a more extensive study, involving additional chiropractors would be required before any final decision on the inclusion of HADS could be made. The existing CIS was bulky to move and was time-consuming to set up due to the heavy touch screen monitor, adapting the CIS to be run on a hand-held device would solve this large usability issue. Having a shorter computer interview would be helpful in that the patients would not have to arrive so early for their appointment time; however, it is necessary to get a balance between a very rapid interview and one that gathers all the necessary information from the patients.

The chiropractors were also asked to complete a simple, single line in a record table for each patient (60 patients in total) that had used the CIS during their periodic reassessment. These provided detailed results which are shown below.

	Combined Chiropractor Responses			
Did CIS highlight communication difficulties?	**Y**		**N**	
	8 (13.33%)		52 (86.67%)	
Useful aid to consultation using 1 (very useful) to 4 (not useful)	**1**	**2**	**3**	**4**
	5 (8.33%)	46 (76.67%)	7 (11.67%)	3 (5%)
Did CIS cause you to alter management?	**Y**		**N**	
	12 (20%)		48 (80%)	
Were you surprised by the HADS results?	**Y**		**N**	
	14 (23.33%)		46 (76.67%)	
	H	**L**		
	7 (11.67%)	7 (11.67%)		

Table 17: Combined Chiropractor Responses from the Record Sheets

The chiropractors altered their style/management 12 times (20%), communication issues were highlighted 8 times (13.33%); the chiropractors were surprised by the HADS results on 14 occasions (23.33%). They rated the interview transcript as useful (1 or 2) for 51 of the patients (85%). These finding clearly show that the inclusion of the CIS was useful and that it did help to facilitate the communication process between chiropractor and patient. The fact that the chiropractors were surprised by the HADS results, particularly in those cases where the results were higher than expected (11.67%), showed that the CIS could help to identify patients where it could be beneficial to address anxiety or depression issues. The fact that the chiropractors found the interview transcript useful for such a high percentage of

patients (85%) suggests that it can be used very effectively as part of the periodic patient reassessment process.

These results were then further analysed for the three different chiropractors involved.

	Chiropractor 1 (30 patients)				**Chiropractor 2 (15 patients)**				**Chiropractor 3 (15 patients)**			
Did CIS highlight communication difficulties?	**Y**		**N**		**Y**		**N**		**Y**		**N**	
	3 (10%)		27 (90%)		1 (6.67%)		14 (93.33%)		4 (26.67%)		11 (73.33%)	
Useful aid to consultation using 1 (very useful) to 4 (not useful)	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
	3 (10%)	20 (66.67%)	5 (16.67%)	2 (6.67%)	1 (6.67%)	14 (93.33%)	0 (0%)	0 (0%)	2 (13.33%)	11 (73.33%)	1 (6.67%)	1 (6.67%)
Did CIS cause you to alter management?	**Y**		**N**		**Y**		**N**		**Y**		**N**	
	8 (26.67%)		22 (73.33%)		0 (0%)		15 (100%)		4 (26.67%)		11 (73.33%)	
Were you surprised by the HADS results?	**Y**		**N**		**Y**		**N**		**Y**		**N**	
	9 (30%)		21 (70%)		0 (0%)		15 (100%)		5 (33.33%)		10 (66.67%)	
	H	**L**			**H**	**L**			**H**	**L**		
	5 (16.67%)	4 (13.33%)			0	0			2 (13.33%)	3 (20%)		

Table 18: Individual Chiropractor Responses from the Record Sheets

The three chiropractors saw differing numbers of patients:

	Male Patients (n=30, 50%)	**Female Patients (n=30, 50%)**	**Total Patients (n=60)**
Chiropractor 1	17	13	30
Chiropractor 2	4	11	15
Chiropractor 3	9	6	15

Table 19: Number of Patients seen by the Individual Chiropractors

A total of 60 patients were included in the study population.

Chiropractor 1 – 30 patients reassessed using CIS

Chiropractor 1 found that the inclusion of the CIS helped to highlight communication difficulties with 10% of their patients, they rated it as useful (options 1 and 2 from the rating scale) for 76.67% of patients and they altered their management with 26.67% of patients. They were surprised by the HADS results for 30% of their patients, with 16.67% of patients scoring higher than expected and 13.33% of patients scoring lower.

Chiropractor 2 – 15 patients reassessed using CIS

Chiropractor 2 found that the inclusion of the CIS helped to highlight communication difficulties with 6.67% of their patients, they rated it as useful (options 1 and 2 from the rating scale) for 100% of patients and they did not alter their management as a result of using the CIS for any of their patients. They also weren't surprised by the HADS results for any of their patients.

Chiropractor 3 – 15 patients reassessed using CIS

Chiropractor 3 found that the inclusion of the CIS helped to highlight communication difficulties with 26.67% of their patients, they rated it as useful (options 1 and 2 from the rating scale) for 86.67% of patients and they altered their management with 26.67% of patients. They were surprised by the HADS results for 33.33% of their patients, with 13.33% of patients scoring higher than expected and 20% of patients scoring lower.

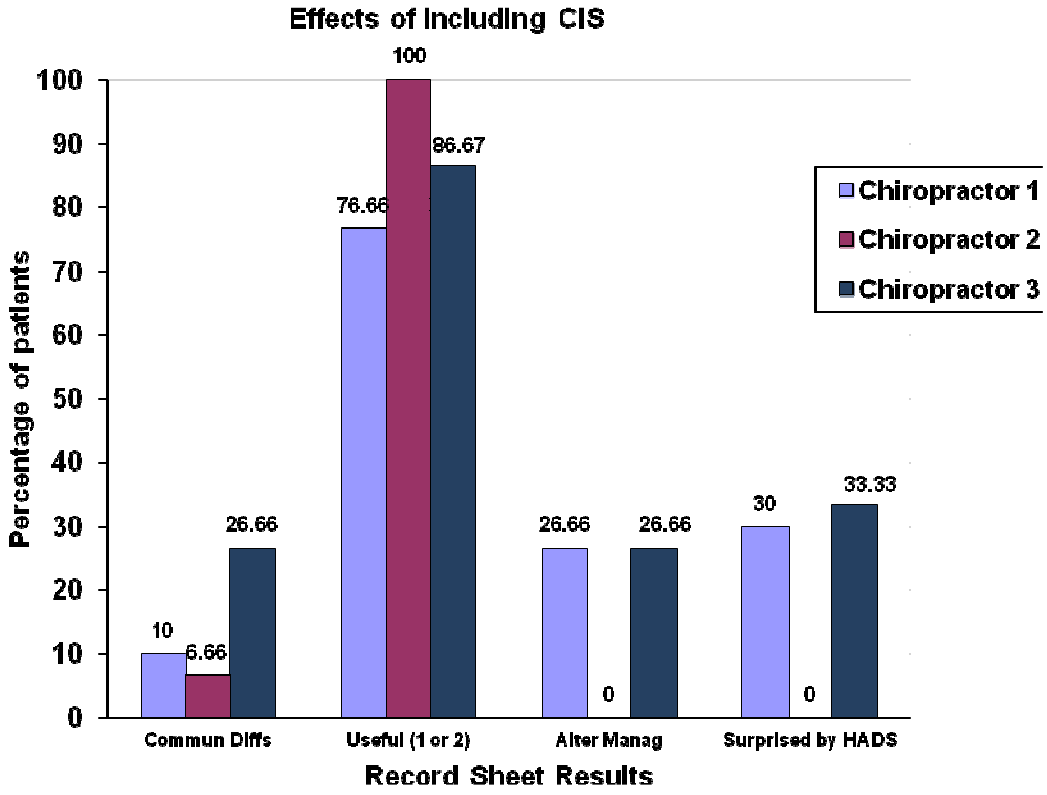

Figure 12: Chiropractors' Responses to use of the CIS

This shows that there was considerable variation between the experiences and opinions of the three chiropractors. Interestingly, chiropractor 2, who found that the information gained from using the CIS affected the communication with the patient the least, also ranked the usefulness of the CIS as the highest. When asked later in a

plenary session, this chiropractor was particularly impressed with the effectiveness of the CIS for gathering, recording and analysing the information from the periodic patient reassessment interview and this is what they based their usefulness scoring on.

Quote:

> *"It was reassuring to discover that I am doing a good job for my patients."* Chiropractor 2

It was found that the CIS helped to identify communication difficulties with 13.33% of patients, ranging from 6.66% to 26.66% for the different chiropractors. Details of communication difficulties included:

- Patient unsure as to exactly what is counted as exercise
- Patient experienced tremor when reaching to CIS touch screen, this was also an issue in day-to-day life which had previously not been mentioned
- Clarification of patient and chiropractor aims for treatment
- Patient disclosed issue of pain when carrying out certain movements

The inclusion of the CIS enhanced the communication in two main ways, firstly it helped identify new issues that the patient had not previously disclosed, for example pain experienced when reaching to a high cupboard; and it also highlighted areas where the patient required clarification or further explanation of, for example, a particular exercise; it also helped to identify where there was a mismatch between

the aims of the chiropractor and the aims of the patient, for example an increase in mobility compared to a reduction in pain.

The chiropractors altered their management of the patient in 20% of cases, ranging from 0 to 26.66% for the different chiropractors. The reasons for altering management included:

- Reemphasis of treatment aims
- Discussion about anxiety and how it affects chiropractic treatment
- Detailed explanation of exercises to be carried out
- Discussion of patient's expectations and aims
- Further discussion of degenerative spinal problems and patient's prognosis
- Change of advice emphasis
- More discussion on improving function

The inclusion of the CIS helped to show where the patient required clarification and more detail on various issues, such as a more detailed explanation of the exercises to be carried out. Through the ability of the CIS to rapidly identify patients suffering from anxiety or depression, it was possible for the chiropractors to address these issues during the treatment session. It proved very beneficial to discuss issues of anxiety with certain patients and was felt by the chiropractors concerned to enhance the communication process and thereby the treatment session.

The chiropractors were surprised by the HADS results for 23.33% of patients (11.67% higher than expected and 11.67% lower than expected); again there was considerable variation between the chiropractors with the range being 0 to 33.33%. Whilst it was reassuring to see where the HADS scores were lower than expected; the treatment session was only altered to include further discussion regarding anxiety or depression where the results were higher than expected.

It was possible for the chiropractors to not only use the HADS results to address issues during the treatment session, but for them to determine whether the study patient population followed the general trend as regards to prevalence of anxiety and/or depression.

The HADS scoring is based on a range:

Score	**Classification**	**Colour**
0-7	Normal	
8-10	Mild	
11-15	Moderate	
16-21	Severe	

Gender	**Age**	**HADS Score A**	**HADS Score D**	**Chiropractor Number**	**Surprised by Result**
F	21-30	10	8	3	
M	31-40	8	2	3	
M	31-40	9	8	2	
F	21-30	5	2	2	
F	21-30	3	1	2	
F	51-60	9	6	3	
F	31-40	3	6	3	
M	41-50	4	1	3	

F	61-70	1	0	1	
F	51-60	8	2	1	
F	61-70	0	3	1	Y - LOW
M	41-50	1	3	3	
M	31-40	1	0	3	Y - LOW
M	61-70	5	4	1	Y - LOW
M	31-40	5	10	1	Y - HIGH
F	41-50	4	2	1	
M	61-70	6	2	1	
M	61-70	5	2	1	
M	51-60	1	1	1	
F	61-70	7	3	1	Y - HIGH
F	31-40	7	2	1	
M	31-40	7	5	1	Y - HIGH
M	41-50	11	6	1	
F	41-50	5	2	3	
F	61-70	3	4	2	
F	51-60	3	9	2	
M	61-70	6	6	3	
F	51-60	11	5	2	
F	41-50	3	4	2	
M	41-50	7	3	2	
F	61-70	11	0	1	
M	61-70	2	0	2	
M	41-50	5	2	2	
F	41-50	9	3	2	
F	51-60	13	7	3	Y - HIGH
F	51-60	4	1	3	Y - LOW
F	51-60	10	3	2	
F	51-60	10	3	1	
M	41-50	1	0	1	Y - LOW
M	61-70	0	1	1	
F	61-70	2	2	1	

M	41-50	4	2	1	
F	>70	4	5	2	
F	61-70	7	0	1	
F	61-70	19	3	1	Y - HIGH
M	41-50	0	0	3	Y - LOW
M	41-50	4	2	1	
M	61-70	12	11	1	Y - HIGH
F	51-60	8	6	1	
M	>70	3	1	3	
M	21-30	7	4	3	
M	61-70	10	1	3	Y - HIGH
F	51-60	7	2	2	
F	51-60	13	7	2	
M	41-50	9	5	1	
M	31-40	3	0	1	
F	51-60	3	0	1	Y - LOW
M	61-70	1	0	1	
M	61-70	2	3	1	
M	41-50	5	2	1	

Table 20: Details of HADS Results for each Patient using the CIS

It can be seen from the table that only one patient scored in the severe range for anxiety, six in the moderate range and 11 in the mild range. So the overall percentage of patients with clinically significant anxiety was 11.67% (those scoring in the moderate or severe range).

The scores for depression were considerably lower, with no patients in the severe range, only one patient in the moderate range and four patients in the mild range. So the overall percentage of patients with clinically significant depression was 1.67% (those scoring in the moderate or severe range). In the case of depression, the

inclusion of the HADS element within the CIS showed that the trends in this patient population did not reflect current evidence based expectations of being elevated depression scores compared to the general population.

Das-Munchi, et al, investigated the significance of mixed anxiety and depressive disorder (MADD) and discovered that the 1-month prevalence of MADD was 8.8% and that mixed presentation of anxiety and depression may be the norm (Das-Munchi, Goldberg, Bebbington, Bhurgra, Brugha, Dewey, Jenkins, Stewart, & Prince, 2008). In this study, only 5% of patients scored out with the normal range for both anxiety and depression, with 1.67% in the moderate range and the remainder in the mild range, with no patients in the severe range.

The chiropractors used the interview analysis interface to view the overall responses of their patients. This gave the chiropractors an instant overview of the patients' responses to the treatment they were receiving and whether it met their needs and expectations. The responses of the chiropractors to the interview analysis were positive; they liked the graphical presentation of the results and found it useful to see the percentage of interviewees that selected each answer choice, as shown below. The chiropractors mentioned that the interview analysis interface could form a useful part of a clinic audit, proving that periodic patient reassessments were being carried out; documentation could be added to demonstrate that the results of the reassessments were reacted to accordingly. It was noted that it may be useful to be able to view patient responses for individual chiropractors.

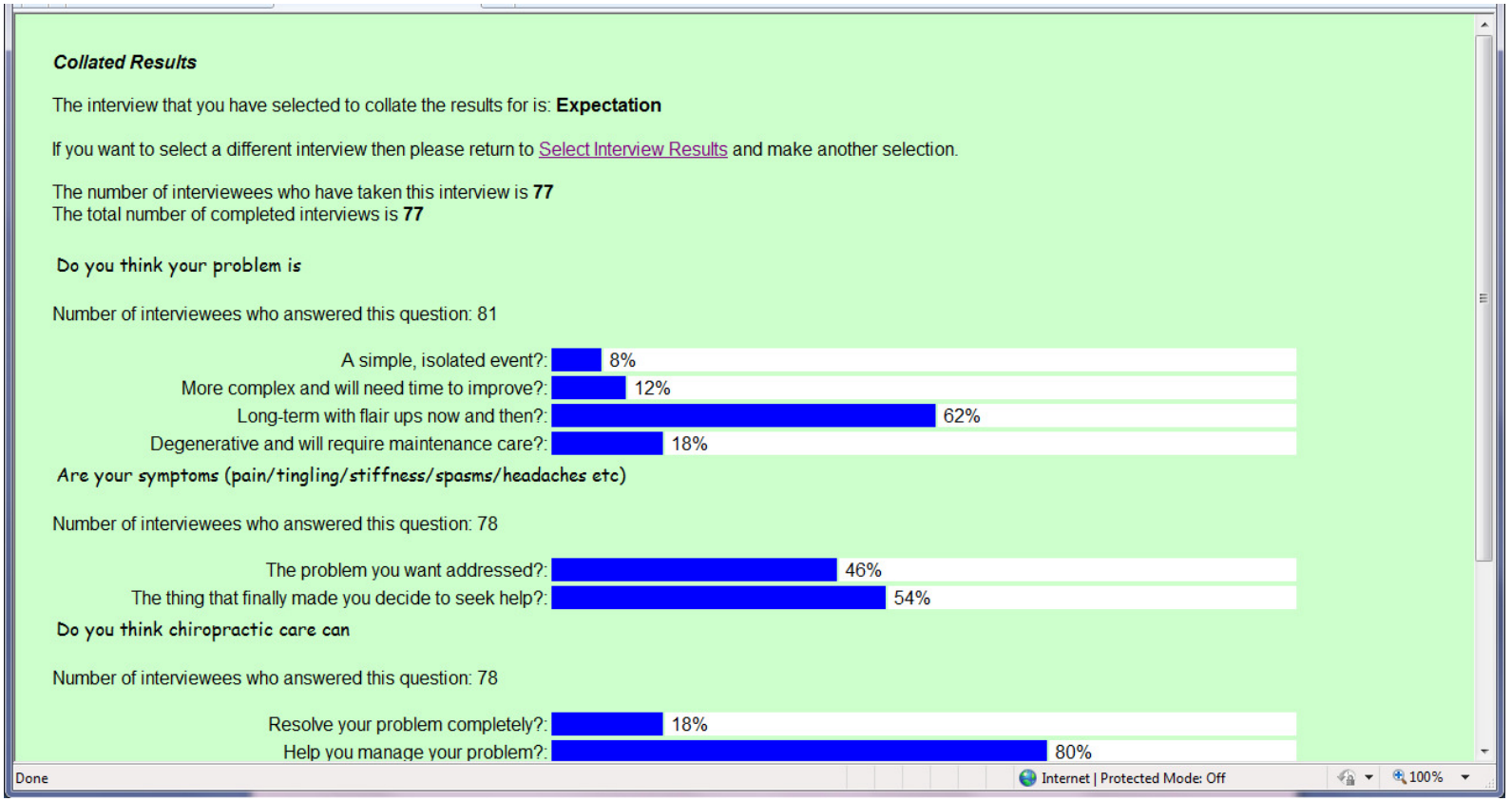

Figure 13: Screenshot of Chiropractor Interview Analysis

7.4.2 Patients

The patients completed a short, 6-question, questionnaire (Appendix 11: Chiropractic Clinic Patient Sheets and Post-Consultation Questionnaire) after their treatment session to determine if they thought that the inclusion of the CIS had been beneficial. The answers were given on a 5-point scale from 1 (strongly agree) to 5 (strongly disagree). The detailed results of which are presented below.

1. I think that the information I gave during the computer interview was useful to the treatment session.

As might be expected, the most frequent response was for the middle option of 3 (38.33%), however, 50% of the patients answered positively (1 or 2 on the rating scale) indicating that these patients thought that the use of the CIS was beneficial to the treatment session.

> *"The computer interview was a good starting point for more in-depth discussion with the chiropractor."* Patient

This shows that the CIS can indeed enhance the communication process between the chiropractors and their patients.

2. I think that the computer interview printout contained information that I have never previously discussed with the chiropractor.

The patient responses were fairly evenly spread for this question, with 41.66% responding positively (1 or 2 on the rating scale) and slightly more (43.33%) responding negatively (4 or 5 on the rating scale). This still shows that for over 40%

of patients the use of the CIS directly led to them disclosing new information to the chiropractor; thus it enhanced the communication process. Indeed one of the patients found difficulty in reaching to use the touch-screen so the chiropractor was able to address this during the subsequent treatment session.

3. I think that the use of the computer interview increased the number of issues discussed during the treatment session.

As before, the largest number of patients selected the middle answer option, with one third of patients responding positively (1 or 2 on the rating scale) that the use of the CIS had led to more issues being discussed during the treatment session. By discussing a greater number of issues, it can be said that the use of the CIS was shown to enhance the communication process between patient and chiropractor. On some occasions the additional issues were related to elevated HADS scores whereby advice regarding management of anxiety was given.

4. I think that the use of the computer interview helped me to be more prepared for the treatment session.

Again, the highest proportion of patients selected the middle option, with exactly one third of patients responding positively (1 or 2 on the rating scale) that they felt more prepared for the treatment session having already used the CIS. These patients felt more focussed on how they had been managing their day to day life between treatment sessions and on whether they had experienced issues or problems that they might otherwise have omitted to mention.

5. I think that the use of the computer interview helped me to think of questions to ask during the treatment session.

As before, most patients selected the middle option, but 38.33% of patients responded positively (1 or 2 on the rating scale). If the use of the CIS helped patients to think of questions to ask the chiropractor then this shows that it enhanced the communication process. By asking questions and entering into dialogue, the level of communication between patient and chiropractor was increased. Some of the questions raised by the patients included asking about specific exercises; what aspects of their daily life count as exercise; what amount of improvement in function they could expect. This also shows the CIS to be an effective part of the periodic patient reassessment process if over one third of patients felt that its use helped them to think of questions to ask.

6. I am likely to agree to use a computer interview in the future.

The answers given for this question deviated from the majority selecting the middle option; exactly half of the patients selected the top option, that they would be very happy to use a computer interview in the future, and 71.66% responded positively (1 or 2 on the rating scale).

Whilst the majority of patients responded favourably to the inclusion of the CIS, much can be learnt from those who were not positive. Of those responding negatively, which was 10% of patients, the reasons stated included that they didn't like the wording of the HADS section, they felt it wasn't relevant to them, that the answer choices were restrictive and that they felt it took too long. The wording of

the HADS obviously cannot be changed but a better explanation could be given prior to this section of the computer interview. The computer interview was designed to ask all patients the same questions as this was a requirement of the chiropractors' for the periodic patient reassessment, however, the existing CIS is designed to alter the questions presented based on interviewee responses throughout the interview, this could perhaps be introduced into the interview structure for use in the chiropractic clinic.

The time taken to complete the computer interview was recorded by the CIS and ranged from 3 minutes and 16 seconds to 14 minutes and 54 seconds, with the average time taken being 8 minutes and 35 seconds. By keeping the interview duration to less than 15 minutes, it should be feasible to include it within the chiropractic setting on a more routine basis. Whilst the computer interview could be shortened by removing the HADS section, it is felt that the range of times taken to complete the computer interview in this study is acceptable. The actual times taken to complete the HADS section of the computer interview ranged from 1 minute and 11 seconds to 4 minutes and 56 seconds, with the average time taken being 2 minutes and 34 seconds. It has been shown that having a question set of less than 60 questions should be acceptable to the majority of interviewees (Hands et al., 2001; Peiris et al., 2000).

The results of the patient responses are presented graphically below, with the answer options chosen for each question given.

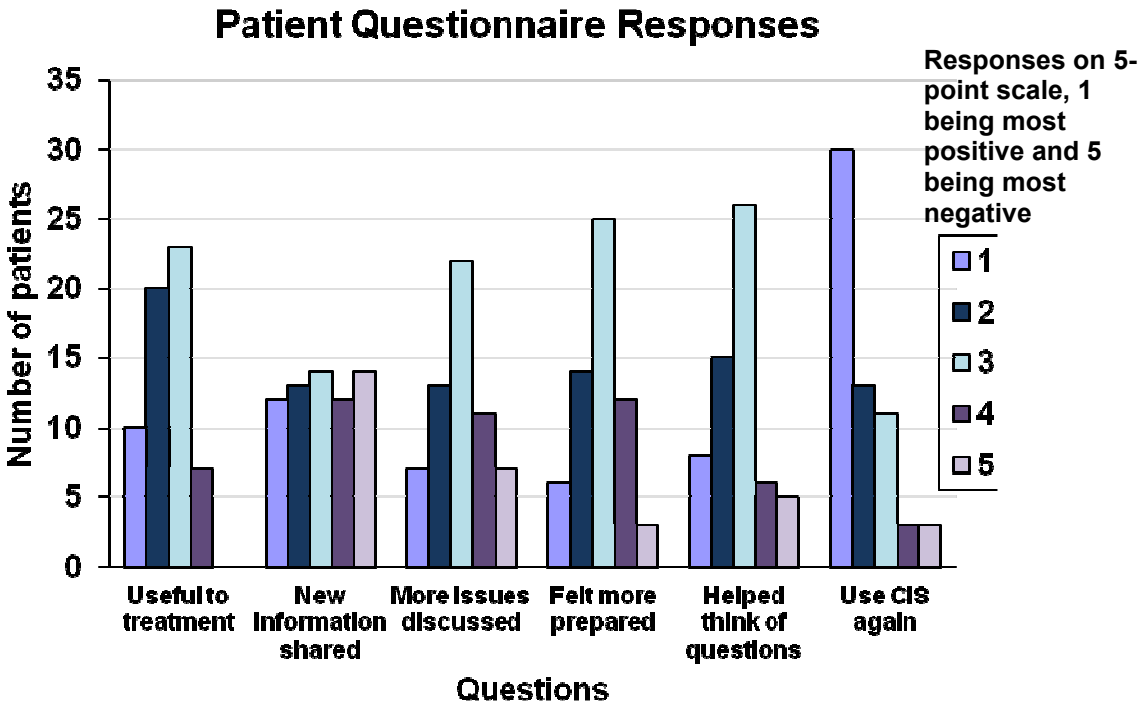

Figure 14: Analysis of Patient Questionnaire Responses

This graphical format shows the preferred answer choice of the middle option for all questions other than question 2, regarding new information, where there is an extremely even distribution across all the answer options, and for question 6 regarding future use of the CIS, where there is an extremely positive response from the patients.

If the answers are analysed looking at the percentage of patients who responded positively, giving an answer of 1 or 2 on the rating scale, the following results can be shown.

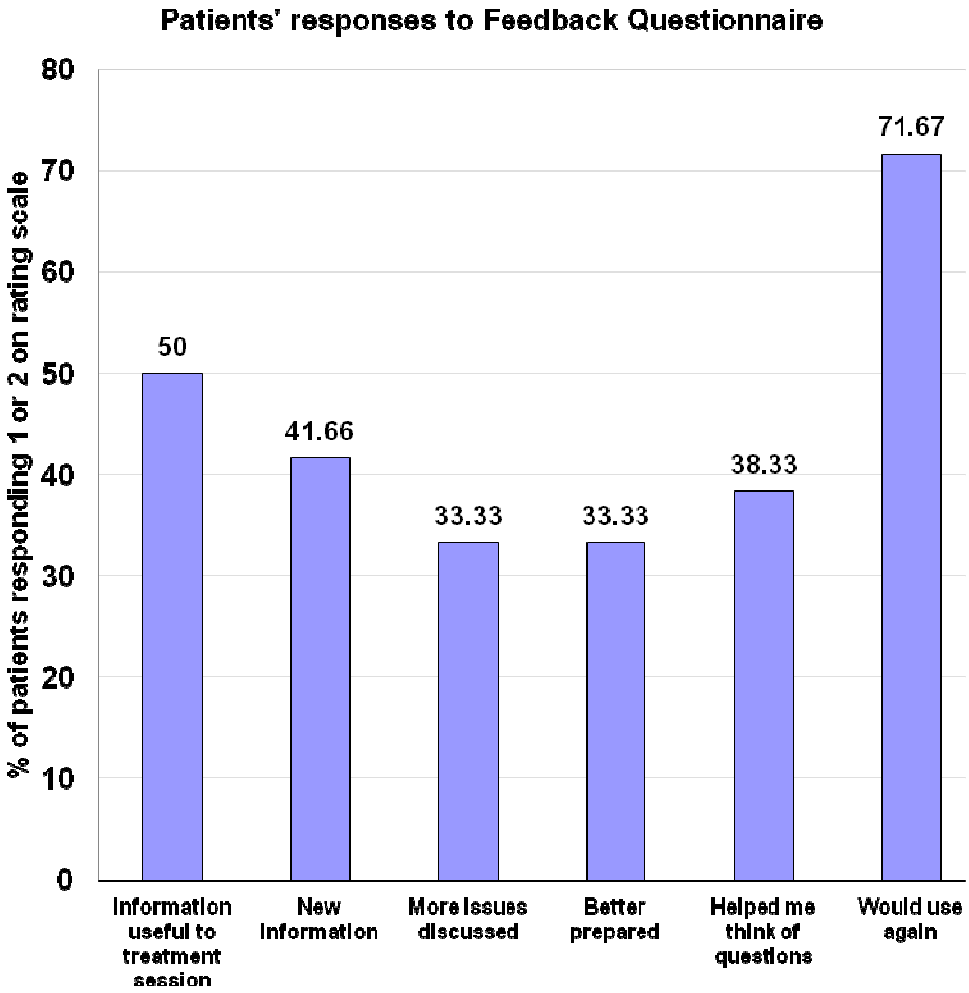

Figure 15: Patients Responding Positively to CIS

Half of the patients felt that the information disclosed during the CIS was useful to the treatment session, with 41.67% of patients stating that they had disclosed new information that they had not previously discussed with the chiropractor. A third of the patients thought they discussed more issues as a direct result of including the CIS and the same number felt better prepared for their consultation. These are very positive findings to support the inclusion of a CIS during periodic patient reassessment. The CIS has proved useful even in a setting where a relationship and trust has been built up between chiropractor and patient. These results show that

not only can the inclusion of the CIS enhance the communication process between the chiropractors and their patients but that it can also be used effectively as part of the periodic patient reassessment process.

7.5 Statistical Analysis

An investigation on the chiropractic clinic data was carried out to establish whether a correlation may exist between a patient's level of anxiety and/or depression and the chiropractor's perceived usefulness of the inclusion of the CIS.

Then analysis was conducted to determine if a correlation may exist, firstly between patients requesting help with the CIS and the patients' self-rated level of computer experience, and secondly between patients requesting help with the CIS and their age range.

Finally, analyses were conducted to compare positive and negative responses from the chiropractic patients for each of the questions included in the patient post-consultation questionnaire.

Non-parametric statistical significance tests were performed for each investigation detailed above to assess whether there was any significant difference.

7.5.1 Patient HADS score and chiropractor perception of CIS usefulness

Given that the chiropractors rating of usefulness was identified by an ordinal value, the Fisher Exact Probability Test was used. The patients were grouped into those with clinically significant HADS scores (anxiety or depression score of ≥11) and those without (anxiety or depression score of <11); thus generating the following table.

	Useful (rating 1 or 2)	Not Useful (rating 3 or 4)	Total
Patients with significant HADS scores	7	0	7
Patients without significant HADS scores	44	9	53
Total	51	9	60

Table 21: Chiropractor Ratings of Usefulness of CIS Based on HADS Scores

The hypotheses were as follows:

H0 – There is no significant difference in the chiropractors' perceived usefulness of the CIS between patients with raised HADS scores and those without;

H1 – There is a difference in the chiropractors' perceived usefulness of the CIS between patients with raised HADS scores and those without;

The H0 is preferred as Fisher Exact Probability gives p=0.361.

7.5.2 Patients requesting help and their level of computer experience

Fisher's Exact Probability was again used. The hypotheses were as follows:

H0 – There would be no significant difference in the number of patients requesting help with the CIS and those completing it independently based on the patients' levels of computer experience;

H1 – There would be a significant difference in the number of patients requesting help with the CIS and those completing it independently based on the patients' levels of computer experience;

Fisher's Exact Probability Test is customarily run using a 2x2 grid, however additional grids (2x3 and 2x4) are available through the VassarStats Website for Statistical Calculation (Lowry, 2011).

Level of computer experience (1, low to 4, high)	Help	Independent	Total
1	4	2	6
2	1	9	10
3	0	30	30
4	0	14	14
Total	5	55	60

Table 22: Number of Patients using CIS Independently or with Help based on Computer Experience

The H1 is accepted as Fisher Exact Probability gives p=0.00003.

7.5.3 Patients requesting help and their age range

It was anticipated that there would be a significant difference between interviewees who completed the computer interview independently and those who requested help. The hypotheses were:

H0 – There is no significant difference between interviewees who used the CIS independently and those who required help based on the patients' age range.

H1 – There is a significant difference between interviewees who used the CIS independently and those who required help based on the patients' age range.

Age Range	Help	Independent	Total
>71	1	1	2
61-70	2	16	18
51-60	2	11	13
41-50	0	15	15
31-40	0	8	8
21-30	0	4	4
<21	0	0	0
Total	5	55	60

Table 23: Number of Patients using CIS Independently or with Help based on Age Range

Two different tests were run to establish which hypothesis to accept. Using the Mann-Whitney U-Test, a marginally significant difference was found between the groups of patients who needed help and those were able to use the CIS independently (p=0.030, Mann-Whitney U-Test). Fisher-Exact Probability was not used as the table has too many cells; chi square was not used as too many cells contain 0 for this test to be valid.

Given that only patients who were 51 years or older requested help, it was decided to also analyse the data using the Fisher Exact Probability Test, using a 2x2 format.

Age	Help	Independent	Total
>50	5	28	33
≤50	0	27	27
Total	5	55	60

Table 24: Number of Patients using CIS independently or with help based on Age (over 50, 50 or less)

Although statistically the H1 had to be rejected as Fisher Exact Probability gives p=0.058, the closeness indicates value in retesting in a future study.

7.5.4 Patients responding positively compared to those responding negatively for each of the post-consultation feedback questions.

Analyses were carried out to determine any significant difference between patients responding positively to the CIS and those responding negatively. The hypotheses were:

H0 – There is no significant difference between patients who responded positively to the inclusion of the CIS and those who responded negatively;

H1 – There is a significant difference between patients who responded positively to the inclusion of the CIS and those who responded negatively;

	+ve response	-ve response	Total	p-value
Gave useful info	**30**	**7**	37	**0.0002**
Gave new info	25	26	51	0.888
Increased issues discussed	20	19	39	0.872
Better prepared	20	17	37	0.622
Helped think of questions	23	12	35	0.063
Use CIS again	**43**	**6**	49	**1.3e-7**
Total	161	87	248	

Table 25: Responses to feedback questions (positive v negative) - (bold highlights significant difference)

Firstly a chi square test was conducted based on the entire table. From this test, the H0 is rejected as Yates' p=0.004. Following this, each question was analysed individually, those questions where a significant difference was found between the patients responding positively and those responding negatively are marked in bold.

7.6 Discussion

The use of a CIS within a chiropractic setting was received positively by patients and chiropractors alike and many benefits were seen from its use. The findings from the chiropractors' record sheets clearly show that the inclusion of the CIS was perceived to be useful and that it did help to facilitate the communication process between chiropractor and patient. The chiropractors found the interview transcript useful for a high percentage of patients (85%) suggesting that it can be used very effectively as part of the periodic patient reassessment process. There was no significant difference in the usefulness of the CIS for patients with significant HADS scores and those without (see section 7.5).

The patients were largely able to complete the computer interview independently (n=55, 91.67%). A significant difference was found between those patients who requested help with the CIS and those who did not based on computer experience, but not when based on age range (see section 7.5). This suggests that only those patients who rate themselves as having a very low level of computer experience are likely to require additional support in the use of a CIS. 59 of the 60 patients (98.33%) rated the CIS as either very easy (n=47, 78.33%) or easy (n=12, 20%) to use and 96.67% rated the CIS positively for engagement.

The inclusion of the CIS enhanced the communication in two main ways, firstly it helped identify new issues that the patient had not previously disclosed, for example pain experienced when reaching to a high cupboard, but it also highlighted areas where the patient required clarification or further explanation, for example, how to

perform a particular exercise. Moreover, it helped to establish where there was a mismatch between the aims of the chiropractor and the aims of the patient, for example an increase in mobility compared to a reduction in pain. Clearly, from the chiropractors' point of view, inclusion of the CIS could be shown to enhance the communication process.

The fact that the chiropractors were surprised by the HADS results reflects previous research that gauging anxiety and depression in a non-psychiatric clinic is not easy (Clarke & Currie, 2009). Of those cases where the HADS results were higher than expected (11.67%), only 3 patients (5%) fell within the range where it would be necessary to address anxiety or depression issues. It should be noted that the HADS results were lower than expected for exactly the same number of patients (11.67%); in all of these cases the patients were well within the normal range, where it might have been expected for them to be experiencing a greater degree of anxiety or depression.

These figures highlight that the majority of the patients in this study do not have anxiety or depression conditions as 88% of these patients fell out with the criteria for significant cases (Montazeri, Vahdaninia, Ebrahimi, & Jarvandi, 2003; Spinhoven et al., 1997; Zigmond & Snaith, 1983). The findings from this study may support the assertion of Waddell and Main that psychosocial factors in back pain patients may come and go, are often due to the spinal problem and generally recede with the condition (Waddell & Main, 1988).

Clearly, through incorporating HADS into the CIS, it was possible to identify patients with anxiety or depression within a chiropractic clinic in a simple and effective manner which didn't require any collating or scoring by the chiropractors. The ability of the CIS to rapidly identify patients suffering from anxiety or depression meant it was possible for the chiropractors to address these issues during that treatment session, which resulted in faster changes to treatment plans. It proved very beneficial to discuss issues of anxiety with certain patients and was felt by the chiropractors concerned to enhance the communication process and thereby the treatment session.

It was then possible to use the HADS results to identify whether the incidence of anxiety or depression in the patient population followed the current evidence based thinking for spinal problems. According to Anxiety Care, Generalised Anxiety Disorder (GAD) is possibly the most common anxiety disorder, affecting 5-6% of the general population (Anxiety Care). As would be expected in those suffering from a chronic condition, there is a higher than usual rate of anxiety 11.67% within this patient population. Hence the inclusion of the HADS element within the CIS showed that the trends in this patient population did reflect current evidence based expectations of being elevated anxiety scores compared to the general population, but they were not as high as in other chronic conditions such as COPD 30%, heart disease 10-50%, diabetes 14%, cancer 15-23% and stroke (Clarke & Currie, 2009; Cleland et al., 2007; Scott et al., 2007).

Anxiety Care states that at any one time, between 5% and 10% of the British population are suffering from depression at a level that needs support (Mental Health Organisation, 2006). Montazeri et al used the following system of assessing HADS scores: 11 or more on either subscale is considered to be a significant 'case' of psychological morbidity, while a score of 8–10 represents 'borderline' and 0–7 'normal' (Montazeri et al., 2003); this also follows the recommendations of Zigmond and Snaith (Zigmond & Snaith, 1983). So, in the case of depression, the inclusion of the HADS element within the CIS showed that the trends in this patient population did not reflect current evidence based expectations of being elevated depression scores compared to the general population, indeed the opposite was the case, with only 1.67% of the study population having clinically significant depression.

Das-Munchi, et al, investigated the significance of mixed anxiety and depressive disorder (MADD) and discovered that the 1-month prevalence of MADD was 8.8% and that mixed presentation of anxiety and depression may be the norm (Das-Munchi et al., 2008). However, the exact criteria for the existence of MADD is still under debate (Das-Munchi et al., 2008). In this study, only one patient (1.67%) scored out-with the normal range for both anxiety and depression.

Both patients and chiropractors indicated that the communication process was enhanced through use of the CIS. The patients felt better prepared for the treatment session, disclosed new information, felt that more issues were discussed and were more able to think of questions to ask during the treatment session. Indeed 50% of them reported that they felt the information given during the computer interview

was useful to the treatment session, and this demonstrates that the CIS can indeed enhance the communication process between the chiropractors and their patients. Additionally, a significant difference was found between patients who responded positively about the inclusion of the CIS and those who did not (see section 7.5).

Whilst computer interviews have been used extensively for gathering sensitive information or for gathering information from new patients at specific clinics; it is novel to use a CIS in this setting where a relationship and trust has already been established between clinician and patient. Although it was anticipated that the CIS could enhance the communication process, it was not expected that so many patients would disclose new information (41.66%) and feel that the information given was useful to the treatment session (50%).

The feedback from the chiropractors also showed that the inclusion of the CIS could enhance the communication process. They rated the results of the interview useful for over 83% of patients; they altered their management during the treatment session due to information gathered by the CIS in 20% of patients and communication issues that required clarification or elaboration were found in 13.33% of patients. They found it easy to recognise the flagged answers and it was beneficial to be able to address any issues instantly. Interestingly the chiropractor that rated the CIS highest also said that it changed their communication with the patient the least, which seemed confusing, but, when asked later in a plenary session, they said that they were particularly impressed with the effectiveness of the CIS for gathering, recording and analysing the information from the periodic patient

reassessment interview and this is what they based their usefulness scoring on. All the chiropractors could see the benefits of the interview analysis interface and were impressed with the clear and simple presentation of the interview results. They felt the results could be rapidly interpreted; although the ability to modify the results shown, for example showing only results for one selected chiropractor would enhance the possible uses of the interface.

The use of the CIS helped some patients (38.33%) to think of questions to ask the chiropractor, this shows that it helped to focus the communication process. By discussing a greater number of specific issues, it can be said that the use of the CIS was shown to enhance the communication process between patient and chiropractor. These results show that not only can the inclusion of the CIS enhance communication/dialogue but that it can also be used effectively as part of the periodic patient reassessment process.

Of the patients who were negative about using the CIS again (10%), some patients had reservations about the wording of the HADS questions saying that they felt it was not relevant to them or that the answers were too restrictive and that it took too long to complete. The wording of the HADS obviously cannot be changed but a better explanation of its purpose could possibly be given prior to this section of the computer interview. When looking at the time taken for the interview, no patients took over 15 minutes to complete the interview; but some patients differ in their perception of acceptable interview duration. However, by keeping the interview

duration to an average of less than 9 minutes, the chiropractors thought that it should be feasible to include it within the chiropractic setting on a routine basis.

Whilst the CIS proved extremely effective as part of the periodic patient reassessment process it needs to be adapted to be more efficient. It was problematic having to set the CIS up in a separate room and this meant that it could only be used in certain sessions when there was a spare room available. It would be far more usable to run the computer interview on a handheld device, such as a tablet, iPad, or even a smart phone, still keeping the touch-screen interface, but having the results transferred directly to the chiropractors' computer screens rather than having to print them. This would clearly make the system more portable, more efficient and would be far easier for the reception staff to manage.

The main limitations of this study were that only one chiropractic clinic was involved and that the patients were partially self-selecting. The findings were descriptive rather than quantitative so only generalised observations can be made. The technology, and the use of it, has progressed greatly since the study was initiated, therefore the potential benefits of using CIS may not be truly reflected.

7.7 Conclusion

The use of a CIS within a private chiropractic setting was trialled and shown to be both efficient and effective in enhancing patient chiropractor communication. The majority of patients could use the CIS independently and it was highly acceptable to both patients and chiropractors alike. It also highlighted the difficulty chiropractors have in estimating anxiety and depression levels in patients, whilst coming up with a

ready solution. There is some need to improve the technical delivery of the CIS but recent advances in handheld devices should make this an easily affordable tool for the average chiropractic clinic. Also, there is scope to investigate the inclusion of additional screening tools within the CIS, such as The Oswestry Low Back Disability Index (OLBDI), Beck Depression Index II (BDI-II), SF-36 or SF-12. Future studies may include using a CIS on a patient's first visit, thus enabling their HADS scores to be tracked throughout treatment. The use of a CIS to deliver personalised screening instruments to individual patients could aid the periodic patient reassessment process.

8 Discussion

As detailed in the two previous chapters, the inclusion of the CIS within the two, very different, clinical settings proved successful. It is possible to make some comparisons between the two studies, with 60 patients within the study populace in both settings; however twice as many GPs (n=6) used the system compared to chiropractors (n=3) and no attempt was made to match the patient populations for age, gender or level of computer experience. Additionally, the computer interview question sets were very different within the two study settings, with a greater number of more specialised questions presented in the chiropractic clinic.

The ability of the patients to complete the computer interview independently improved between the two settings, with 21.67% of patients in the GP surgery requiring assistance (see Chapter 6), but only 8.3% of patients requiring assistance in the chiropractic clinic (see Chapter 7). This increase in successful, independent completion could have occurred for a number of reasons, fewer patients in the chiropractic clinic rated themselves as “1, very inexperienced” computer users (n=6, chiropractic clinic v n=15, GP surgery), there were less patients in the 71+ age range in the chiropractic clinic (n=2, chiropractic clinic v n=7, GP surgery), the time delay between the two studies (GP surgery study 2002-2003 and chiropractic clinic study 2007-2008) meant that computer use within the general populace has increased and so using such technology is considered to be “the norm”, the socioeconomic status of the chiropractic clinic patients is likely to differ from that of the GP surgery patients, however, data of this nature was not recorded as it was felt to be outwith

the scope for this thesis. The statistical analyses carried out on the separate study populations showed there to be a significant difference between patients completing the computer interview independently and those who required help in both settings when based on level of computer experience; but only in the GP surgery setting when based on age range (see sections 6.5.3, 6.5.4, 7.5.2 and 7.5.3).

In addition to these analyses, the combined data for the GP surgery and chiropractic clinic was examined to establish if a correlation may exist firstly between patients requesting help with the CIS and those completing independently based on the patients' self-rated level of computer experience, and secondly based on the patients' age range.

8.1.1 Overall patients requesting help and their level of computer experience

Fisher's Exact Probability was used. The hypotheses were:

H0 – There is no significant difference in the number of patients requesting help with the CIS and those completing it independently based on the patients' levels of computer experience;

H1 – There is a significant difference in the number of patients requesting help with the CIS and those completing it independently based on the patients' levels of computer experience;

Fisher's Exact Probability Test is customarily run using a 2x2 grid, however additional grids (2x3 and 2x4) are available through the VassarStats Website for Statistical Calculation (Lowry, 2011).

Level of computer experience (1, low to 4, high)	Help	Independent	Total
1	17	4	21
2	1	19	20
3	0	50	50
4	0	29	29
Total	18	102	120

Table 26: Overall Number of Patients using CIS Independently or with Help based on Computer Experience

The H0 is rejected as Fisher Exact Probability gives p=2.16e-16.

8.1.2 Overall patients requesting help and their age range

It was anticipated that there would be a significant difference between interviewees who completed the computer interview independently and those who requested help. The hypotheses were:

H0 – There is no significant difference between interviewees who used the CIS independently and those who required help based on the patients' age range.

H1 – There is a significant difference between interviewees who used the CIS independently and those who required help based on the patients' age range.

Age Range	Help	Independent	Total
>71	5	4	9
61-70	7	21	28
51-60	6	16	22
41-50	0	25	25
31-40	0	22	22
21-30	0	12	12

<21	0	2	2
	18	102	120

Table 27: Overall Number of Patients using CIS Independently or with Help based on Age Range

Two different tests were run to establish which hypothesis to accept. Using the Mann-Whitney U-Test, a significant difference was found between the groups of patients who needed help and those were able to use the CIS independently (p=0.018, Mann-Whitney U-Test). Fisher-Exact Probability was not used as the table has too many cells; chi square was not used as too many cells contain 0 for this test to be valid.

Given that only patients who were 51 years or older requested help, it was decided to also analyse the data using the Fisher Exact Probability Test, using a 2x2 format.

Age	Help	Independent	Total
>50	18	41	59
≤50	0	61	61
Total	18	102	120

Table 28: Number of Patients using CIS independently or with help based on Age (over 50, 50 or less)

A more significant difference was seen using this test; hence, the H0 is rejected as Fisher Exact Probability gives p=5.96e-7.

A success rate of almost 80% within the GP surgery, to over 90% within the chiropractic clinic, for independent use of the CIS was felt to positively answer the first specific research question **"Can the patients, regardless of age and computer experience, take the computer interview independently?"** Additionally, the CIS was

rated extremely positively for ease of use by the patients in both clinical settings, with 119 of the 120 patients (99.17%) rating the computer interview as either very easy or easy to use; 80% of patients rated it as very easy.

Incorporating the HADS screening interview into the CIS enabled patients scoring significantly for anxiety and/or depression to be identified. In the GP surgery setting, 21.67% of patients scored in the clinically significant range for anxiety, and 10% for depression; with the GPs surprised by the HADS results of 11.67% of patients (see Chapter 6). In the chiropractic clinic setting, 11.67% of patients scored in the clinically significant range for anxiety, and only 1.67% for depression; with the chiropractors surprised by the HADS results of 23.33% of patients (see Chapter 7). In both settings, where the clinicians were surprised by the HADS results, approximately half were higher than expected and half lower than expected. The chiropractors were surprised by the HADS results for considerably more of their patients than the GPs; this could be because GPs are perhaps more used to treating patients specifically for mood related disorders, while chiropractors are more likely to incur patients with mood related disorders that are comorbid with a pre-existing physical complaint.

It could be said that in answering the research questions **"Can the incorporation of an anxiety and depression screening interview aid in the recognition of individuals suffering from anxiety or depression?"**, the CIS proved more successful within the chiropractic clinic setting, where the chiropractors were surprised by the results of over one fifth of their patients. There was still worth in the screening within the GP

surgery as it enabled the GPs to see the increased prevalence of anxiety disorders, and to a lesser extent depressive disorders, than is suggested by current research (Marc Ansseau et al., 2005; Ronalds, Kapur, Stone, Webb, Tomenson, & Creed, 2002; Terluin et al., 2009). Asking the clinicians if they were surprised by the screening results was a novel aspect of this study. Gathering the thoughts, opinions and views of the clinicians throughout the course of this research was viewed as being of the utmost importance and enabled a perspective that has perhaps been little considered in the past to be more fully examined; thus furthering current research in the field of clinical computer interviewing.

There was a large difference in the perceived usefulness of the CIS within the consultation process between GPs and chiropractors, with GPs rating it as useful for 21.67% of patients (see Chapter 6) and chiropractors rating it as useful for 85% of patients (see Chapter 7). Any comparisons must be made with caution as the interview question sets were considerably different in the two clinical settings. The GP interview consisted predominantly of the HADS screening instrument, with only a few additional questions asked about the main reason for the visit to the GP surgery. Hence, the GPs mainly rated the inclusion of the CIS as useful when the HADS results directly aided their consultation. The chiropractors, however, invested considerable time in compiling a suitable periodic patient reassessment question set, which consisted of 15 questions. The chiropractic clinic interview transcript contained considerably more information than that of the GP surgery. It is felt that the difference of interview questions had a direct effect on the increased perception of

usefulness within the chiropractic clinic. This highlights the importance of ensuring that the interview question set within the CIS is detailed enough to gather information that is useful, can enhance discussion, and may otherwise not have been shared by the interviewee.

An investigation on the overall data was carried out to establish whether a correlation may exist between a patient's level of anxiety and/or depression and the clinicians' perceived usefulness of the inclusion of the CIS.

8.1.3 Patient HADS score and clinicians' perception of CIS usefulness

Given that the rating of usefulness was identified by an ordinal value, Fisher Exact Probability Test was used. The patients were grouped into those with clinically significant HADS scores (anxiety or depression scores of ≥11) and those without (anxiety or depression score of <11); thus generating the following table:

	Useful	Not Useful	Total
Significant HADS scores	13	7	20
Not significant HADS scores	51	49	100

Table 29: Overall Number of Patients that the CIS was useful for compared to HADS scores

The hypotheses were:

H0 – There is no significant difference in the clinicians' perceived usefulness of the CIS between patients with raised HADS scores and those without;

H1 – There is a significant difference in the clinicians' perceived usefulness of the CIS between patients with raised HADS scores and those without;

The H1 is rejected as Fisher Exact Probability gives p=0.328. Additionally, the odds ratio was calculated; this showed the CIS to be perceived as useful 1.7843 times more for patients with raised HADS scores compared to those without raised HADS scores.

The CIS proved acceptable to clinicians in both settings, with all clinicians willing to use a CIS again in the future and rating the CIS as potentially very useful. A high level of acceptability was also achieved within the patient populations of both settings. In the GP surgery, 100% of patients were happy to use a CIS in the future and 96.67% found the CIS engaging (see Chapter 6). In the chiropractic clinic, 71.67% of patients were happy to use a CIS in the future (see Chapter 7); whilst this is still a high success rate, the drop in percentage of patients could be due to the interview within the chiropractic clinic containing more questions than that in the GP surgery, hence it took longer to complete (GP average time for interview 6 minutes, 32 seconds; chiropractic average time for interview 8 minutes, 35 seconds). With an average interview time of less than 10 minutes, it seems unlikely to considered “too lengthy”, however this was the main reason cited by those patients within the chiropractic clinic populace who indicated that they would less than willing to use the CIS again in the future, the only other reason given was the dislike of the wording of the HADS questions. A different screening tool could be implemented instead; however, as discussed in earlier chapters, HADS is an appropriate tool for use in this environment.

Hence it can be shown that, yes, **"the incorporation of the CIS into the consultation process is considered useful and acceptable by the clinicians as well as the patients."** Unsurprisingly, given the differing interview question sets, considerable variation was seen between perceived usefulness, but acceptability was consistently high across all user groups. As mentioned in Chapter 1, considerable research has been carried out to investigate the acceptability of computer interviews with the patient population and studies have been conducted into the reliability of data gathered using such methods. This research study contributes to further existing knowledge by gathering details of acceptability and usefulness from the clinicians as well as the patients.

In the GP surgery, patients were asked if the computer interview helped them to focus better on issues they wanted to discuss with the GP; 11.67% answered "Yes, definitely" and 68.33% answered "Possibly" (see Chapter 6). Additional, more specific, questions to determine perceived usefulness of the CIS by patients in the chiropractic clinic were asked through means of a post-consultation questionnaire. This had not been considered feasible, due to space and time constraints within the GP surgery, but proved a valuable improvement to the study design in the chiropractic clinic. In the chiropractic clinic, 50% of patients rated the information that they gave during the computer interview as useful to the treatment session; 41.66% indicated that they shared information never previously discussed with the chiropractor; one third of patients felt that the inclusion of the CIS increased the number of issues they discussed and that the CIS helped them to be better prepared

for the treatment session; 38.33% of patients were of the opinion that the computer interview helped them to think of questions to ask during the treatment session (see Chapter 7).

When addressing the question **"Can the CIS be shown to enhance the communication process between clinicians and their patients?"** it was felt that the first phase of the clinical testing, in the GP surgery, did not adequately answer this. However, the improvements to the study design for the second phase within the chiropractic clinic, specifically the inclusion of a post-consultation patient questionnaire, did enable this question to be successfully answered (see Chapter 7). Clearly, with over 40% of patients indicating that they had divulged new information due to the use of the CIS and the patients feeling better prepared and more able to think of questions to ask, it was possible to enhance communication between patient and clinician. This effect was more noticeable in a specialised setting using a carefully selected question set. Additionally, the chiropractors were specifically asked if, in their opinion, the CIS helped to highlight communication difficulties, to which they answered positively for 13.33% of patients (range of 6.67% to 26.67% across the individual chiropractors). It is novel to examine the effect of a computer interview on the communication process between patient and clinician, and particularly to ask specific questions about whether new information was shared or if communication difficulties were highlighted.

The inclusion of the CIS was perceived to be of greater benefit in a more specialised setting, with more potential for asking detailed questions. This concurs with

previous studies, where valuable information has been gathered from patients, or their relatives, in specific clinical settings (Chinman, Hassell, Magnabosco, Nowlin-Finch, Marusak, & Young, 2007; Porter et al., 2010; Tideman, Chen, Pitts, Ginige, Slaney, & Fairley, 2007). Moreover, this study furthers such research by examining the opinions of the clinicians within different clinical settings as to the usefulness of the inclusion of the CIS.

One of the research questions was directly related to the use of the CIS within the chiropractic setting: **"May the CIS be effectively and efficiently used as part of the periodic patient reassessment process?"** The findings outlined above contribute to answering this question. As the CIS was shown to enhance communication between patient and chiropractor, it could thereby be said to be an effective part of the periodic patient reassessment process. In addition to this, the chiropractors altered the management of 20% of patients due to information gained through use of the CIS, hence showing a direct, positive effect of including the CIS within the patient reassessment (see Chapter 7). The chiropractors also commented favourably on the analysis interface of the CIS, which enabled them to instantly gain an overview of patient responses to their reassessment questionnaire. Not only could they include the interview transcript for individual patient reassessment records, but the overall analysis could provide a picture of the strengths of the clinic and areas requiring attention.

The CIS was considered efficient by GP surgery and chiropractic clinic staff in that it was able to instantly present the results of the HADS screening questionnaire

without any burden on their time. Additionally, the analysis interface enabled staff to view the patients' overall responses and results for specified interviews. The staff found the graphical presentation simple to understand and interpret. The ease of incorporating the CIS within the clinical setting, or indeed any setting, could be greatly enhanced by changing to a handheld device; this would remove the need for a separate room to be available in order run the CIS. There are many such handheld, touch screen devices readily available now, which was not the case at the time of conducting these studies; a tablet type computer could prove an ideal medium on which to run the CIS and current research has shown them to be acceptable within the clinical setting (Main, Quintela, Araya-Guerra, Holcomb, & Pace, 2004; Richter, Becker, Koch, Nixdorf, Willers, Monser, Schacher, Alten, Specker, & Schneider, 2008; Skeels et al., 2006). This would also alleviate the main difficulty of access to set up the CIS that the author experienced when conducting the studies, which proved particularly problematic in the GP surgery.

The final specific research question to be answered was **"Can the CIS be shown to highlight any unexpected trends in anxiety and/or depression levels in the patient population that may not reflect current evidence based expectations?"** The results and follow up meetings with the clinicians show this to be possible. Using the HADS results and examining current research, the GPs could see that a higher level of anxiety was found within their patient population than would be expected; the levels of depression were also slightly raised. The trends seen in the chiropractic clinic were different, with anxiety levels of about that which would be expected in

patients with a chronic spinal condition; however, depression levels were extremely low. This thesis does not seek to suggest reasons for these findings, but merely look at the potential of the incorporation of a CIS into a clinical setting to aid in the discovery of unexpected trends.

It is acknowledged that these studies were initiated some time ago; however literature searches have shown it to still be novel and relevant. Studies in the area of computer interviewing in the clinical setting continue to focus on the acceptability and usability for the patients and also on using medical tests to prove the reliability of data gathered using a computer interview. Reported studies of degree of usefulness and acceptability to the clinicians have not been found. Additionally, studies have not investigated the impact of the inclusion of a CIS on the subsequent consultation or treatment session. Here, great emphasis was placed on the effect of the CIS on the communication process between patients and clinicians and on seeking the opinions of the clinicians involved as to degree of usefulness and perceived benefits or difficulties. Positive results were found in both clinical settings, but particularly so within the chiropractic clinic setting and it is felt that the studies carried out successfully further current knowledge in the field of clinical computer interviewing.

Whilst it was anticipated that the CIS would prove to be of greater benefit within the more specialised chiropractic clinic setting, it was not expected that the degree of usefulness would be perceived to be so high. The patients included within this study population had all seen the chiropractor on at least 6 other occasions and had hence

established some sort of relationship with their clinician. There is not the same pressure of time within the chiropractic clinic as there is in the GP surgery, with treatment sessions typically taking 20 minutes, and 40 minutes being allowed for full patient reassessment, compared to 10 minutes allocated for a GP consultation. Given these factors, whilst it was expected that the CIS could enhance communication by helping the discussion to be more in-depth, having the CIS cause management to be altered for 20% and being rated as useful for 85% of patients showed the inclusion of the CIS to be even more successful than initially anticipated. This use of the CIS in a situation where the patient is already familiar with their clinician is a major, novel aspect of this thesis and serves to show the value in the use of such devices to facilitate communication.

8.2 A Critical Assessment of the Study

8.2.1 Strengths

A total of 120 patients used the CIS within the clinical studies conducted during this research. The protocol and computer interview delivery tool were rigorously tested prior to initiating the studies.

A validated measure, namely HADS, was used to assess the psychosocial factors of the study groups. This tool has been widely trialled in many different setting and was considered highly appropriate for both the GP surgery and chiropractic clinic.

The inclusion of quantitative data, in particular the possible prevalence of anxiety or depressive disorders within the study populations enabled some comparisons to be

made between the study populations and between the expected results for patients either in a GP surgery setting or those with a chronic spinal condition or low back pain.

The inclusion of qualitative data enabled the author to look beyond the percentages to gain an understanding of the users' feelings, impressions and viewpoints.

The diversity of backgrounds of study participants and the variation in time interval between the two clinical studies all add to the richness of data collected in the course of the study. This is reflected in the variations in impact, in terms of the perceived usefulness and evidence of communication enhancement between the two clinical studies.

The study design was improved after conducting the research within the GP surgery; modifications were made in order to gather more direct evidence of the effect of the CIS on communication between clinicians and their patients. Thus, the author demonstrated the ability to adapt, improve and learn from early research studies.

Hackshaw states that:

> *"It is often better to test a new research hypothesis in a small number of subjects first. This avoids spending too many resources, e.g. subjects, time and financial costs, on finding an association between a factor and a disorder when there really is no effect. However, if an association is found it is important to make it clear in the conclusions that it was from a hypothesis-generating study and a larger confirmatory study is needed"* (Hackshaw, 2008).

The author is of the belief that this advice has been adhered to in the clinical studies carried out during this research project. A hypothesis-generating study was appropriate given the lack of previous research into the opinions of the clinicians or the possible effect of inclusion of a CIS on the consultation process.

8.2.2 Limitations

There are restrictions in the comparisons that can be made between the two studies as, firstly there is a "general selection problem": when an effect may be due to the difference between the kinds of people in one experimental group as opposed to another; the demographics, in particularly the socioeconomic status of the GP surgery patient population is likely to differ from that of the chiropractic clinic patient population. Secondly, there is a "specific selection problem": groups differ in specific criteria, such as computer experience or in age range; the two patient groups were not matched. Having said that, it was never intended to make direct comparisons between the results from the two clinical settings, rather the focus was on the perceived benefits of including a CIS within the consultation process. Only generalised comments as to the most appropriate setting, where the CIS could have the most worth, are made.

An obvious limitation of the study is the restriction of the data to one GP surgery and one chiropractic clinic only. This limits the possibilities of generalising of the results. The study participants were partially self-selecting and the information gathered using the CIS was self-reported so, like all self-reported data, has some inherent weaknesses.

Another limitation of the study is the absence of a comparison or control group. However, the development of a meaningful comparison group for an evaluation would have been extremely difficult and the ability to closely match a study group with a control group even within the chiropractic clinic would have been problematic. The samples would have not only had to be matched for gender, age and level computer experience but type of condition, duration of condition, number of previous visits and which chiropractor they had been consulting. The chiropractors and author felt it was out with the scope of this study to attempt such a comparative study and acknowledge that this challenges the ability to draw conclusive results.

Whilst some degree of quantitative research was included within this study, the sample sizes were not particularly large. Hence, in this research study, only a few quantitative measures are used and caveats are attached to their interpretation.

Including a largely qualitative aspect to the research study enabled data-rich results to be gathered; however, the analysis is subjective and deals with a relatively small sample size, hence generalisation is limited. This has been accounted for in the conclusions drawn from this research study.

9 Conclusion and Further Research

9.1 Conclusion

The findings from the research that has been conducted clearly answers the research questions and contributes novel material to the area of research – primarily that the CIS is beneficial even in an area where the clinician and patient have already established trust; also that clinicians in a more specialised setting perceive the inclusion of a CIS as more useful than those in a generalised setting.

The study focused on two clinical settings, and produced a very rich set of data taken from a real world context. Focussing firmly not only on the views and thoughts of the patients, but also those of the clinicians was another novel aspect of this study. Gathering largely qualitative data enabled clinicians to express their opinions and add detailed comments as required, thus providing a clearer picture of when the inclusion of the CIS proved particularly useful and when it was less so.

This thesis details the entire process involved to answer the specific and overall research questions from the background literature review to the design and development of the interviewing tool, the user testing and then to the actual clinical studies.

Chapter 1 gave the background to computer interviewing, with a particular focus on its' role in the clinical setting and additionally provided details of anxiety and depression and the chiropractic periodic patient reassessment process. This background underpinned the rationale for the entire thesis.

Chapter 2 detailed the research aims and the plan of research, with specific aims for each of the two clinical settings.

Chapter 3 described the design and development of the CIS, with a clear emphasis given to use of an iterative process in order to optimise usability.

Chapters 4 and 5 outlined the user evaluations that were conducted, firstly in a non-clinical setting and secondly within the clinical setting of a GP surgery. The resulting modifications to the protocol and the CIS were detailed at each stage of the user evaluations. These user evaluations were a crucial part of the usability process, firstly in ensuring that the CIS was usable and, secondly, in ensuring that the protocol and implementation of the CIS were manageable and caused minimal disruption to the GP surgery and chiropractic clinic staff.

Chapter 6 described the study conducted within the GP surgery. This was one of the two major studies forming this thesis. 60 patients and 6 GPs were involved in this study, which showed the CIS to be partially efficient and effective in enhancing patient-clinician communication. It did prove to be significantly more useful for those patients with elevated scores for anxiety and/or depression than those without; hence the suggestion of the GPs to use the screening tool for patients already identified as suffering from a mood disorder was validated. Additionally, more specific areas in which the CIS could enhance current practice by estimating anxiety and depression levels in patients and being used to aid communication were suggested by the participating GPs.

Chapter 7 described the study conducted within the chiropractic clinic. This was the second of the two major studies. 60 patients and 3 chiropractors were involved in this study, which showed that the use of a CIS enhanced the periodic patient reassessment process. The CIS was both efficient and effective in enhancing patient chiropractor communication; it helped to identify new issues that the patient had not previously shared with the chiropractor and it highlighted areas where the patient required clarification or further explanation.

Chapter 8 discussed the findings of both the GP surgery study and the chiropractic clinic study and made some tentative comparisons across the two studies. It was possible to investigate issues regarding whether patients could use the CIS independently or not. A significant difference was found between users who were able to complete the computer interview independently and those who could not when based on their self-rated level of computer experience and also when based on their age range. Overall, the information gathered using the CIS was felt to be far more useful in the chiropractic clinic than in the GP surgery. Suggestions from both clinician groups were presented; these included updating the CIS to be delivered using a handheld device, which would make its routine inclusion far more feasible. Use of a handheld device would alleviate the problem of a spare room in which to run the computer interview and would enable reception staff to direct patients to the CIS more readily. Additionally, the strengths and limitations of the research were presented.

These chapters of the thesis enabled the author to answer the research questions:

Can the patients, regardless of age and computer experience, take the computer interview independently?

The majority of patients were able to take the computer interview independently, with 78.33% doing so in the GP surgery and 91.7% in the chiropractic clinic. Both age and level of computer experience were found to have a statistically significant effect on patients' ability to use the CIS independently. 119 of the 120 patients (99.17%) rated the computer interview as either very easy (n=96, 80%) or easy to use (n=23, 19.17%).

Can the incorporation of an anxiety and depression screening interview aid in the recognition of individuals suffering from anxiety or depression?

The CIS proved an efficient means through which to deliver the HADS questionnaire; it highlighted patients with clinically significant scores through a flagging mechanism on the interview transcript. The GPs were surprised by the HADS results of 11.67% of patients, with the scores higher than expected for 5% of patients. The chiropractors were surprised by the HADS results of 23.33% of patients, with higher scores than expected for 11.67% of patients. The inclusion of the screening interview helped to identify some individuals with anxiety and/or depression, particularly within the chiropractic clinic. Whilst the GPs were less surprised by the results of individual patients, they were not expecting the percentage of their patient population with significant scores for anxiety and depression to be so high; thus the CIS was considered an aid.

Will the incorporation of the CIS into the consultation process be considered useful and acceptable by the clinicians as well as the patients?

The information from the CIS was perceived as being far more useful in the chiropractic clinic than the GP surgery (85% v 21.67%); this could be attributable to the far more detailed question set that was used in the chiropractic clinic. In the GP surgery, the inclusion of the CIS was significantly more useful for those patients with elevated HADS scores than for those without; no such difference was found in the chiropractic clinic. Whilst the level of usefulness varied considerably between the two settings, the level of acceptability was high throughout the entire study, both with clinicians and patients.

Can the CIS be shown to enhance the communication process between clinicians and their patients?

Limited questions were asked in the GP surgery regarding the communication process; 11.67% of patients definitely felt more focussed on issues that they wanted to discuss during the GP consultation. More detailed questions were asked in the chiropractic clinic and a patient post-consultation questionnaire was implemented to determine if the consultation had been affected by the inclusion of the CIS. A positive response was received from both patients and chiropractors; 50% of patients rated the information given during the computer interview as useful to the consultation; over 40% stated that they had shared new information; the chiropractors indicated that they felt the CIS helped to highlight communication

difficulties in 13.33% of patients and caused them to alter management for 20% of patients. These factors clearly indicate an enhancement in communication.

May the CIS be effectively and efficiently used as part of the periodic patient reassessment process?

The patients and chiropractors responded very positively about the inclusion of the CIS in the periodic patient reassessment process. Not only did the CIS enable chiropractors to efficiently record patient responses with minimal burden on staff time, it also helped to identify issues requiring clarification. Also, the interview analysis interface allowed the chiropractors to gain an instant overview of the patients' responses. Efficiency could be improved by moving to a handheld device.

Can the CIS be shown to highlight any trends in the patient population that may or may not reflect current evidence based expectations?

Examining the HADS results for the two different patient populations enabled the clinicians to determine where the study populace followed the levels expected from current research and were it deviated. Use of additional screening tools would further expand possibilities in this area.

Thus it is possible to address the overall research aim: **To investigate whether a computer interviewing system can be used in a clinical setting to enhance patient-clinician communication during the subsequent consultation**.

It is felt that it was successfully proven that the inclusion of a pre-consultation computer interview did indeed enhance patient-clinician communication. The

information in the computer interview transcript proved a good starting point for discussion and led to more in-depth discussion of issues that were of concern to the patients. Moreover, new, previously undisclosed information was shared with the chiropractors and areas of uncertainty that the patients wished to be clarified were dealt with instantly. The flagging system on the interview transcript enabled the clinicians to rapidly scan the transcript and identify issues that required to be addressed.

There are several major contributions of this thesis, the greatest being that the use of the CIS was considered useful by the clinicians for the vast majority of patients (85%) in a specialised clinical setting, moreover this was a setting where there were few pressures of time on the consultation and the patients had already been seen by the clinician on at least 6 other occasions and had established some rapport and degree of trust. Within the more general setting of a GP surgery, the CIS was rated as significantly more useful for those patients with clinically significant scores for anxiety and/or depression. Previous studies have found high levels of acceptability amongst patients following the introduction of a computer interview. In this study extremely high levels of acceptability and usability of the CIS were found, both within the patient populace and the clinician populace, which was gratifying given the time and effort spent by the author using an iterative process to ensure that this was the case; the novel aspect being that the clinicians' opinions were gathered as well as those of the patients. The continued focus on the thoughts and opinions of the clinicians formed a major, novel aspect of this research; previous studies have

focussed on the views of patients and validity of data gathered but not on whether it was of use to the clinicians and whether a CIS could actually enhance communication during their consultation. It is felt that the studies carried out as part of this thesis have demonstrated not only the ability of a CIS to enhance communication between patient and clinician, but have also highlighted exciting potential uses for such a system.

9.2 Areas for Further Research

There are many different areas in which the CIS could potentially be applied. The chiropractors expressed interest in the possibility of including additional screening tools within the CIS, for example the The Oswestry Low Back Disability Index (OLBDI), Beck Depression Index II (BDI-II), SF-36 or SF-12. It would be feasible to set up the CIS such that the chiropractors could use a simple menu selection process to personalise which screening tool(s) would be presented to individual patients. This should further enhance the periodic patient reassessment process in that the CIS could be used to deliver, score and record the results for one or more specified screening tools in addition to delivering the standard patient reassessment interview. Hence the chiropractors would have detailed, highly specific reassessment records for each patient with minimal impact on clinic staff time.

The chiropractors also indicated that there would be potential to use the CIS at the first booking in consultation, whereby the CIS would be used to ask questions regarding medical history. Computer interviews have been used widely in this area in the clinical setting; utilisation of screening tools within such an interview would

enable a patient's scores and progress to be recorded throughout the entire course of treatment.

The positive findings from the chiropractic clinic setting could lead to interest from within the osteopathy and physiotherapy communities as there are similarities within the settings and within the patient populations. These are also areas where periodic patient reassessment forms a vital part of the treatment process.

There is also potential for the use of the CIS within more specialised primary care clinic settings such as asthma or diabetes clinics. Many GP surgeries run such clinics at allocated times within their surgery. Having proved some benefit of the CIS within a GP surgery setting, it would be appropriate to concentrate on extending its use into different aspects of primary care. Should the CIS be shown to have a significant impact in any of these more specialised GP clinics then there could be potential to move into a secondary care setting.

10 References

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Appendix 1: Database Design

Microsoft Access was chosen as the database system as it is available within the department. It should be noted however, that Access is a single user database so should extensive multiple user access be required, then this could pose a problem. Currently the OLEDB connection is used to ensure that no errors occur should more than one user attempt to complete the interview simultaneously.

It was decided to follow the rules of normalisation in the database design as this also helped to ensure that the ASP code utilised the database tables efficiently, thus avoiding the need for hardcoding whenever possible.

Table and Query Design

Details of the table and query design are given below, and the relationships between the different tables in the database are given below:

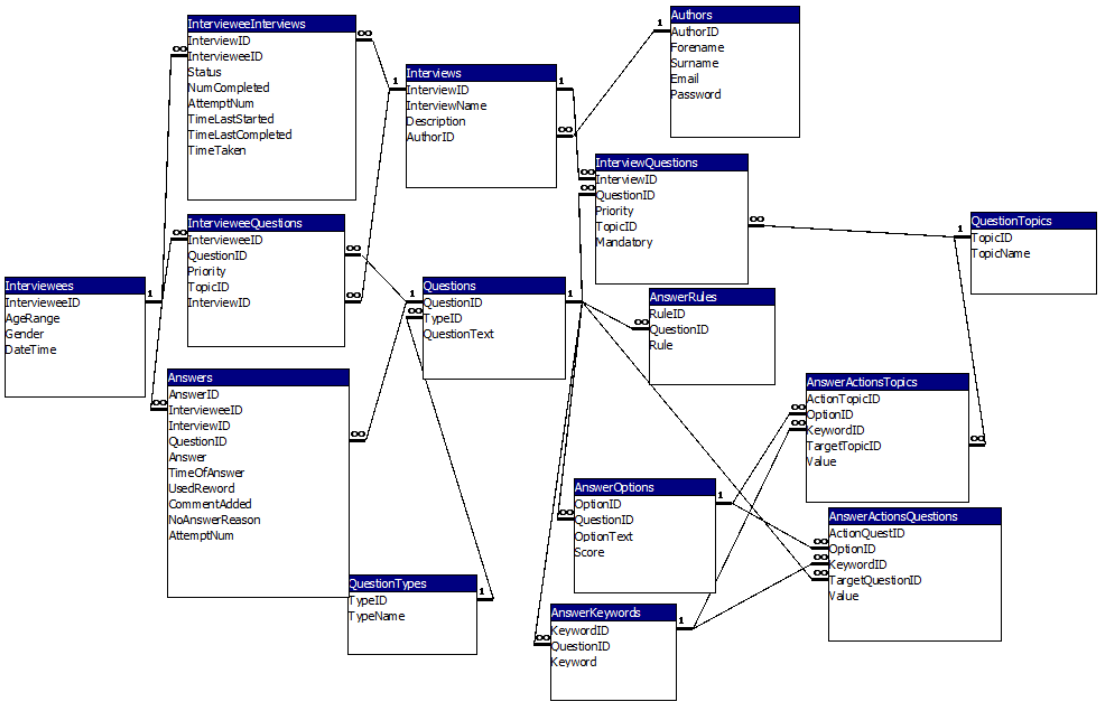


Figure 16: Database Table Relationships

Interviewees: Details of each interviewee and the date/time that their details were recorded.

Authors: Details of authors, including their password for accessing the interview authoring interface. Authors can only edit interviews that they created.

Interviews: Details of each interview, including which author created the interview

IntervieweeInterviews: A linking table between interviewees and interviews. Contains details of whether the interview is in progress of completed, how many

times the interviewee has attempted the interview and how many times they have completed it.

Questions: Contains the question text and question type. The Question TypeID controls how the question is displayed.

InterviewQuestions: A linking table between interviews and questions enabling questions to be a part of more than one interview. Contains details of the question priority, the topic and whether it is mandatory (must be answered).

IntervieweeQuestions: A set of “working questions” for the current interviewee.

QuestionTypes: A list of question types, which is used to control how the question is displayed and how the answer is saved.

QuestionTopics: Details of the question topics so that questions can be grouped into different topics.

Answers: Details of the answers, including when the answer was saved and whether a comment has been added.

AnswerOptions: Details of the answer choices available for multiple choice, checkbox and drop-down list questions.

AnswerKeywords: Details of keywords required for answer interpretation.

AnswerRules: Details of rules required for answer interpretation

AnswerActionsTopics: Details of priority changes to be carried out to groups of questions of a particular topic.

AnswerActionsQuestions: Details of priority changes to be carried out to individual questions.

Appendix 2: System Description

The system starts with the Welcome page, which provides a brief explanation of the computer interviewing system and the purpose of its use within the GP practice or chiropractic clinic. The actual pages used to run the computer interview are described in detail below.

Interview Delivery Interface

The pages/files included in the interview process and descriptions of their functionality are as follows:

Welcome.asp – provides the interview name and the name of the GP surgery or chiropractic clinic involved in the study. Gives a link to Start the interview, and informs the interviewee that this will open in a new window.

StartInterview.asp – displays information regarding the interview about to be presented and informs the interviewee about how to select answers and more through the interview; links unseen to create a record of the interviewee and a working set of questions in order to deliver the interview.

NewIntervieweeSub.asp – creates a record for the new interviewee.

SetUpNextInterview.asp – creates the working question set to deliver the interview for the current interviewee.

QuestionComment.asp – Displays the name of the current interview and displays the current question within that interview, along with the relevant answer choices. Also shows the number of questions still to be answered during this computer interview session. Uses the QuestionType to determine the display format for the question and answer choices. Then uses a query string to pass the IntervieweeID, the InterviewID and the QuestCount to QuestionCommentSub.asp.

QuestionCommentSub.asp – processes the data from the QuestionComment.asp page, adding a record to the Answers Table for each question that has been answered by the interviewee; checks to see if there are more questions to be presented for the current interview, if there are then back to QuestionComment.asp. If there are no more questions within the current interview it checks to see if there is another interview to link, if there is then continue to QuestionComment but with a new InterviewID string. If there are no more questions to be presented then it links to the form to gather interviewee details.

IntervieweeDetailsForm.asp – Displays a form to gather details of the interviewee. The details currently gathered are age range, through use of a radio button, and gender, again through use of a radio button. The IntervieweeID and InterviewID are passed using a query string. A submit form button links to the page to handle the data.

IntervieweeDetailsFormSub.asp – Processes the data from within the form and saves the details into the Interviewee table; links to the print information page.

PrintInformation.asp – displays guidance on how to print the results page.

Scores.asp – displays all the questions from the interview(s) just completed by the interviewee with the answer that was selected displayed under the relevant question. Any answers requiring attention by the clinicians are flagged on this page. The HADS scores for the interviewee are displayed on this page. A button to print the page is provided and a link is available to "Finish", this redirects the page back to the thank you page. An automatic redirect is included to ensure that the previous interviewee's results are not still displayed when the new interviewee is ready to start.

Thankyou.asp – thanks the interviewee for completing the interview and reminds them to take their interview transcript with them; includes an automatic redirect to StartInterview.

Style sheets are used throughout to aid continuity and there is a "tidy up" process at the end to delete the "working question set" that is used to enable personalisation of the ordering of questions.

Interview Authoring Interface

The Administrator Options are available only to approved administrators and access is password protected. The pages include:

AdministratorOptions.asp – enables the administrator to select from the options of Add Questions: Add to Standard Questions (AddStandardQuestion.asp) or Add to Interest Questions (AddInterestQuestion.asp) or Edit Questions: Edit Standard Questions (SelectStandardQuestion.asp) or Edit Interest Questions (SelectQuestionInterestArea.asp).

AdministratorOptionsSub.asp – redirects the administrator depending upon their selection on the AdministratorOptions.asp page.

AddStandardQuestion.asp – provides a form enabling the administrator to easily add a question to the standard question set. A text box is provided for entering the question text and a drop-down list is used for selecting the question type. After completing the fields the administrator can choose to **Add Question** or **Reset Fields**. Form validation is used to check that question text has been entered before the form can be submitted.

AddQuestionSub.asp – adds the data from the form in AddQuestion.asp to the Questions Table and confirms if the question has been successfully saved or not; provides the options to: add another question, view all questions or return to administrator options.

AddInterestQuestion.asp – provides a form enabling the administrator to easily add a question to the interest question set. A text box is provided for entering the question text and drop-down lists are used for the selection of both the question

type and the area of interest. After completing the fields the administrator can choose to **Add Question** or **Reset Fields**. Form validation is used to check that question text has been entered before the form can be submitted.

AddInterestQuestionSub.asp – adds the data from the form in AddInterestQuestion.asp to the InterestQuestions Table and confirms if the question has been successfully saved or not; provides the options to: add another interest question, view similar interest questions or return to administrator options.

SelectQuestion.asp – displays a list of all standard questions with a link from the question ID to enable the administrator to select the question that they wish to edit. The option to return to administrator options is also provided.

EditQuestion.asp – displays the full data for whichever question the administrator selected on the SelectQuestion.asp page and enables them to edit any aspect of the question. Information is provided as to the data that is required for the question type field. The administrator can choose to **Save Changes** or **Delete Record**. Form validation is used to check that question text has been entered and that the question type is of an allowed value.

EditQuestionSub.asp – either saves the modifications made on the EditQuestions.asp or deletes the record depending upon the option selected by the administrator and informs the administrator of the action taken and whether it was successful; provides the options to select another question or return to administrator options.

SelectQuestionInterestArea.asp – enables the administrator to select which category of interest questions that they wish to view. A drop-down list provides the interest area options available and the administrator must click on the **Submit Area of Interest Selection** button to process their selection.

SelectQuestionInterestAreaSub.asp – process the information regarding the selected interest area from SelectInterestArea.asp and passes this information to SelectInterestQuestion.asp via a query string.

SelectInterestQuestion.asp – displays a list of all interest questions matching the interest area selected on the SelectQuestionInterestArea.asp page. A link is provided from the question ID to enable the administrator to select the question that they wish to edit. The option to return to administrator options is also provided.

EditInterestQuestion.asp – displays the full data for whichever question the administrator selected on the SelectInterestQuestion.asp page and enables them to edit any aspect of the question. Information is provided as to the data that is required for both the question type and the interest type fields. The administrator can choose to **Save Changes** or **Delete Record**. Form validation is used to check that question text has been entered and that the question type and interest types are of an allowed value.

EditInterestQuestionSub.asp – either saves the modifications made on the EditInterestQuestions.asp or deletes the record depending upon the option selected

by the administrator and informs the administrator of the action taken and whether it was successful. Provides the options to select another related interest question, select a different interest area set of questions or return to administrator options.

The style used for the Administrator Options is consistent with that used for the Interview Process. Every attempt has been made to keep the interface simple to use, with clear on-screen instructions and informative error messages.

Interview Analysis Interface

The interview analysis pages were developed for use by the author of this thesis and for the author of the computer interviews; they have additionally proved of use to the clinicians involved in the research detailed, the GPs in Chapter 6 and the chiropractors in Chapter 7. The interface style has again been kept consistent with the other pages. The pages included are:

SelectInterviewResults.asp – displays a list of interviews, ordered by interview name, and enables a particular interview to be selected to see the graphical presentation of the answers given by all interviewees who have undertaken that interview. The option to go to the administrator options is also provided.

CollatedResults.asp – displays the full details of the interview selected by the user, including the number of interviewees who have started the interview and the number who have completed the interview. For each question in the interview, the number of interviewees who have answered that particular question is displayed, additionally; each selected answer option is given with the percentage of interviewees selecting that answer option displayed graphically and in numerical format. For free text answers, each answer is displayed under the question. A link back to the Select Interview page is provided.

In the system developed for the software engineering project, additional functionality of being able to view answers for individual interviewees was provided. This was not included within this study, but could prove useful functionality to add for future studies.

Appendix 3: HADS Questionnaire and Scoring System

Hospital Anxiety and Depression Scale (HADS)

Instrument designed to detect the presence and severity of mild degrees of mood disorder, anxiety and depression.

Questions relating to anxiety are indicated by an 'A' while those relating to depression are shown by a 'D'. Scoring: 0-7 normal, 8-10 mild, 11-14 moderate and 15-21 severe.

1	**I feel tense or 'wound up':**		**A**
	Most of the time		3
	A lot of the time		2
	Time to time, occasionally		1
	Not at all		0
2	**I still enjoy the things I used to enjoy:**	**D**	
	Definitely as much	0	
	Not quite so much	1	
	Only a little	2	
	Not at all	3	
3	**I get a sort of frightened feeling like something awful is about to happen:**		**A**
	Very definitely and quite badly		3
	Yes, but not too badly		2
	A little, but it doesn't worry me		1
	Not at all		0
4	**I can laugh and see the funny side of things:**	**D**	
	As much as I always could	0	
	Not quite so much now	1	
	Definitely not so much now	2	
	Not al all	3	

5	**Worrying thoughts go through my mind:**		**A**
	A great deal of the time		3
	A lot of the time		2
	From time to time but not too often		1
	Only occasionally		0
6	**I feel cheerful:**	**D**	
	Not at all	3	
	Not often	2	
	Sometimes	1	
	Most of the time	0	
7	**I can sit at ease and feel relaxed:**		**A**
	Definitely		0
	Usually		1
	Not often		2
	Not at all		3
8	**I feel as if I am slowed down:**	**D**	
	Nearly all of the time	3	
	Very often	2	
	Sometimes	1	
	Not at all	0	
9	**I get a sort of frightened feeling like 'butterflies in the stomach':**		**A**
	Not at all		0
	Occasionally		1
	Quite often		2
	Very often		3
10	**I have lost interest in my appearance:**	**D**	
	Definitely	3	
	I don't take as much care as I should	2	
	I may not take quite as much care	1	

	I take just as much care as ever	0	
11	**I feel restless as if I have to be on the move:**		**A**
	Very much indeed		3
	Quite a lot		2
	Not very much		1
	Not at all		0
12	**I look forward with enjoyment to things:**	**D**	
	A much as I ever did	0	
	Rather less than I used to	1	
	Definitely less than I used to	3	
	Hardly at all	2	
13	**I get sudden feelings of panic:**		**A**
	Very often indeed		3
	Quite often		2
	Not very often		1
	Not at all		0
14	**I can enjoy a good book or radio or TV programme:**	**D**	
	Often	0	
	Sometimes	1	
	Not often	2	
	Very seldom	3	

Appendix 4: GP Record Sheet and Questionnaires

GP Record Sheet

Date: **Time:** **Initials:** **Practice:**

NHS Num (opt)	Gender M/F	Age	Score A	Score D	GP surprised by screening results? Y (high, low)/N	Useful aid to consultn? Y/N – Scale 1 (v useful) to 4 (not useful)	Did it cause you to alter management? (if yes, how?)	Did it alter the time taken? (increase, decrease, no change)	Other comments

GP Post-Surgery Questionnaire

Date: ***Time:*** ***Initials:*** ***Practice:***

1. Did the pre-consultation computer interview alter the style of your consultations in any way? Please give examples where relevant.

   Yes No

Examples:

2. Did you deal with any extra issues today due to the computer interview? Please give examples where relevant.

   Yes No

Examples:

3. This pre-consultation computer interview uses the HADS interview. It is relatively easy to implement other screening tools. Are there any other areas/issues that you feel would be useful to screen for using standard screening tools? E.g. Quality of Life Index or Drug Regimen Adherence.

4. Which particular groups of your patients do you think would be most likely to benefit from a pre-consultation interview using a computer? E.g. antenatal, hypertension, back pain, mood disorder, diabetes.

5. How willing would you be to use a pre-consultation computer interview in the future? Using a scale of 1 (very willing) to 4 (not at all willing).

   1 2 3 4

6. How do you rate the potential usefulness of computer decision-support systems where data input is done directly by the patient? Using a scale of 1 (extremely useful) to 4 (not at all useful).

   1 2 3 4

Are there any changes that you would like to see (in the questions or interviews themselves or in the way the computer interview is used or managed)?

Appendix 5: Patient Consent Form (GP Surgery)

CONSENT FORM

Title of Project: **Computer-based screening (for anxiety and/or depression) within a GP surgery**

Name of Researchers: **Dr Nora Ricketts and Ms Katrina Hands**

Please initial box

1	**I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.**	☐
2	**I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.**	☐
3	**I agree to take part in the above study.**	☐

_____	_____	_____
Name of Patient	**Date**	**Signature**
_____	_____	_____
Name of Person taking consent (if different from researcher)	**Date**	**Signature**
_____	_____	_____
Researcher	**Date**	**Signature**

1 for patient; 1 for researcher; 1 to be kept in GP records

Appendix 6: Patient Information Sheet (GP Surgery)

About the research

This research project is to test the use of interviews conducted by a computer in the GP waiting area. Your selection to take part in this trial is based purely upon the day and time of your appointment and the researchers do not have access to your medical records.

You will first be asked a few questions regarding the reason for your visit to the GP today. Then the Hospital Anxiety and Depression Scale screening interview will be run. There are an increasing number of people suffering from anxiety and depression, many of whom go undetected. The use of this screening interview could be a means of efficiently recognising individuals who may benefit from a further investigation with their GP. You will finally be asked a few questions about how you found the computer interview to use. The interview process will take you about 10 minutes to complete.

We want to discover:

Can the computer be used easily?

Did the computer interview provide useful information for the patient and doctor?

Did using the computer interview affect the following GP consultation in any way?

If you have any questions at any stage then please ask the researcher and she will be happy to help you.

What to do

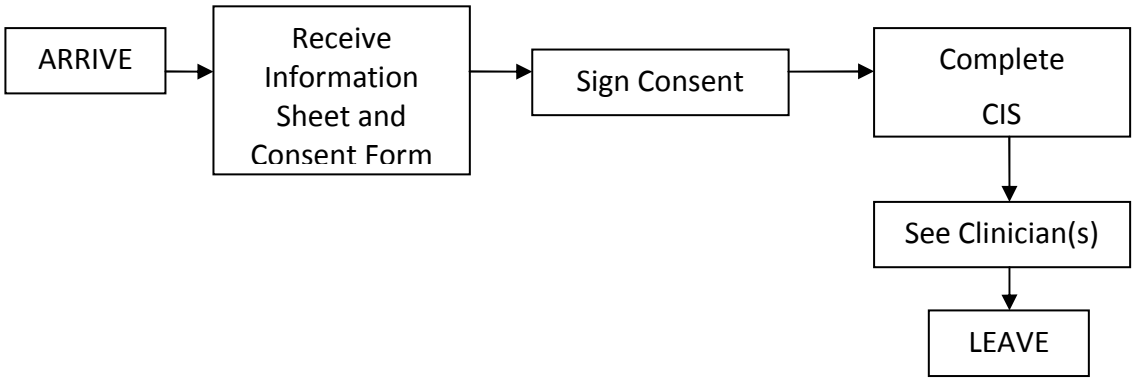
To do the interview, please follow the instructions on the screen.

When you have completed the interview you will be shown your answers to the questions regarding the reason for your visit to the GP and the results of the screening interview. Please print this screen/page and show it to the GP at the start of your consultation.

Your help in this testing is greatly appreciated and any comments that you make will be taken into consideration before setting up the next trial.

All information that is collected about you during the course of the research will be kept strictly confidential. Any information that leaves the hospital/surgery will have your name and address removed so that you cannot be recognised from it. You are free to stop the trial at any stage.

Appendix 7: Patient Protocol Flowchart (GP Surgery)



Appendix 8: Anxiety and Depression Information Sheets

Anxiety/Stress

All people have times when they feel less full of life and are under pressure. When this is having a significant influence on our daily life both emotionally and physically then we call it stress. Stress disturbs the balance between what we can cope with and what is demanded of us. This can manifest itself in many ways. You can get physical complaints like a headache, back pain, or feel short of breath through breathing too much and too quickly (hyperventilation).

Becoming ill can be your body's way of escaping heavy pressure. When ill you do not care anymore. You can also get emotional symptoms like tiredness or feeling rejected. Because each person is different, each reacts differently to stress. Different people's bodies produce different physical symptoms. Some people get headaches, others get stomach aches, abdominal or muscle aches, different physical symptoms. Some people get headaches, others get stomach aches, abdominal or muscle aches.

What you can do yourself

Don't wait too long. Stress also makes us more likely to become ill.

There are no simple solutions for stress.

It is not usually possible to change things in our lives. And you cannot always change yourself just like that. But the fitter you are the better your body and mind are able to cope, so think about taking regular exercise twice a week.

Consider whether or not it would be better to share the problem. Seek help or advice to see if the difficult situation could be altered or ended. Think about how you might relieve stress yourself, for example exercise and relaxation time with friends (this is now called stress management!). Stress can also be connected with a difficult relationship or work that demands too much of you. A drastic change in your life might be serious, yet your peace of mind in the long term is of more value. Tranquillisers are not the answer.

Talking with others, particularly if they have experienced the same problems, can help. For some problems there are self-help groups, allowing people to share in the experiences of others who have gone through similar problems and coped with them. Your local social services office will tell you about such groups. Social services exist to help people with problems by referring them to agencies best suited to help.

Do not drink any more alcohol than usual and do not take it out on those around you.

Source document: www.whatshouldido.com/stress.shtml

Depression

Key Signs

- Low mood, especially in the morning.
- Tearfulness often without apparent reason.
- Poor concentration.
- Disturbed sleep, especially waking early unable to return to sleep..
- Change in sex drive.
- Poor self image.
- Loss of confidence.
- Irritability that is out of character.
- Alcohol and drug abuse that is unusual.
- Inability to enjoy usual pleasures like good music, art or games.
- Feeling suicidal and planning how to end your life.
- Tiredness all the time, severe lack of energy or stamina.

Self Help

What you can do yourself

If you suffer some of the key signs for a ***fortnight or more*** your quality of life will be seriously affected and your work and social life will suffer.

It is sometimes hard to acknowledge there may be a problem and that help to assess and treat it is available through your local GP. Close friends or partners are often the first people to notice someone is depressed and can make a difference in encouraging or discouraging them seeking help.

Many myths and taboos surround the subject based on ignorance and prejudice.

Depression has a biological component - it is not about being a 'wimp' or having to 'pull your socks up'. Modern antidepressants are safe and ***NON*** addictive. They are not stimulants but work by re-balancing the levels of certain brain chemicals involved in setting mood.

Because there is an inherited component to depression younger members of families with a history of the disease have heard and assimilated a lot of old fashioned prejudices and are often frightened to seek help for fear of letting the family down. This is not the case.

Contact your doctor if you want advice about symptoms of depression.

Your doctor will be able to assess the level and severity of depression you have and advise about possible medication.

He/she may also carry out various blood tests to exclude other physical illnesses like thyroid disease or anaemia.

If you are prescribed anti-depressants you will be advised about possible mild side effects, like transient nausea, and are likely to be on them for a number of months to fully treat the depression and consolidate the recovery to minimise the risk of relapse.

There is often a delay of 7 to 10 days before anti-depressants begin to work and then the effects are gradual often with 'good' and 'bad' days initially.

Contact your doctor immediately if you are consistently feeling suicidal. Friends often try to persuade suicidal people to attend a doctor.

Source document: www.whatshouldido.com/depression.shtml

Appendix 9: Chiropractic Clinic Computer Interviewing System

Questions

Expectation

Chiropractors see health as the sum of your mental, physical and chemical health, and all are equally important to your overall health. Chiropractors specialise in improving your physical health but are very aware of the other 2 areas.

1. Do you think your problem is
    a. A simple, isolated event?
    b. More complex and will need time to improve?
    c. Long-term with flair ups now and then?
    d. Degenerative and will require maintenance care?
2. Are your symptoms (pain/tingling/stiffness/spasms/headaches etc)
    a. The problem you want addressed?
    b. The thing that finally made you decide to seek help?
3. Do you think chiropractic care can
    a. Resolve your problem completely?
    b. Help you manage your problem?
    c. Doesn't seem to be helping at all?
4. Do you feel the 20 minutes allocated for your treatment is
    a. Too long?
    b. About right?
    c. Too short?

Improvement

The symptoms (pain/tingling/stiffness/headaches etc) that brought you to see a chiropractor are your body telling you that something is wrong. Although relief from these symptoms is a priority for both you and us they are only one indicator of how you are responding to treatment.

5. How much change have you noticed in your everyday activities since starting chiropractic care?
    a. I can do most things I had been avoiding
    b. I can do more, but still get sore
    c. No change in what I can do
    d. I am doing less than before
6. Mentally, can you tolerate your problem better since starting chiropractic care?
    a. Understanding what is happening makes me less anxious
    b. A little easier, still concerned about it
    c. Still worried, I don't understand what is happening

Education

Chiropractic care involves the patient taking an active role in their care. Understanding what caused the problem you have, and how to adapt your daily activities to help your body heal, make your life easier and the treatment more effective.

7. Do you understand how the problem you have developed?
    a. I see a chain of events that caused it
    b. Looking back, something was not right for a while
    c. It suddenly happened without any apparent reason
    d. I don't understand what happened
8. During your treatment you would have received some advice, such as walk for 20 minutes every day. Have you been able to implement this advice?
    a. Yes
    b. No
9. How useful was the **advice** you received about changes to everyday activities?
    a. It made a major difference to my lifestyle
    b. It has been helpful, allowing me to do a little more
    c. It has not helped
    d. It has made me sorer, and do less
    e. I am not aware of any advice
10. During your treatment you may have been given exercises to do. Have you been able to perform these exercises?
    a. Yes
    b. No
11. How useful were any **exercises** you received to your everyday activities?
    a. I feel much more comfortable and confident in what my body can do
    b. I feel a bit easier
    c. I don't feel they make any difference
    d. I feel sorer after exercising
    e. I have not been given any exercises

General Health

The nervous system controls every part of the body, and every function and movement of the body. Chiropractic care often results in changes that you might not have expected, for example; breathing, digestion, bladder function, sleep pattern, bowel function, your skin, energy levels and so on.

12. Have you experienced any changes that seem unrelated to those you came to see the chiropractor with?
    a. I feel generally better
    b. A specific problem has settled
    c. I noticed a temporary change in my health
    d. No change

13. Do you feel that having time to talk in confidence about your health and other personal matters is
    a. Very useful to help understand and resolve concerns
    b. Allows me to get things off my chest
    c. Of no benefit
14. Has chiropractic care altered how you see your health?
    a. It had shown me how I can be more in control of my health
    b. It has shown me how one thing can affect another
    c. It has not changed my attitude to health
15. Since having chiropractic care, do you feel more able to affect your long-term health?
    a. I want to learn more and have made some changes already
    b. I am making changes
    c. I can see changes I can easily make
    d. I do not see it as affecting my health

Appendix 10: Chiropractic Clinic Record Sheet and Chiropractor Questionnaires

Chiropractor Record Sheet

Date: **Time:** **Initials:** **Practice:**

Gender M/F	Age	Score A	Score D	Did it highlight communication difficulties? Y/N	Useful aid to consultn? Scale 1 (v useful) to 4 (not useful)	Did it cause you to alter management? (if yes, how?)	Chirop. surprised by HADS results? Y (high, low)/N	Other comments

<u>Chiropractor Post-Clinic Questionnaire</u>: to be completed after each day/clinic when the interview is used.

Date: ***Time:*** ***Initials:*** ***Practice:***

1. Did the pre-consultation computer interview alter the style of your treatment sessions in any way? Please give examples where relevant.

   Yes No

   Examples:

2. Did the pre-consultation computer interview highlight any communication difficulties? Please give examples where relevant.

   Yes No

   Examples:

3. Did you deal with any extra issues today due to the computer interview? Please give examples where relevant.

   Yes No

   Examples:

4. This pre-consultation computer interview uses the HADS interview. It is relatively easy to implement other screening tools. Are there any other areas/issues that you feel would be useful to screen for using standard screening tools?

5. Which particular groups of your patients do you think would be most likely to benefit from a pre-consultation interview using a computer?

6. How willing would you be to use a pre-consultation computer interview in the future? Using a scale of 1 (very willing) to 4 (not at all willing).

   1 2 3 4

7. How do you rate the potential usefulness of computer decision-support systems where data input is done directly by the patient? Using a scale of 1 (extremely useful) to 4 (not at all useful).

   1 2 3 4

8. Are there any changes that you would like to see (in the questions or interviews themselves or in the way the computer interview is used or managed)?

Appendix 11: Chiropractic Clinic Patient Sheets and Post-Consultation Questionnaire

Patient Information Sheet

About the research

This research project is to test the use of interviews conducted by a computer in a chiropractic clinic. Your selection to take part in this trial is based purely upon the day and time of your appointment and no one other than your chiropractor has access to your records.

You will first be asked a number of questions regarding the changes that you have experienced since starting chiropractic care. This information may be useful to highlight any issues that are still outstanding in the management of your problem.

Then the Hospital Anxiety and Depression Scale screening interview will be run. There are an increasing number of people suffering from anxiety and depression, many of whom go undetected. The use of this screening interview could be a means of efficiently recognising these individuals.

You will finally be asked a few questions about how you found the computer interview to use. The interview process will take you about 15 minutes to complete.

We want to discover:

1. Can the computer be used easily?
2. Did the computer interview provide useful information for the patient and chiropractor?
3. Did using the computer interview affect the following treatment in any way?

If you have any questions at any stage then please ask and we will be happy to help you.

What to do

To do the interview, please follow the instructions on the screen.

When you have completed the interview you will be shown your answers to the questions regarding changes since starting chiropractic care and the results of the screening interview. Please print this screen/page and show it to the chiropractor at the start of today's treatment.

Your help in this testing is greatly appreciated and any comments that you make will be welcomed.

All the data collected is anonymous so no personal data about you is collected, other than in your treatment.

Patients Post-Consultation Questionnaire

Please indicate your level of agreement with the following statements by circling the number which most closely represents your opinion (1 indicates total disagreement and 5 indicates total agreement).

1. I think that the information I gave during the computer interview was useful to the treatment session.

Strongly Agree 1 2 3 4 5 Strongly Disagree

2. I think that the computer interview printout contained information that I have never previously discussed with the chiropractor.

Strongly Agree 1 2 3 4 5 Strongly Disagree

3. I think that the use of the computer interview increased the number of issues discussed during the treatment session.

Strongly Agree 1 2 3 4 5 Strongly Disagree

4. I think that the use of the computer interview did help me to be more prepared for the treatment session.

Strongly Agree 1 2 3 4 5 Strongly Disagree

5. I think that the use of the computer interview helped me to think of questions to ask during the treatment session.

Strongly Agree 1 2 3 4 5 Strongly Disagree

6. I am likely to agree to use a computer interview in the future.

Strongly Agree 1 2 3 4 5 Strongly Disagree