

# **REDUCING HEALTH WORRY AND SEARCHING THE INTERNET FOR HEALTH INFORMATION**

A thesis submitted to the University of Manchester for the degree of Doctor of Clinical Psychology in the Faculty of Biology, Medicine and Health, School of Health Sciences

**2016**

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## Thesis Abstract

This thesis titled 'Reducing health worry and searching the Internet for health information' was completed by Sara Bardsley for the degree of Doctor of Clinical Psychology (ClinPsyD) at The University of Manchester. The thesis was submitted on the 14<sup>th</sup> of July 2016 for examination in September 2016 and incorporates three chapters.

Chapter 1 presents a systematic review of the literature examining the relationship between impulsivity and problematic internet use. The systematic review was prepared for publication in the Journal 'Clinical Psychology Review'. A comprehensive literature search was conducted using the following search engines: EMBASE, PsycINFO, MEDLINE, and CINAHL. Twenty-four studies met inclusion criteria and were identified for the systematic review. Each study was quality rated using a quality assessment tool. The findings indicate a consistent relationship between impulsivity and problematic internet use in the majority of reviewed articles. Findings from the review, strengths and limitations, and theoretical and clinical implications are discussed.

Chapter 2 details a preliminary test of the effects of Attention Training Technique (ATT) on reducing problematic health-related Internet use in health anxious individuals. The empirical paper was prepared for publication in the Journal 'Behaviour Research and Therapy'. Thirty-seven participants identified as health anxious on the Short Health Anxiety Inventory (SHAI) and having problematic health related internet use on the Online Health Beliefs and Behaviours Inventory (OHBBI) were randomly allocated to receive either ATT or no treatment. Participants completed measures of health anxiety (SHAI), illness-related Internet use (OHBBI) and problematic health related Internet use (OHBBI) at baseline and three time points post-intervention. Emotional (State-Trait Anxiety Inventory), somatic (Checklist for Symptoms in Daily Life), and physiological responses (skin response conductance) to a health relevant stressor were also measured before and after the intervention. Analyses of Covariance indicated that the ATT intervention resulted in a significantly greater reduction in health anxiety, illness-related Internet use and problematic Internet use for health purposes at times 2 and 3 than no treatment when controlling for baseline scores. There was no significant difference in physiological arousal in response to a health-relevant stressor between the ATT and no treatment group but state physical symptoms improved at time 2 when controlling for baseline scores. Conclusions: The findings indicate ATT and metacognitive strategies are a potentially effective treatment for health anxiety and problematic Internet use, although longer-term follow-up data are awaited.

Chapter 3 presents a critical reflection, including the evaluation and appraisal of the systematic review and empirical paper. It also appraises the research process as a whole and examines the strengths and limitations of the systematic review and empirical paper.

## **Declaration**

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

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## Acknowledgements

I would like to thank Dr Richard Brown for supervising me on this project. I have hugely appreciated his patience, guidance and support during my time on the Doctorate. Richard made the research process as smooth as it could have been for me and that is something that I have really valued. Always a calming influence during times of instability, he certainly kept me grounded and always enabled me to see the light at the end of the tunnel. I would also like to extend my thanks to Prof Adrian Wells for supervising me and providing me with a great opportunity to learn Attention Training Technique. Supervision was most definitely interesting and varied and I always looked forward to his feedback on my progress.

My cohort has been a tremendous source of support throughout the process of this thesis and although I would like to thank every one of them individually, I wanted to acknowledge the friendship, comradery and shared moments of despair in the basement. Thanks to (P) Vanessa Herbert and Gemma Knight for giving me that final push to complete my thesis, I really could not have got to the end without them.

It also feels important to acknowledge Mufasa and friends who appeared just at the right moment to remind me exactly where I was in this process. Finally, I would like to thank my family and friends for always caring and making sure I was on track and a special thanks to Tom Singleton whose support and kindness got me through the final week.

**Title**

**A Systematic Review of the Literature Exploring the  
Relationship between Problematic Internet Use and  
Impulsivity**

**The following paper has been prepared for submission to 'Clinical Psychology Review'.  
The guidelines for authors can be found in Appendix A.**

## **Abstract**

As the importance of the Internet in our lives has grown, so too have concerns about the negative impact of internet use. Problematic Internet use (PIU), characterized by excessive use of the internet and difficulties controlling the impulse to go online, can be a serious problem that leads to marked distress and functional impairment. PIU is typically understood as a type of behavioural addiction, where a lack of impulse control is considered to be a key feature. This systematic review aims to synthesise and evaluate the research pertaining to the relationship between impulsivity and PIU. EMBASE, PsycINFO, MEDLINE, and CINAHL research databases were systematically searched to identify relevant articles. Inclusion and exclusion criteria were applied and the quality of the final studies was assessed using a well validated quality assessment tool (Downs & Black, 1998). Twenty four studies met the inclusion criteria, which identified studies using either case control or correlational designs. The majority of studies were from East Asia, they used different populations including clinical and student samples, and they discussed varying definitions of impulsivity and PIU. Additionally, different measures of impulsivity and PIU were used in the reviewed articles.

A clear and consistent relationship between impulsivity and PIU was found across the majority of studies. A relationship was present across all types of questionnaire and behavioural measures apart from differences between clinical groups (problematic Internet use (PIU) and pathological gambling) and methodological quality was often lower for studies which did not find a relationship between impulsivity and PIU. Findings from the review, limitations and clinical implications are discussed and the relationship between impulsivity and PIU is considered.

**Keywords** Problematic internet use, internet addiction, impulsivity, metacognitive treatment, cognitive attentional syndrome

## Introduction

The Internet is playing an increasing role in our lives and has taken up an ever expanding place in our society over time (Burnay, Billieux, Blairy & Laroi, 2015). It is estimated to be used by more than two and a half billion people worldwide (Argaez, 2016). Over 80% of the UK population has access to the Internet ("International Telecommunications Union," 2016). Positive aspects of the Internet include its capacity to support cognitive, social and physical development as well as its ability to deliver psychological treatments (Guan & Subrahmanyam, 2009).

Paralleling the expansion of the Internet are emerging concerns about the harmful effects of Internet use. The term *problematic Internet use* (PIU) is often used to refer to excessive Internet use and difficulties controlling the impulse to use the Internet (Shapira, Goldsmith, Keck, Khosla, & McElroy, 2000; Lee et al., 2012). PIU can be a serious problem, which impacts negatively on social functioning and psychological and physical health (Aboujaoude, 2010). Inconsistencies in defining PIU and methods for researching it have created a gap in how it is understood scientifically (Aboujaoude, 2010). Other terms for PIU include Internet dependence (Scherer, 1997) and pathological Internet use (Davis, 2001). Internet addiction (IA) is a specific behavioural disorder, whereby inability to control Internet use leads to increased distress and impairment in functioning (Shapira et al., 2000; Young, 1998).

A recent systematic review identified various associations between IA and psychiatric comorbidity such as depression, anxiety, attention deficit hyperactivity disorder, obsessive compulsive symptoms, hostility and aggression (Carli et al., 2013). IA is increasingly considered a serious public health issue (Ko, Yen, Yen, Chen, & Chen, 2012) and is a common mental health concern worldwide (Spada, 2014) with prevalence rates ranging from 0.7% to 35% depending on the country and sample of study (respectively (Bakken, Wenzel, Gotestam, Johansson, & Oren, 2009; Wu & Zhu, 2004).

There is debate over whether Internet addiction is most appropriately classified as an impulse control disorder (Treuer, Fabian, & Furedi, 2001) or as a behavioural addiction (van Holst, van den Brink, Veltman, & Goudriaan, 2010). Although the mechanisms of this phenomenon have not been clearly defined within the literature (Dalbudak et al., 2013), it has typically been understood within the context of models of behavioural addiction, with a lack of impulse control as a key feature (Block, 2008; Shapira et al., 2003).

The conceptualisation of PIU as a dysfunctional coping strategy i.e. a maladaptive self-regulatory strategy has been discussed in the literature (LaRose, Lin & Eastin, 2003) and the potential role of cognitions in the development and maintenance of PIU has been indicated (Davies, 2001). The role of metacognitions with reference to the maintenance and development of psychological disorders has also been highlighted (Wells, 2009). Metacognition refers to the processes, knowledge, and strategies involved in evaluation, monitoring, and controlling cognitions (Wells, 2009). The S-REF model conceptualises the role of metacognition in the development and maintenance of mental disorders, and suggests that maladaptive coping strategies impede the modification of unhelpful metacognitions. This creates a particular pattern of responding to experiences, which causes individuals to become 'stuck' in negative cognitive-emotional states (cognitive attentional syndrome; CAS) (Wells, 2009).

Previous research has applied the S-REF model to addictive behaviours and has conceptualised the CAS and metacognitive beliefs within the three identified phases of addictive behaviours i.e. pre-engagement, engagement, and post engagement (Spada, Caselli & Wells, 2013). For example, urges, images, thoughts, or memories activate and trigger the S-REF and metacognitive beliefs in the pre-engagement stage, which influences appraisal and coping style (Spada, Caselli, Nikčević, & Wells, 2015). Metacognitive beliefs trigger the perseverative processing of intrusions and attempts to suppress them (CAS), which leads to an increase in distress and desire in relation to a specific behaviour. As the addictive behaviour intensifies, negative metacognitive beliefs develop in relation to uncontrollability, which contributes to its addictive and continuous nature (Spada, Caselli, Nikčević, & Wells, 2015). If PIU is more broadly understood within the context of models of behavioural addiction then the role of metacognition may be implicated.

There is also evidence of shared clinical features, comorbidity and neurobiological correlates in IA and other behavioural addictions (Grant, Potenza, Weinstein, & Gorelick, 2010). Definitions of IA share features with substance abuse (Anderson, 2001) and pathological gambling (Young, 1996), including problems with tolerance, withdrawal, preoccupation with the stimulus and functional impairment. PIU has been described as a maladaptive coping strategy and a way in which individuals try to deal with their emotional distress (Kardefelt-Winther, 2014). Research suggests that high levels of impulsivity influence Internet addiction, alongside other factors such as personality traits and co-morbid psychopathology (Billieux et al., 2013).

There is disagreement in the literature regarding how to define and measure impulsivity (Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001). Impulsivity has been conceptualised as a personality trait associated with risk taking, lack of planning and rapid decision making (Eysenck & Eysenck, 1977). Patton, Stanford, and Barratt (1995) describe three dimensions of impulsivity, including motor (the tendency not to consider the consequences of an act before acting), cognitive (rapid decision making) and non-planning (behaviours that are considered in the present moment and lack planning for the future). Impulsivity is often associated with response-inhibition or inhibition-control aspects of executive functioning (Choi et al., 2014).

Research suggests that impulsive behaviours that occur in the context of negative emotional states may have the function of reducing the individual's immediate distress, but without them considering potentially negative consequences in the longer term (Thorberg & Lyvers, 2006). Emotional states have been found to inhibit executive functioning (Pessoa, 2009), which suggests an individual experiencing distress will have reduced ability to exert control (Billieux, Gay, Rochat, & Van der Linden, 2010). The proneness to behave impulsively in heightened emotional states (Cyders & Smith, 2008) (the feature of impulsivity known as urgency) may indicate a tendency to engage in problematic behaviours (Billieux et al., 2010), such as repeated and unhelpful Internet use.

The rate at which the Internet is becoming a central part of our lives suggests that its potential to impact negatively on our psychological functioning, mental health and well-being will only increase. Understanding why people develop problems with Internet use and the mechanisms that serve to maintain it is therefore crucially important. Although numerous studies have sought to understand this by investigating the relationship between impulsivity and PIU (Billieux et al., 2010; Cao, Su, Liu, & Gao, 2007), there has been no attempt to synthesise and evaluate this research to date. In this paper, we describe a systematic review of research studies investigating the relationship between PIU and impulsivity.

## **Method**

### *Search strategy and selection*

The systematic review aimed to evaluate the evidence for a correlation between problematic Internet use and impulsivity. The literature was reviewed by searching online databases EMBASE, PsycINFO, MEDLINE, and CINAHL from 1989 (advent of the Internet; Berners-Lee, 2010) to 27<sup>th</sup> March 2016. The review used a title and abstract word strategy, which included the following terms: 1) for problematic Internet use: Internet OR disorder OR cyberchondria; 2) for impulsivity: impuls\* OR inhibit\* OR disinherit\* OR metacog\*. The above terms were used to capture general problematic Internet use rather than specific types of problematic Internet use and impulsivity.<sup>1</sup> For the purpose of this review the terms PIU, IA and any other reference to PIU within the reviewed articles are used interchangeably.

Citations were exported to reference management software (Endnote Library) and duplicates were removed. A three-stage screening process using the PRISMA approach was completed. Stage one involved reviewing the article titles and abstracts for relevance. Articles were screened according to the inclusion and exclusion criteria stated below. If the abstract indicated that the study evaluated the relationship between problematic Internet use and impulsivity, the full text was acquired. Stage two involved a full-text screening process where the same inclusion and exclusion criteria were applied. The third stage involved the identification and removal of articles that focused specifically on Internet gaming populations, as the clinical features, mechanisms and functions involved in online gaming were considered to be different to those involved in more general PIU<sup>2</sup>. It is important to distinguish between PIU and online gaming as they are two different types of behaviours, which are conceptually distinct (Kiraly et al., 2014).

### *Criteria for inclusion of research articles*

English language articles were included only. Papers had to describe quantitative empirical studies published in a peer reviewed journal that included measures of PIU and

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<sup>1</sup> The choice of search terms will be discussed in the critical review chapter.

<sup>2</sup> Articles which specifically focused on Internet gaming populations were excluded at stage 3 rather than at stage 2 of the screening process. Additionally, PIU specifically focused on Internet gaming populations was not specified as an exclusion criterion at stage 1. This will be discussed in the critical evaluation section.

impulsivity and which provided data about the relationship between the two. This included both correlational studies and case control studies where people with PIU were compared to those without PIU or to another clinical population. Samples where PIU was exclusively identified as online gaming were excluded.

### *Quality Assessment*

The Downs and Black Checklist (Downs & Black, 1998) was used to assess the quality of the reviewed articles. The tool, which comprises 27 items, assesses methodological quality of randomised and non-randomised studies, and focuses on reporting, external validity, internal validity, and power. The tool has high internal consistency and good test-retest and inter-rater reliability (Downs & Black, 1998). For the purpose of this review, the tool was modified to make it more appropriate for the final reviewed articles. The articles consisted of case control and correlational designs and 17 items were used from the original checklist. From those 17 items, further modifications were made dependent on the design of the reviewed articles and specific items were not used to assess quality if they were deemed inappropriate e.g. item 15 regarding blinding was not considered relevant when assessing the quality of correlational designs. Each quality item was scored using the following criteria: 0 = unable to determine, 0 = no, and 1 = yes, with the exception of item 5 which was scored using the following criteria: 0 = no, 1 = partially, and 2 = yes. The proportion of rated items scoring positively was used as the overall quality rating.

The quality rating process consisted of two stages. In the first stage, quality assessment was performed by two researchers who independently assessed the quality of a five randomly selected articles from those that were included in the final review. Following this, ratings were shared and discussed to identify discrepancies and ensure consistency. Agreement between the two independent raters was 0.9 (Cohen's kappa), which indicates excellent inter-rater reliability (Cohen, 1960). After sources of disagreement were identified, decisions regarding how quality ratings should be made were clarified. For example, it was agreed that information regarding psychometric properties of measures used should not be assumed if not present and whichever item this related to should receive a lower quality rating to represent this. Once all discrepancies were resolved and, being confident that a reliable method for rating the



quality of articles had been established, the second stage involved the researcher applying these rules to rating the remaining articles included in the review.

#### *Data extraction*

All included articles were read in order to extract and record details pertaining to areas of interest relevant to the review. Details were recorded onto a standardised extraction form, which included the following information: authors and year of publication, country of origin, methodology (study design, procedure for recruitment, and measures), participant characteristics (population, sample size, age, and gender), and outcomes on a measure of the relationship between PIU and impulsivity.

## Results

A systematic search of the literature was performed; the study identification and selection process is outlined in a PRISMA diagram (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (see Figure 1). Researchers have used different methods to assess impulsivity and the results have been organized accordingly. An overview of the reviewed papers is presented in Table 1; quality ratings assigned to each article included in the review are presented in Appendix B.

It is noteworthy that none of the reviewed articles are from the UK, with most studies completed in East Asia and particularly China. This raises questions about generalisability. A large proportion of the research was judged as low quality. Common shortcomings of the low quality studies included representative sample of target group, and insufficient information or poor validity and reliability of outcome measures. Shortcomings also included participants recruited from different populations, insufficient information regarding the time period for recruitment, inadequate adjustment for confounding variables and insufficient power to detect a clinically important effect ( $p < .05$ ). The interpretation of findings within this review considers quality ratings when drawing conclusions, with lower quality findings given less emphasis.<sup>3</sup>

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<sup>3</sup> Issues regarding study quality will be discussed in the critical appraisal chapter.

Figure 1. PRISMA Diagram

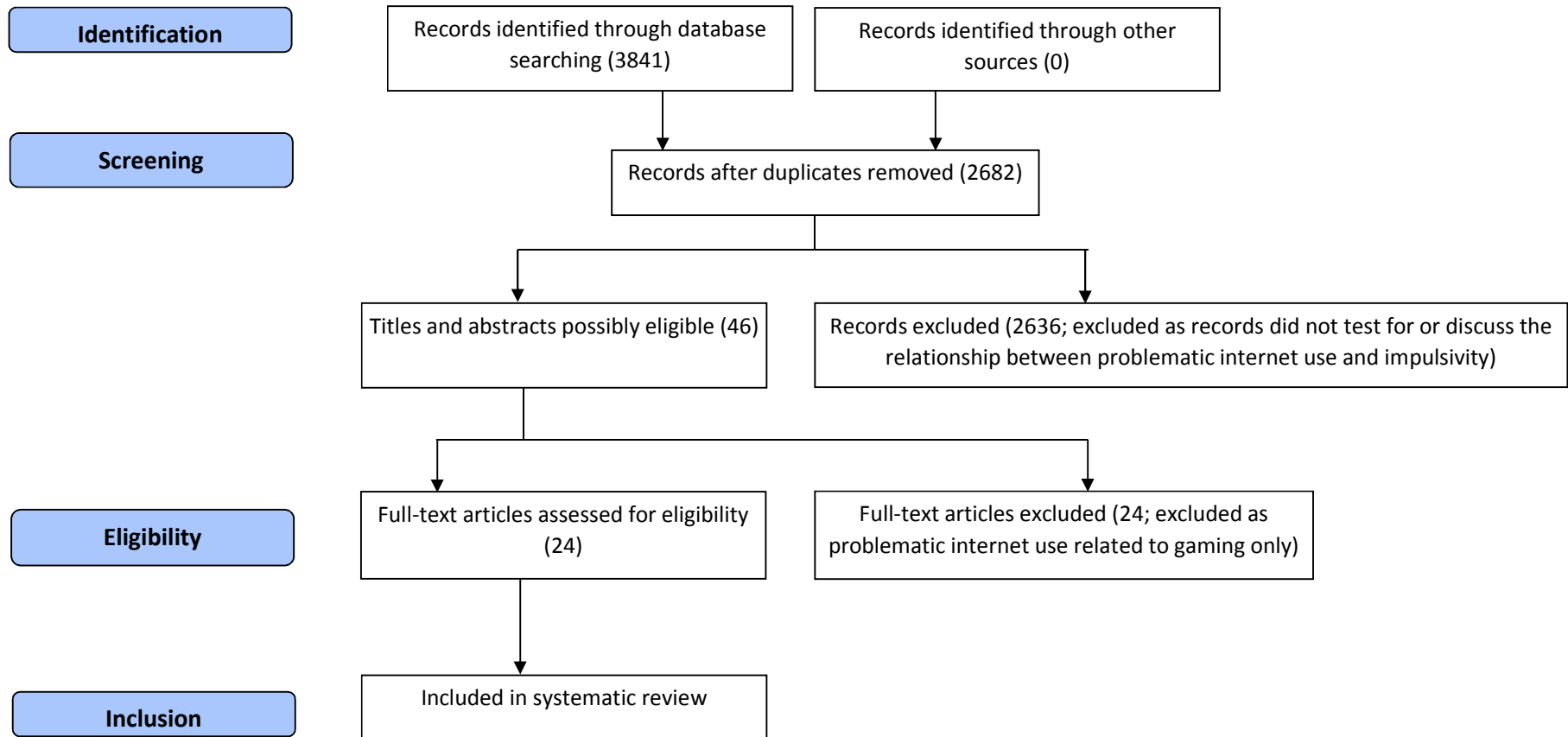


Table 2: Characteristics of included studies

Author and date of study	Quality rating	Participants	Design	Measures		Findings	Correlation coefficient/ Cohen's d
				Internet use	Impulsivity		
Balconi and Finocchiaro (2016)	62.5%	56 undergraduate students at The Catholic University of Milan. 28 with high IAT scores and 28 with low IAT scores	Case control	Internet Addiction Inventory (IAT)	Go/no-go task	Response times measured as an indicator of impulsivity. Participants with high IAT scores were significantly quicker on go and no-go trials than participants with low IAT scores. The low IAT group responded significantly slower for no-go trials than go trials. Slower responses are interpreted as a sign of inhibitory processing and quicker responses as a sign of impulsivity.	Insufficient data presented to calculate effect size.
Cao et al. (2007)	87.5%	100 high school students recruited from four high schools in Changsha City, China. 50 in the IA group and 50 in the control group.	Case control	Diagnostic Questionnaire for Internet Addiction (YDQ)	Barratt Impulsiveness Scale II (BIS-II).  GoStop Impulsivity Paradigm.	IA group scored significantly higher on the attentional key and motor key BIS-II subscales and for BIS-II total score compared to the control group. Errors (failure to inhibit a response) measured as an indicator of impulsivity. The BIS-II attentional key subscale correlated with trials where the target stop was presented at 50ms and 350ms. The BIS-II motor key subscale correlated with trials where	*Differences between IA and controls: - attentional key d=.61, 95% CI (0.2077, 1.0096). - motor key d= 0.52, 95% CI (0.1244, 0.9217). - total BIS scores d = 0.61, 95% CI (0.2172, 1.0197).  *Attentional key correlated with: - target stop presented at 50ms r =

						<p>the target stop was presented at 50ms, 150ms, 250ms, and 350ms. The BIS-II non-planning key correlated with 50ms and 350ms target stop trials.</p> <p>YDQ scores correlated positively with attentional key, motor key and non-planning BIS-II subscales. There was a significant positive correlation between YDQ scores and number of errors on the GoStop task.</p>	<p>0.297 and 350ms <math>r = 0.213</math></p> <p>*Motor key correlated with: - target stop presented at 50ms <math>r = 0.225</math>, 150ms <math>r = 0.239</math>, 250ms <math>r = 0.274</math>, and 350ms <math>r = 0.275</math></p> <p>*Non planning correlated with: - target stop presented at 50ms <math>r = 0.251</math> and 350ms <math>r = 0.220</math></p> <p>*IA correlated with errors: - target stop presented at 50ms <math>r = 0.461</math>, 150ms <math>r = 0.475</math>, 250ms <math>r = 0.460</math>, 350ms <math>r = 0.508</math></p> <p>*Differences between IA and controls: - target stop presented at 50ms <math>d = 1.57</math>, 95% CI (1.121, 2.0176), 150ms <math>d = 1.47</math>, 95% CI (1.024, 1.907), 250ms <math>d = 1.61</math>, 95% CI (1.1619, 2.0644), 350ms <math>d = 1.89</math>, 95% CI (1.4199, 2.363).</p>
Zhou, Zhou and Zhu (2016)	53.13%	IAD (23) and PG (23) groups recruited from a Psychology Department of Wuxi Mental Health Centre of Nanjing Medical University, China (WMHC). Controls (23)	Case control	Modified Diagnostic Questionnaire for Internet Addiction (YDQ)	Barratt Impulsiveness Scale II (BIS-II).  Go/no-go task.	<p>Attentional key, non-planning, and motor key BIS-II subscale scores and total BIS-11 scores were significantly higher for the IAD and PG groups compared to the control group. The IAD group scored significantly higher on the attentional key, non-planning, and motor key subscales, and total BIS-11 scores compared to the PG group. Reaction time (RT), hit, and error rates measured as an indicator</p>	<p>*Differences between IA and controls: - attentional key <math>d = 2.60</math>, 95% CI (1.8178, 3.3888). - motor key <math>d = 2.06</math>, 95% CI (1.3478, 2.7786). - non planning <math>d = 2.99</math>, 95% CI (2.1551, 3.8393). - BIS total score <math>d = 2.97</math>, 95% CI (2.1355, 3.8129). - error rate <math>d = 0.81</math>, 95% CI (0.2089,</p>

		recruited from people living in Wuxi City, China.				of impulsivity. Error rates for the IAD and PG groups were significantly higher and hit rates were significantly lower than the control group. Error rates for the IAD group were significantly higher and the hit rate was significantly lower than the PG group. RT's not significantly different between the IA, PG and control groups.	1.4113). - hit rate d= -11.5, 95% CI (-13.9199, -9.0801).
Zhou, Zhu, Li and Wang (2014)	53.13%	IAD group (22) recruited from the Psychology Department of WMHC. AD group (22) were in-patients at the Psychiatry Department (WMHC). Controls (22) recruited from people living in Wuxi City, China	Case control	Modified Diagnostic Questionnaire for Internet Addiction (YDQ)	Barratt Impulsiveness Scale II (BIS-II).  Go/no-go task.	Attentional key, motor key, and non-planning BIS-II subscales and BIS-II total scores were significantly higher in the IAD and AD groups compared to the control group. No significant differences for the BIS-II total score or subscales between the IAD and AD groups.  Reaction time, hit, and error rates measured as an indicator of impulsivity. Error rates for the IAD and AD group were significantly higher and hit rates were significantly lower compared to the control group. Error rates and hit rates were not significantly different between the IAD and AD groups.  No correlational data regarding the relationship between behavioural measures and questionnaire measures of impulsivity. RT's not significantly different between the IAD, AD, and control groups.	*Differences between IA and controls: - attentional key d = 0.98 - motor key d = 0.76 - non planning d = 0.62 - total BIS d = 1.18 - error rates d = 0.81 - hit rate d = 0.89

Zhou, Yuan, Yao, and Cheng (2010)	59.4%	IAD group (26) recruited from the IAD Therapeutic Department (WMHC). Controls (26) recruited through people living in Wuxi City, China	Case control	Modified Diagnostic Questionnaire for Internet Addiction (YDQ)	Barratt Impulsiveness Scale II (BIS-II).  Go/no-go task.	Attentional key and motor key subscales for the BIS-II and BIS-II total scores were significantly higher in the PIU group compared to the control group. Non-planning scores were not significantly different between the PIU and control group Reaction time, hit, and error rates measured as an indicator of impulsivity. Significantly higher scores for error rates and significantly lower scores for hit rates for the PIU group compared to the control group. RT's were not significantly different between the two groups. No correlational data regarding the relationship between behavioural and questionnaire based measures of impulsivity.	Differences between IA and controls: - attentional impulsiveness $d=0.84$ , 95% CI (0.2721, 1.4062). - motor key $d=.49$ , 95% CI (-0.0663, 1.0368). - total BIS scores $d = 0.677$ , 95% CI (0.1181, 1.236). - error rate $d = 0.65$ , 95% CI (0.0946, 1.2103). - hit rate $d = -.4$ , 95% CI (-4.9415, -3.0585).
Li et al. (2016)	68.75%	Chinese college students. 28 in the PIU group and 28 in the control group.	Case control	Diagnostic Questionnaire for Internet Addiction (YDQ)	Barratt Impulsiveness Scale II (BIS-II).  Delay and probability discounting tasks	The PIU group obtained significantly higher scores on the BIS-II compared to the control group. YDQ scores were positively correlated with total BIS-11 scores and with each of the three subscales on the BIS-II. The PIU group had significantly faster discounted delayed gains compared to the control group. No correlational data regarding the relationship between behavioural and questionnaire based measures of impulsivity.	*Differences between IA and controls: - BIS total score $d = 1.28$ , 95% CI (0.7067, 1.8569). - discounting delays $d = -.4$ , 95% CI (-4.9073, -3.0927)  *IA correlated with: - attentional key $r = 0.52$ - motor key $r = 0.49$ - non planning $r = 0.44$ - BIS total score $r = 0.52$ ,

Choi et al. (2014)	56.25%	23 IA and 24 controls recruited using an online referral system from the Health Service Centre of a university in Seoul, South Korea	Case control	Internet Addiction Test (IAT)	Barratt Impulsiveness Scale II (BIS-II)	The IA group scored significantly higher than the control group on the BIS-II (total score and all subscales).	Differences between IA and controls: - attentional impulsiveness d=0.77, 95% CI (0.1798, 1.3655). - motor impulsiveness d=.28, 95% CI (-0.2943, 0.8557). - non planning d= 1.29, 95% CI (0.6642, 1.9218). - total BIS scores d = 2.09, 95% CI (1.3826, 2.8057).
Dalbudak et al. (2013)	68.75%	39 moderate/high IA, 82 mild IA, and 198 without IA university students from two universities in Ankara.	Case control	Internet Addiction Scale (IAS)	Barratt Impulsiveness Scale II (BIS-II)	The moderate/high IA group obtained significantly higher scores on the attentional impulsiveness and motor impulsiveness subscales and BIS-II total scores than the without IA group. The mild IA group scored significantly higher on the attentional impulsiveness and motor impulsiveness subscales and BIS-II total scores than the without IA group. The moderate/high IA and mild IA groups scored significantly higher for the non-planning impulsiveness subscale of the BIS-II compared to the without IA group. IAS scores correlated with attentional impulsiveness, motor impulsiveness, non-planning impulsiveness subscales and total BIS-II scores.	*IA correlated with: - attentional impulsiveness r = .39 - motor impulsiveness r = .38 - total BIS scores r = .42  *Differences between moderate/high IA and mild IA: - attentional impulsiveness d=1.4, 95% CI (1.0325, 1.734). - motor impulsiveness d=1.33, 95% CI (0.9697, 1.6972). - non planning d= 0.84, 95% CI (0.4892, 1.1924). - total BIS scores d = 1.48, 95% CI (1.1117, 1.8483).  * Differences between mild IA and no IA: - attentional impulsiveness d=0.55, 95% CI (0.2932, 0.8161). - motor impulsiveness d=0.41, 95% CI (0.1416, 0.6607).



Hwang et al. (2014)	50%	Male out-patients recruited from the outpatient clinic of the Seoul Metropolitan Government-Seoul National University, South Korea. Outpatients diagnosed with IA (30) or AD (30). Healthy controls (30).	Case control	Young's Internet Addiction Test (IAT), Korean Version.	Barratt Impulsiveness Scale II (BIS-II)	Total BIS-11 scores were significantly higher in IA and AD groups compared to the control group. Motor and non-planning subscales of the BIS-II were significantly higher in IA and AD groups compared to the control group. Correlation revealed that severity of IA significantly correlated with BIS-11 scores.	*Differences between IA and controls: -motor key $d = 0.09$ , 95% CI (0.3759, 1.4388). - non planning $d = 0.9886$ , 95% CI (0.4525, 1.5247). - BIS total score $d = 0.99$ , 95% CI (0.4312, 1.5345).  *IA correlated with: - BIS total score $r = 0.47$
Lim et al. (2015)	60%	Middle school children in South Korea. IA group (13), high-risk group (191), and usual user group (487).	Case control	Young's Internet Addiction Test (Y-IAT)	Barratt Impulsiveness Scale II (BIS-II)	IA group had significantly higher scores for BIS-11 total score compared to high-risk and usual user groups. There were positive correlations between BIS-11 total scores and Y-IAT scores.	*Differences between IA and controls: - BIS total score $d = 8.59$ , 95% CI (7.8303, 9.363).  *IA correlated with: - BIS total score $r = 0.323$
Lin et al. (2015)	53.13%	Chinese adolescents with IAD (14) and matched controls (15).	Case control	Young's Internet Addiction Scale (YIAS)	Barratt Impulsiveness Scale II (BIS-II)	There was no significant difference in BIS-II total scores between the IAD and control group.	No significant difference
Park et al. (2013)	46.7%	211 high school students from South Korea.	Correlational	The Young's Internet Addiction Test (IAT)	The Barratt Impulsivity Scale II (BIS-II)	Impulsivity was positively correlated with IA (total BIS-11 scores).	*IA correlated with: - total BIS scores $r = .48$

te Wildt et al. (2010)	31.25%	Members of the public from Hanover. Patient group (25) and control group (25).	Case control	Young and Beard's criteria for IA. The German Internet Addiction Scale (ISS)	Barratt Impulsivity Scale II (BIS-II)	The patient group had significantly higher scores than the control group for BIS-II total scores. No significant correlation was found between ISS and BIS-II within the patient group.	Differences between IA and controls: - total BIS scores $d = 0.97$ , 95% CI (0.3836, 1.5557).
Wee et al. (2014)	65.63%	Patients (17) were recruited from the Department of Child and Adolescent Psychiatry in Shanghai. Controls (16) were recruited from the local community.	Case control	Modified Young's Diagnostic Questionnaire (YDQ) (translated to Chinese). The Young's Internet Addiction Scale (YIAS).	Barratt Impulsivity Scale II (BIS-II)	There was no significant difference in BIS-II total scores between the IAD and control group.	No significant difference found
Yau, Potenza, and White (2013)	56.25%	Adults from the United States who responded to online advertisements. Non-at risk PIU (non-ARPIU) 364, at-risk PIU (ARPIU) 391.	Case control	Questions modelled from the Minnesota Impulsive Disorder Interview (MIDI)	Barratt Impulsivity Scale II (BIS-II)	ARPIU group scored significantly higher on the BIS-II total score than the non-ARPIU group.	*Differences between ARPIU and non-ARPIU: - BIS total score $d = -0.21$ , 95% CI (-0.3569, -0.0705).
Zhang et al. (2015)	60%	Random sample of college students studying	Correlational	Young's Diagnostic Questionnaire (YDQ)	Barratt Impulsivity Scale II (BIS-II)	IA and BIS-II scores were positively correlated and a direct effect of impulsivity on internet addiction was found in a regression analysis.	*IA correlated with: - BIS total score $r = -0.781$

		medical disciplines at three colleges in North China (1537).					
Chen, Lo and Lin (2015)	50%	University students in Taiwan (367).	Correlational	self-developed PIU Scale	Revised Impulsivity Scale (based on the BIS-II)	Motor impulsivity at time 1 and time 2 were positively correlated with PIU but non-planning impulsivity was not correlated with PIU at time 1 or time 2.	IA correlated with impulsivity at: - time 1 $r = 0.22$ - time 2 $r = 0.36$
Lin, Ko, Wu (2011)	81.25%	Participants from universities and colleges across Taiwan. IA group (536) and no IA group (2960).	Case control	Chen Internet Addiction Scale - Revision	Short-form of the Impulsivity Scale (based on the BIS-II)	The IA group scored significantly higher than the no IA group for impulsivity. A stepwise logistic regression revealed that high levels of impulsivity were found to significantly increase the risk of IA.	*Differences between IA and controls: - impulsivity $d = 0.7041$ , 95% CI (0.6106, 0.7976).
Billieux et al. (2010)	56.7%	95 volunteers from Switzerland recruited by advertisement.	Correlational	Internet Addiction Test (IAT) (French version)	UPPS Impulsive Behaviour Scale (UPPS) (French version). The emotional stop-signal task.	The negative urgency and lack of perseverance subscales of the UPPS were significantly positively correlated with IAT total scores. IAT total scores did not correlate with any condition in the emotional stop-signal task. Positive correlations found between the sensation seeking subscale on the UPPS and the positive and emotional conditions on the stop-signal task. Negative urgency, lack of premeditation, and lack of perseverance subscales on the UPPS were not correlated with any	*IA correlated with: - negative urgency $r = .30$ (medium effect). - lack of perseverance $r = .24$  *Sensation seeking correlated with: - the positive condition on the stop-signal task $r = .26$ - the emotional condition on the stop-signal task $r = .22$

						condition on the stop-signal task.	
Burnay et al. (2015)	60%	A Belgium convenience sample recruited through an online survey (502).	Correlational	Internet Addiction Test (IAT) (French Version)	UPPS Impulsive Behaviour Scale (UPPS) (French version)	IA was predicted by the lack of perseverance and urgency subscales of the UPPS.	Regression analysis performed so no statistic to present
Yau, Potenza, Mayes and Crowley (2015)	50%	Community based sample of adolescents from the United States (66). 39 ARPIU and 27 non-ARPIU.	Case control	Questions modelled from the Minnesota Impulsive Disorder Interview (MIDI)	UPPS Impulsive Behaviour Scale (UPPS)	The ARPIU group had significantly higher scores for the urgency and lack of perseverance subscales of the UPPS compared to the non-ARPIU group. There was no significant difference for the premeditation or sensation seeking subscales of the UPPS.	* Differences between ARPIU and non-ARPIU: - negative urgency $d=0.60$ , 95% CI (0.1004, 1.103). - lack of perseverance $d=0.55$ , 95% CI (0.0499, 1.049).
Mottram, Michele and Fleming (2009)	46.7%	Undergraduate students at an Australian university (272)	Correlational	Internet Addiction Test (IAT)	UPPS Impulsive Behaviour Scale (UPPS)	Only the lack of perseverance subscale on the UPPS was significantly positively correlated with IAT scores.	IA correlated with: - lack of perseverance $r=0.39$
Meerkerk, van den Eijnden, Franken and Garretsen (2010)	68.75%	Participants from the Netherlands responding to an online survey carried out amongst a sample of 'heavy users'. Compulsive Internet Users (CIU) (14) and	Case control	Compulsive Internet Use Scale (CIUS)	Revised version of The Dickman Impulsivity Inventory (DII) (translated to Dutch)	The CIU group scored significantly higher than the non-CIU group for dysfunctional impulsivity and significantly lower for functional impulsivity. There was a correlation between CIU and dysfunctional and functional impulsivity. In a regression equation both scales of impulsivity contributed to the explanation of CIU and had substantial predictive value.	IA correlated with: - functional impulsivity $r=-0.252$ - dysfunctional impulsivity $r=0.308$

		non-compulsive IU (non CIU) (290).					
Wu, Cheung, Ku and Hung (2013)	53.33%	Chinese adults (277).	Correlational	Young's Internet Addiction Test (IAT)	Chinese version of the Eysenck and Eysenck Impulsiveness Scale	YIAT scores were positively correlated to impulsivity. In a regression analysis impulsivity significantly explained part of the variance in IA.	IA correlated with: - impulsivity $r= 0.14$

Note. AD = Alcohol dependence; BIS-II = Barratt Impulsivity Scale II; YDQ = Diagnostic Questionnaire for Internet Addiction; CIU = Compulsive Internet Use; DII = Dickman Impulsivity Inventory; IA = Internet addiction; IAD = Internet addiction disorder; IAT = Internet Addiction Inventory; MIDI = Minnesota Impulsive Disorder Interview; PG = Pathological Gambling; ISS = The German Internet Addiction Scale; YIAS = The Young's Internet Addiction Scale; UPPS = UPPA Impulsive Behaviour Scale; Y -IAT = Young's Internet Addiction Test.

All of the identified papers used either behavioural measures of impulsivity (e.g. the go/no-go task), questionnaire based measures of impulsivity (e.g. BIS-II) or both. A description of the behavioural and questionnaire based measures are provided below and the outcomes of the different studies grouped by methodologies are presented after this.

### *Behavioural measures of impulsivity used within identified articles*

#### *The go/no-go task*

The go/no-go is a cognitive task that examines an individual's ability to inhibit inappropriate responses. It involves a series of stimuli presented in a continuous performance task, where participants are required to respond to stimuli by pressing a key or withhold their response by not pressing a key. The required response is dependent on the type of stimuli presented i.e. if it is a go or no-go stimulus (Verbruggen & Logan, 2008). Dependent on the specifics of a task, reaction times, hits (correct responses) or false alarms/errors (incorrect responses) are provided as a measure of impulsivity.

#### *The stop-signal task*

The stop-signal task assesses an individual's ability to suppress an action which has already been initiated but which is no longer appropriate. Participants are asked to respond to a visual stimulus (go signal) by pressing a key. In a proportion of presented trials an auditory stimulus (stop signal) is presented after the visual go signal, which indicates to participants that the key response should be withheld. A stop-signal reaction time (SSRT) is estimated from participants' performance on these trials, which relates to the time required for successful inhibition (Kalanthoff, Cohen, & Henik, 2013). Verbruggen and De Houwer (2007) used emotionally salient stimuli (negative or positive pictures) in a stop-signal task and found longer SSRT in emotional trials, which indicated a decrease in the effectiveness of inhibitory control under these conditions.

#### *Delay and probability discounting task*

Delayed discounting is a cognitive process where individuals compare values between immediate and delayed choices (Loewenstein, 1988). A delayed discounting task involves a participant being presented with a series of choices. They are required to indicate their

preference to receive a lower quantity of a determined commodity now (e.g. £1) or receive a high amount in a year's time (e.g. £10). Throughout the presented trials, the lower value, which is immediate, is increased and the larger delayed alternative value is decreased, or the delays or amounts of money are altered based on the choices made by participants. Eventually most participants alter their choice of reward, choosing the immediate value (Lawyer, 2008; Odum & Rainaud, 2003). This alteration of choice (indifference point) indicates subjective equivalence of the immediate and delayed value. A discounting rate is calculated and is used to indicate a level of impulsivity i.e. higher rates of delay discounting (and therefore impulsivity) are present for those who dismiss greater delayed rewards and prefer smaller immediate rewards (Tesch & Sanfey, 2008).

#### *Questionnaire based measures of impulsivity*

##### *Barratt Impulsiveness Scale II (BIS-II; Patton et al., 1995)*

The Barratt Impulsiveness Scale is composed of 30 items measuring common impulsive and non-impulsive behaviours or traits. It includes three subscales: attentional, motor and non-planning impulsiveness. Attentional impulsiveness measures task focus, and intrusive and racing thoughts, motor impulsiveness measures the tendency to act hastily on the spur of the moment, and non-planning impulsiveness assesses cognitive processes such as thinking and planning. It has good internal consistency (Patton et al., 1995).

##### *UPPS Impulsive Behaviour Scale (UPPS; Whiteside and Lynam, 2001)*

The UPPS Impulsive Behaviour Scale is a 45-item self-report questionnaire that aims to measure different dimensions of impulsivity, based on the Five Factor Model of personality. The UPPS consists of four subscales including urgency, lack of premeditation, lack of perseverance, and sensation seeking. Whiteside and Lynam (2001) report good levels of internal consistency.

##### *The Dickman Impulsivity Inventory (DII; Dickman, 1990)*

The Dickman Impulsivity Inventory (DII) is a questionnaire based measure of two different types of impulsivity, which Dickman proposes are significantly different from one another. The DII comprises 63 items, of which 23 measure dysfunctional impulsivity, 17 measure functional impulsivity, and 17 are questions that relate to neither construct. Dysfunctional impulsivity refers to the process of making quick decisions when they are not optimal.

Functional impulsivity measures quick decision making when it is optimal. The dysfunctional impulsivity scale has good internal consistency and the functional impulsivity scale has moderate internal consistency (Claes, Vertommen, & Braspenning, 2000).

*The Eysenck Impulsiveness Scale (EIS; Eysenck & Eysenck, 1991)*

The Eysenck Impulsiveness Scale is a 54-item questionnaire of impulsivity traits and venturesomeness. Impulsiveness is defined as risk taking without thinking about the consequences, and venturesomeness is risk taking despite being aware of potential negative consequences. There is no information available regarding the psychometric properties of this measure.

*Findings from studies using behavioural measures of impulsivity*

From the five studies that used the go no-go task as a behavioural measure of impulsivity, four measured reaction times to go and no-go trials. Balconi and Finocchiaro (2016) found that participants with higher levels of IA responded significantly quicker on both go and no-go trials compared to the low IA group. Additionally, the low IA group slowed significantly on no-go trials. Slower responses were interpreted as being indicative of inhibition and faster responses were indicative of impulsivity traits. Reaction times were not significantly different between groups in the other three studies (Zhou et al., 2010; Zhou et al., 2014; & Zhou et al. 2016). Balconi and Finocchiaro's (2016) study was rated as a higher quality study compared to the other three studies (Zhou et al. 2010; Zhou et al. 2014; & Zhou et al. 2016), which may account for the different findings. Additionally, Balconi and Finocchiaro (2016) used a student population whereas the other three studies used clinical populations. It is likely that reaction times on go no-go tasks are different for different populations and it may not be equally sensitive across groups.

Three studies measured both error (failure to inhibit a response) and hit rates, (correct response) and one study measured error rates only. Error rates were significantly higher and hit rates were significantly lower for the IA groups compared to the control groups in all three studies that measured both hit and error rates (Zhou et al., 2010; Zhou et al., 2014; & Zhou et al. 2016). Cao et al. (2007) measured error rates only and demonstrated significantly higher number of errors for the IA group than the control



group. Two studies had three groups within the study design including an IA, a control group and an alcohol dependent (AD) or pathological gambling (PG) group. For the study which had an AD group (Zhou et al., 2014), no significance difference was found for error or hit rates between the PIU and AD groups but error rates were significantly higher and hit rates were significantly lower for the IA group compared to the PG group (Zhou et al., 2016). The above studies used different populations (student or clinical populations) but found similar results with regards to increased rates of errors for the PIU group compared to control groups. The quality of the studies ranged from 53.13% to 87.5% (higher percentage indicating better quality) but this did not appear to impact on the findings, which appear to be relatively consistent across the studies. The differences in error rates and hit rates for different clinical populations compared to the PIU groups may indicate commonalities between PIU and AD with regards to failure to inhibit a proponent response, suggesting that choice of control group or arms of the study is an important consideration and may have impacted upon the different results found for other clinical populations.

Four studies incorporated both behavioural (go no-go tasks) and questionnaire based measures (BIS-II) of impulsivity. For three studies, no correlational data were presented for associations between behavioural and questionnaire based measures of impulsivity (Zhou et al., 2010; Zhou et al., 2014; & Zhou et al., 2016). Cao et al (2007) found significant correlations between specific time points when target-stops were presented (i.e. inhibited response required) for all subscales on the BIS-II, providing some evidence for convergent validity.

Li et al. (2016) used the delay and probability discounting task as a behavioural measure of impulsivity. Scores were calculated for discounted delayed gains and the PIU group were found to have faster discounted delayed gains than the control group. This indicated that PIU individuals had diminished sensitivity to delayed outcomes, suggesting higher levels of impulsivity. This study also used the BIS-II, although no data concerning the correlation between the two are presented.

Finally, Billieux et al. (2010) used the emotional stop-signal task as a behavioural measure of impulsivity and SSRTs were measured. There was no correlation between SSRTs and IAT scores but significant correlations for SSRT-positive and SSRT-emotional (positive and negative stimuli together) stimuli and the sensation seeking scale on the UPPS. Billieux et al. (2010) used a convenience sample, which may account for the lack of correlation between their measure of impulsivity (SSRTs) and PIU or it may be that SSRTs

and other behavioural measures of impulsivity such as error and hit rates are not comparable and measure different constructs. Verbruggen and Logan (2008) suggest that differentiating between the go no-go task and the stop signal tasks may be necessary as response inhibition may not be achieved in the same way across the two tasks.

There was no significant difference between reaction times for the IA and control groups in the majority of studies. Error rates were found to be significantly higher and hit rates significantly lower for IA compared to control groups. As the majority of studies did not present data on the relationship between behavioural measures of impulsivity and questionnaire based measures, it is difficult to draw conclusions about the validity of the measures in these studies. People with IA do appear to make more errors when asked to withhold an appropriate response but this may not necessarily be a measure of impulsivity.

#### *Findings from studies using questionnaire-based measures of impulsivity*

*BIS-II.* Seventeen studies used the BIS-II as a measure of impulsivity (two used a modified version of the BIS-II). All provided data on the relationship between total BIS-II scores and PIU and ten provided data on the relationship between PIU and the subscales on the BIS-II. Twelve studies found significantly higher BIS-II total scores for the PIU group compared to a control group (control groups typically incorporated individuals from the same population who obtained a score below cut-off on a PIU measure or sex, age and education matched healthy controls, which were considered appropriate as a use of control; Cao et al., 2007; Choi et al., 2014; Dalbudak et al., 2013; Hwang et al., 2014; Li et al., 2016; Lim et al., 2015; Lin et al., 2011; te Wildt et al., 2010; Zhang et al., 2015; Zhou et al., 2010; Zhou et al., 2014; & Zhou et al., 2016). In contrast, Lin et al. (2015) and Wee et al. (2014) did not find any significant difference between the PIU group and the control group for BIS-II total scores. The quality and samples of these studies do not appear to explain the discrepant findings of the latter studies. Park et al. (2013) and Zhang et al. (2015) did not provide data on the relationship between BIS-II total score and PIU and non-PIU groups and the results from Lin et al. (2011) are based on a modified version of the BIS-II. Three studies used a third group consisting of a population with a different problematic behaviour i.e. pathological gambling (PG) or alcohol dependence (AD). Hwang et al. (2014) and Zhou et al. (2014) did not find any significant difference between

the PIU and AD groups for BIS-II total scores. However, Zhou et al. (2016) found significantly higher scores for the PIU group compared to the PG group. This finding may indicate shared clinical features of impulsivity between PIU and AD and less commonality between PIU and PG.

From the seven studies examining the relationships between PIU and non-PIU groups and BIS-II subscales, six studies found significantly higher attentional key scores for the PIU group compared to the control group (Cao et al., 2007; Choi et al., 2014; Dalbudak et al., 2013; Zhou et al., 2010; Zhou et al., 2014; & Zhou, et al., 2016). In contrast, Hwang et al. (2014) found no significant difference between attentional key scores for the PIU group and control group. Hwang et al. (2014) was a lower quality study compared to the other studies, which may have impacted on the findings. All seven studies found significantly higher motor key scores in the PIU group compared to the control group (Cao et al., 2007; Choi et al., 2014; Dalbudak et al., 2013; Hwang et al., 2014; Zhou et al., 2010; Zhou et al., 2014; & Zhou, et al., 2016). Finally, five studies found that the PIU group scored significantly higher for non-planning compared to the control group. For the three studies that used a third group consisting of a population with a different problematic behaviour (PG or AD), Zhou et al. (2016) found that the PIU group scored significantly higher on the attentional key, non-planning, and motor key subscales compared to the PG group. Zhou et al. (2014) did not find any significant difference between any subscale scores for the PIU and AD group and Hwang et al. (2014) did not find any significant differences between the motor and non-planning subscales between the PIU and AD groups but found that the AD group scored significantly higher on the attentional key subscale than the PIU group. This further suggests shared features of impulsivity (motor and non-planning) between the PIU and AD groups and perhaps fewer shared impulsivity traits between PIU and PG.

Ten studies examined the correlation between PIU and impulsivity. Nine studies measured the correlation between PIU and BIS-II total scores and four examined the relationship between PIU and BIS-II subscales. Seven studies found significant positive correlations between BIS-II total scores and PIU (Cao et al., 2007; Dalbudak et al., 2013; Hwang et al., 2014; Li et al., 2016; Lim et al., 2015; Park et al., 2013; & Zhang et al., 2015), whereas te Wildt et al. (2010) did not. Again, te Wilde et al. (2010) obtained the lowest quality rating of all reviewed articles, which may account for the lack of significant correlation. Four studies examined the relationship between PIU and BIS-II subscales and three of them found significant correlations between each of the three subscales and PIU

(Cao et al., 2007; Chen et al., 2015; Dalbudak et al.; 2013; & Li et al., 2016). Chen et al. (2015) measured impulsivity and PIU at two time points using a within-subject design and found significant correlations for motor impulsivity and PIU at time 1 and time 2 but no significant correlations for non-planning impulsivity and PIU at time 1 or time 2 (a revised measure was used which did not measure attentional key scores). Finally, Lin et al. (2011) completed a regression analysis which revealed higher levels of impulsivity were found to significantly increase the risk of PIU.

*UPPS.* Four studies used the UPPS as a measure of impulsivity. From those studies, all provided data on the relationship between the four dimensions of impulsivity measured by the UPPS and PIU. One study examined differences in scores between PIU and non-PIU groups and the UPPS and found significantly higher scores in the PIU groups for the urgency and lack of perseverance dimensions compared to the control group (control groups typically incorporated individuals from the same population who obtained a score below cut-off on a PIU measure) and no significant between-group differences in scores for the premeditation or sensation seeking dimensions (Yau et al., 2015). Two studies looked at the correlation between UPPS dimensions and PIU. Billieux et al. (2010) found significant correlations between the urgency and lack of perseverance dimensions on the UPPS and PIU and Mottram et al. (2009) found significant correlations between the lack of perseverance dimension on the UPPS and PIU. A similar relationship between PIU and lack of perseverance and urgency was also found by Burnay et al. (2015).

*Other questionnaire measures.* Two studies used other self-report measures of impulsivity, including the EIS and the DII. Meerkerk et al. (2010) found significantly higher scores for dysfunctional impulsivity and significantly lower scores for functional impulsivity for the PIU group compared to the control group. Both studies found significant correlations between the measures of impulsivity and PIU, and impulsivity was found to be a unique predictor of PIU in a multiple regression analysis incorporating other predictor variables (Meerkerk et al., 2010; & Wu et al., 2013). There is no available data pertaining to the psychometric properties of the EIS, although this does not appear to have impacted on the findings.

## Summary and discussion

The majority of studies reviewed demonstrated a relationship between impulsivity and PIU, across a range of clinical and student populations. Overall, the study population did not appear to impact on outcomes but low methodological quality often appeared to be implicated where non-significant results were found. Effect sizes varied within studies using both behavioural and questionnaire based measures and there was no consistent pattern or link between quality of studies and effect sizes.

In the seven papers that used behavioural measures of impulsivity, the majority presented data indicating a relationship between PIU and impulsivity. However, it is difficult to draw conclusions regarding the validity of these tasks, as only one study presented data on the correlations between questionnaire-based and behavioural measures of impulsivity. Additionally, the generalisability of findings may be in question, as different behavioural measures define and capture response inhibition in different ways (Verbruggen & Logan, 2008). Ultimately, it is not clear if different dependent variables such as RTs, error rates, SSRTs and delay and probability discounting tasks measure the same constructs of impulsivity or if indeed they are valid measures of impulsivity. Only one study out of the four that used both behavioural and questionnaire-based measures provided correlational data regarding the relationship between the two methodologies, which demonstrated significant correlations between error rates and all subscales on the BIS-II (attentional key, motor and non-planning impulsivity). Although the correlation between BIS-II subscales and error rates is suggestive of convergent validity, it is unclear how the different behavioural tasks map onto the construct of impulsivity and because task requirements vary within different go-no-go study trials, it is difficult to draw conclusions regarding the validity of behavioural measures of impulsivity and the two methodologies.

Twelve questionnaire studies found a relationship between PIU and impulsivity, demonstrating significantly higher BIS-II total scores for PIU groups compared to control groups in the majority of studies. For studies that examined the relationship between PIU and individual subscales on the BIS-II (attentional key, motor, and non-planning impulsivity), the majority found significantly higher scores for the PIU groups across all subscales. Similarly, the majority of studies that used correlational analysis demonstrated significant positive correlations between PIU and BIS-II total and subscale scores.

The urgency and lack of perseverance dimensions of impulsivity as measured by the UPPS also appear to be related to PIU as demonstrated in both case-control and correlational studies. Studies that used different measures of impulsivity to those discussed above also demonstrated significantly higher scores for dysfunctional impulsivity and significantly lower scores for functional impulsivity for the PIU group compared to the control group. They also found significant correlations between measures of impulsivity and PIU.

Three studies examined the relationship between impulsivity in PIU groups compared to other clinical populations. One study found significantly higher BIS-II total scores and subscale scores for the PIU group compared to a problematic gambling group. No significant differences between the PIU and alcohol dependence groups for BIS-II total scores were found. There were mixed results found regarding the relationship between BIS-II subscale scores in PIU groups compared to AD groups. Of the two studies that examined this relationship, both found no significant difference on the motor and non-planning subscales of the BIS-II between the PIU group and the AD group. One study found that the AD group scored significantly higher on the attentional key subscale compared to the PIU group and another study found no significant between-group differences for the attentional subscale. This suggests shared clinical features of impulsivity between PIU and AD but less commonality between PIU and PG. The mixed findings for the attentional key subscale are less clear and may indicate that shared clinical features are dependent on the constructs of impulsivity being measured. Shared clinical feature of AD and PIU indicate the potential utility of trans-diagnostic treatment models in these populations.

Conceptual and diagnostic ambiguities exist for both PIU and impulsivity. Diagnostic criteria for PIU are not present in any of the major diagnostic systems and there does not appear to be consensus regarding appropriate diagnostic criteria (Spada, 2014). One perspective conceptualizes PIU as a behavioural characteristic of a wider, more established psychiatric disorder (e.g. as an aspect of another addiction such as problematic gambling (Shaffer, Hall, & Bilt, 2000). Another perspective suggests that PIU is best conceptualized as a distinct psychiatric disorder, that is, as an addiction or an impulse control disorder in its own right (Yau, Crowley, Mayes, & Potenza, 2012). Commonly used self-report measures of PIU such as the Internet Addiction Test (Young, 1998), Young's Diagnostic Questionnaire (1998), and the Chen Internet Addiction Scale

(Chen, Wenf, Su, & Yang, 2003) vary considerably regarding the facets that comprise PIU (Beard, 2005).

Due to developments in mobile technology and the increasing occurrence of smart phones, access to the Internet is easy and commonplace (Wu, Cheung, Ku & Hung, 2013). The proportion of UK adults with a smartphone has risen from 61% in 2014 to 71% in 2016 (Ofcom, 2016). The studies within the systematic review were conducted between 2007 and 2016 and during this time, Internet use will have increased due to an increase in smartphone use, tablet computers, the expansion of social media and online gaming applications, and the increased number of home broadband connections (Pew 2014). Therefore studies conducted in previous years may underestimate the current prevalence of PIU as Internet use has become more extensive and widespread in recent years (Pew, 2014). The term PIU may therefore be outdated given the advent of smartphones and access to the internet via smartphones as research may not account for this type of Internet use. To date, there is no research that investigates the relationship between smartphone use and PIU but there is evidence to suggest that smartphone users who spend more time on social networking sites report higher addictive tendencies (Wu, Cheung, Ku & Hung, 2013). It will be important for further research to explore the impact of Internet use more broadly to capture continual changes in technological developments, which impact on ease of Internet access. Indeed, the boundaries between online and offline activities have been blurred by the always-on Internet connections provided by smartphones.

There is also no consensus within the literature about how to define impulsivity (Moeller et al., 2001), which is discussed in the DSM-5 (American Psychiatric Association, 2013) as part of the diagnostic criteria for different disorders but is not clearly classified. Regardless of the conceptualization and measures used, there appears to be a consistent relationship between PIU and impulsivity. As measures of PIU within the review focused on PIU in general as opposed to specific subtypes, the findings pertain to all types of PIU such as pornography, social networking, virtual reality societies, and online gambling. However, articles that focused specifically on internet gaming populations were removed from the review as the clinical profile of online gaming is considered to be conceptually different to more general PIU (Kiraly et al. 2014). Nevertheless, further clarification of the relationship between impulsivity and the different characteristics that comprise PIU, as well as the numerous variants of this phenomenon, would be an important consideration for future research.

Although the relationship between impulsivity and PIU is clearly evident within the reviewed articles, we did not attempt to identify the possible source of this relationship. Overuse and misuse of Internet functions relate to PIU and PIU has been suggested to result from specific pre-existing psychopathology, which becomes associated with using the Internet (Davies, 2001). For example, an individual who might worry about their health and accesses support from their GP would effectively realise that health information is easily available online and this develops into PIU. Griffiths (2000) suggests that the majority of people who present with PIU use the Internet to fuel other addictive behaviours. Cooper, Putnam, Planchon and Boies (1999) demonstrated online sexual compulsivity as a major predictor of PIU, which supports the cognitive-behavioural model of PIU i.e. that pornography is an immediate stimulus-response condition. Individuals who use the Internet are able to locate information or a stimulus immediately, from which immediate reinforcement is obtained. Consequentially, the magnitude of the behavioural association increases and the need for information or a specific stimulus becomes stronger (Davies, 2001). Indeed, if people with PIU have pre-existing psychopathology and demonstrate impulsive traits, the ease and speed in access to a desired stimulus via the Internet may be attributed as advantageous and may provide a source of immediate reinforcement.

Davies (2001) suggests that the reinforcement an individual receives from using the Internet is an important factor, whereby continued engagement with the Internet is reinforced if the outcome is appraised as positive. Davies (2001) indicates that as behaviours are reinforced, the individual is conditioned to increasingly engage in the activity, which impacts on the development and maintenance of associated PIU symptoms. If Internet use is reinforced through positive appraisal of associated cognitions or behaviours for individuals with high levels of impulsivity, problematic use of the Internet may be a likely consequence.

In the context of a stress-vulnerability framework for understanding pathology, problematic behaviours result from a predisposed vulnerability and the event of a stressor (Zubin & Spring, 1977). Within a cognitive-behavioural framework, Davies (2001) suggests that existing psychopathology is a predisposed vulnerability to the development of further difficulties. Underlying psychopathology has been implicated in PIU, including social anxiety, depression, and substance misuse (Kraut et al., 1998). Indeed, research indicates comorbidities between PIU and other psychiatric disorders (Ko, Yen, Yen, Chen, & Chen, 2012), however underlying psychopathology does not result in the development



of PIU by itself but is associated with its etiology (Davies, 2001). With respect to the relationship between impulsivity and PIU, it would be important to establish the causal link between the two factors as it may be more advantageous for treatment to focus on the underlying psychopathology that may drive PIU. Alternatively, although psychopathology might increase vulnerability to PIU, the set of associated symptoms may be specific to PIU, which would warrant separate assessment and treatment of symptoms associated with PIU (Davies, 2001).

Maladaptive cognitions about the self and the world are indicated for individuals with PIU and are suggested to be sufficient to cause symptoms associated with PIU (Davies, 2001). Thoughts in relation to the self are driven by a ruminative cognitive style and these types of individuals will experience more prolonged and severe PIU (Davies, 2001). Nolen-Hoeksema (1991) suggested that rumination is likely to maintain or intensify psychopathology by influencing the individual to engage in behaviours guided by ruminative processes i.e. by taking action. If individuals are impulsive in nature and tend to ruminate about their Internet use, instrumental behaviours such as taking action by using the Internet may be more likely to occur. Additionally, rumination focused on the self influences an individual to recall more reinforced memories in relation to their Internet use, which maintains the cycle of PIU (Davies, 2001). Again, if individuals are more impulsive, it may be harder for them to withhold an unhelpful response to rumination or reinforced memories, thus making PIU more likely.

Negative cognitive distortions about the self such as self-doubt, low self-efficacy, and negative appraisal of the self may be regulated through Internet use if positive responses from others are provided online (Davies, 2001). If negative cognitive distortions exist and positive reinforcement is obtained via the Internet, an individual with impulsive characteristics may be more likely to seek positive responses from the quickest and least threatening source available to them i.e. the Internet, which may exacerbate internet dependence. Cognitive distortions are automatic in nature (Davies, 2001) and if such distortions influence a person to seek positive responses from others, an individual who is impulsive may struggle to regulate immediate responses i.e. Internet use in response to automatic cognitive distortions.

Associations between social anxiety and PIU have been demonstrated (Yen, Lin, & Yang, 2007) and symptoms related to social anxiety have been shown to predict the emergence of PIU (Ko, Yen, Chen, Yang, Lin, & Chen, 2009). Research indicates that adolescents with PIU have poorer interpersonal relationships (Milani & Di Osualdella,

2009). Additionally, a lack of social support and social isolation is related to PIU (Davies, 2001). If individuals who have PIU and demonstrate impulsivity are socially anxious or have poor interpersonal relationships, they may be more likely to access social support or reinforcement via a source which is less threatening and less likely to immediately increase their levels of anxiety or instigate an interpersonal conflict with another person. For example, they may use the Internet to avoid direct social contact and if this behaviour is reinforced it may serve to exacerbate PIU in individuals who display impulsivity.

Impulsive individuals may find it hard to resist their urge to use the internet (Ko, Yen, Chen, Chen & Yen, 2005) or be more likely to find themselves acting upon it without thinking (Patton et al., 2005). Metacognition, including the awareness and understanding of one's own thoughts and mental processes, plays a central part in monitoring, controlling and appraising cognition. The metacognitive approach to emotional disturbance is a trans-diagnostic model, which suggests that emotional disorders such as anxiety or depression arise when unhelpful metacognitions create a particular pattern of responding to experiences that causes individuals to become 'stuck' in negative cognitive-emotional states (Wells, 2009). This pattern of responding is known as the 'cognitive attentional syndrome' (CAS), and involves processes such as fixated attention, worry, rumination, and unhelpful coping strategies. It is also characterised by a specific attentional bias whereby attention is locked onto threat (Wells, 2009).

Metacognition shapes and influences our focus of attention, the factors which enter our awareness, and our appraisals. Additionally, it impacts upon the types of strategies we choose to regulate our emotions (Wells, 2009). Positive metacognitions relate to beliefs about the advantages of engaging in cognitive processes which form the CAS (e.g. "I need to use the Internet to stay healthy"). Negative metacognitions relate to beliefs about uncontrollability and the dangerousness of cognitive experiences, which inform the CAS (e.g. "I can't control my internet use") (Wells, 2009). Metacognitive beliefs impact on how people respond to negative thoughts, emotions, beliefs, and symptoms and generate the activation of the CAS (Wells, 2009). Individuals who struggle to inhibit their Internet use may hold positive and negative metacognitive beliefs about their internet use, which may influence how they respond to negative thoughts, feelings, sensations, or bodily symptoms. They may therefore be more likely to engage in Internet use and less able to resist an urge to use the Internet as their responses may be influenced by their metacognitions. Indeed, if individuals use the Internet as a self-regulatory strategy (e.g., as a form of pleasure seeking or to make themselves feel better)

and exhibit impulsive traits, they may be less able to resist the impulse to use the Internet. Consequently, they will be more likely to engage in Internet use, which inadvertently causes further distress by affirming metacognitive beliefs i.e. that an individual can not control their Internet use. The CAS will then be activated and this pattern of responding to distress, influenced by impulsivity and metacognitive beliefs will lead to ongoing emotional distress and increased use of the Internet to self-regulate in the presence of future appraised threat.

Metacognition is thought to shape the processes involved in attentional bias and attentional control. As metacognitive treatment is designed to increase cognitive flexibility and awareness so that individuals become aware of their level of control over their attention, thereby reducing the need for maladaptive coping strategies driven by the CAS (Wells, 2009), it may well be an appropriate treatment for PIU with consideration of its relationship with impulsivity. If individuals can develop attentional detachment and control, whereby their attention remains flexible as opposed to being fixed on any one thing (Wells, 2009), it may be possible for them to disengage with the CAS when a threat is perceived and they may be able to disengage with unhelpful coping strategies such as PIU, which may be driven by the CAS.

One strength of the review was the use of a validated quality assessment tool, which enabled the methodological quality of each paper to be systematically assessed. The quality assessment tool (Downs & Black, 1998) used within the review was modified to make it more appropriate for use with all of the reviewed articles, which consisted of both case control and correlational designs. This resulted in the final quality being measured as a percentage of quality items meeting criteria rather than a raw score, the range of which varied across study designs. This meant that a dimensional quality rating was available but a consistent approach to categorical rating (i.e. low, medium, high) was not. Interpretations of final quality ratings were therefore subjective. It is not clear how modification of the Downs and Black (1998) tool impacted on validity but this was considered the most appropriate way to modify the tool within the limitations of this review to enable it to be appropriate for use with the reviewed articles.

Study quality ranged from 31.25 % to 87.5% with the majority of studies scoring 50% to 60%. A clear difference between poor and high quality studies was the amount of detail that was provided within the study (e.g. regarding the validity and reliability of outcome measures, the time period for recruitment, and adjustment for confounding variables). Due to the lack of detail, it was difficult to ascertain quality for specific items,

therefore those items received a low quality rating. Rather than having methodological shortcomings, some papers may have received a lower quality rating as they did not provide enough detail in relation to a specific quality criterion. Some papers, for example, received higher quality ratings simply because they provided detail about the reliability and validity of outcome measures, representativeness of the sample, detailed information in relation to recruitment, and sufficient detail about adjustment for confounding variables. Other papers, in contrast, may have received a lower quality rating because they did not provide details regarding reliability and validity of outcome measures, despite referring to exactly the same measures that were described as valid and reliable in other studies. Although it may have been more appropriate to exclude poorer quality studies from the review (rather than retaining these and commenting on them where appropriate), including the poorer quality studies demonstrated that methodological quality does seem to have a bearing on whether a correlation is seen, which is an important finding in its own right. The review did not calculate or present effect sizes, however, which would have determined whether the magnitude of the correlation varied due to aspects related to the study design (e.g. according to population, measures used, and methodological quality). This is a clear limitation.

The majority of studies within the review were conducted in China. The cultural impact of PIU may therefore be relevant and may account for why more research on PIU is carried out in China. Internet censorship in China is extreme and Internet control is considered to be more wide-spread and developed than in any other country in the world (Shen, Wang, Guo & Guo, 2009). Personal expression in the public domain is restricted and the general public are largely shielded from the processes of social discourse (Shen, Wang, Guo & Guo, 2009). Reports suggest that China utilises some of the most sophisticated monitoring systems in the world, which means that internet use is highly censored (Cherry, 2005). The impact of this has led to individuals withholding personal information from significant others, fearing that voicing opinions and beliefs that would be considered oppositional would incur negative consequences (Wu & Engelmann, 2006).

There is a paucity of information on how Internet censorship impacts on people's internet use and the relationship between individuals, authoritarian settings and health settings more specifically. There are challenges in measuring levels of trust where people are fearful of expressing their opinions about authorities; however it is likely that Chinese people perceive the government as less trustworthy because of its authoritarian nature (Zhong, 2014). There are numerous studies which explore PIU in Chinese populations (e.g.

Lin et al., 2015; Wee et., 2014; & Zhang et al., 2015) but none of these explore the cultural relevance or impact of censorship with regards to the relationship between individuals and healthcare providers, how people use the internet and how this impacts on levels of problematic use. It may be that individuals are less trusting of authorities and services (e.g. health services), and social discourse is inhibited and so people may be more likely to access information online rather than approach others. Additionally, as it is a widely held belief in Chinese culture that the behaviour of individuals reflects more broadly on the family, mental illness or behaviours associated with a lack of self-control (i.e. problematic Internet use) may create feelings such as shame and guilt (Chen, 2001). Therefore people may be less likely to seek support in relation to problematic behaviours and more likely to attempt to manage difficulties by other means such as through use of the internet.

Interpersonal conflicts are not openly expressed within Chinese culture and if conflict exists between an individual and someone in a position of power, challenging an 'expert' is not considered appropriate. If for example a nurse or doctor is held within that 'expert' model, an individual who does not agree with what has been prescribed will not share their opinion but instead will fail to adhere to the advice provided (Chae, 1987). Although this may relate to problematic health related Internet use rather than PIU more broadly, this may increase the likelihood that people will not challenge the opinions of health professionals and instead seek other avenues to maintain their health i.e. using the internet as a means of health management.

The impact of Internet censorship, living within an authoritarian setting, trust in services, and the expression and discussion of interpersonal conflict within Chinese culture may contribute to why there are more studies on PIU conducted in China.

In order to develop a further understanding of the mechanisms involved in both PIU and impulsivity, to establish causal relationships, and to facilitate treatment, further research should incorporate longitudinal and experimental designs. Future research exploring the relationship between impulsivity and PIU should be conducted using different clinical populations where impulsivity has been identified as a feature (e.g. substance-related disorders, attention hyperactivity disorder, and mood disorders), in order to establish a clearer conceptualization for both impulsivity and PIU. As generalizability of the reviewed articles may be problematic due to the majority of research having been completed in East Asia, further research should be conducted using varying world populations in order to establish whether clinical profiles of PIU and

impulsivity are cross-cultural. Finally, RCTs comparing different treatments for PIU would be an important consideration for future research.

Given the consistency of the evidence regarding the relationship between PIU and impulsivity, assessment, formulation, and treatment of PIU should encompass impulsivity as a potential key feature. Emotional states have been found to inhibit executive functioning (Pessoa, 2009), which indicates that an individual experiencing distress will have reduced ability to exert control (Billieux et al., 2010). The proneness to behave impulsively in heightened emotional states (Cyders & Smith, 2008) may indicate a tendency to engage in problematic behaviours (Billieux et al., 2010), such as repeated and unhelpful Internet use. Treatment of PIU may therefore involve raising a person's awareness of their attentional flexibility and control, so that when they experience a heightened emotional state and an impulse to use the Internet occurs, their ability to exert control is increased. If people have more awareness of their level of attentional control, they will be more able to exercise this control in heightened emotional states and when faced with an impulse that will inadvertently lead to a behavior which causes increased distress. Metacognitive intervention may be relevant for treating PIU given the consistent findings of the relationship between PIU and impulsivity.

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## Chapter 2: Empirical Paper

Title

# **Reducing health worry and searching the internet for health information**

**The following paper has been prepared for submission to 'Behaviour Research and Therapy'. The guidelines for authors can be found in Appendix C.**



## **Abstract**

Background: Health-related Internet use is thought to be a maintenance factor for health anxiety. Health anxious individuals often engage in longer and more frequent health-related Internet searches and report more negative affect such as tension, distress, and anxiety after being online. Aims: The present study was a preliminary test of the effects of Attention Training Technique (ATT) on reducing problematic health-related Internet use in health anxious individuals. Method: Thirty-seven participants identified as health anxious on the Short Health Anxiety Inventory (SHAI) and having problematic health related Internet use on the Online Health Beliefs and Behaviours Inventory (OHBBI) were randomly allocated to receive either ATT or no treatment. Participants completed measures of health anxiety (SHAI), illness-related Internet use (OHBBI), and problematic health related Internet use (OHBBI) at baseline and three time points post-intervention. Emotional (State-Trait Anxiety Inventory), somatic (Checklist for Symptoms in Daily Life), and physiological responses (skin response conductance) to a health relevant stressor were also measured before and after the intervention. Results: Analysis of Covariance indicated that the ATT intervention resulted in a significantly greater reduction in health anxiety, illness-related Internet use and problematic Internet use for health purposes at times 2 and 3 compared to the no treatment when controlling for baseline scores. There was no significant difference in physiological arousal in response to a health-relevant stressor between the ATT and the no treatment group but state physical symptoms improved at time 2 when controlling for baseline scores. Conclusions: The findings indicate ATT and metacognitive strategies are a potentially effective treatment for health anxiety and problematic Internet use, although longer-term follow-up data are awaited.

**Keywords** Attention Training Technique, health anxiety, problematic Internet use, metacognitions, Cognitive Attentional Syndrome

## Introduction

An estimated 12.5 million worldwide health-related Internet searches were performed daily in 2009 (Bennett & Glasgow, 2009) and 43% of all UK adults used the Internet to find health information online in 2013 (Office for National Statistics, 2013). Although the Internet may provide useful information about health, the validity of online health information may be questionable (Gagliardi & Jadad, 2002) and potentially alarming (White & Horvitz, 2009). Indeed, research suggests that health-related Internet use has the potential to increase anxiety (Singh & Brown, 2014) and is associated with negative emotional responses including depression (Bessiere, Pressman, Kiesler, & Kraut, 2010) and fear (Lauckner & Hsieh, 2013). Additionally, anxiety-provoking health searches are associated with interruptions to both online and offline activities (White & Horvitz, 2009). Increases in anxiety related to health-related Internet use are seemingly related to excessiveness of use (Starcevic & Berle, 2013).

Severe health anxiety affects up to 5% of the population (Asmundson, Taylor, Sevcur, & Cox, 2001) and exists on a continuum, ranging from occasional worry to persistent preoccupation about illness (Hitchcock & Mathews, 1992). Health anxious individuals often believe that they have a serious illness in the absence of a diagnosed medical condition (Salkovskis & Clark, 1993). Health anxiety can be extremely problematic for individuals, impacting on psychosocial functioning, employment, and daily living (Robbins & Kirmayer, 1996). It also has huge economic costs and is associated with overutilization of healthcare services and financial burden (Williams, 2004). Health-related Internet use is thought to be a maintenance factor for health anxiety. Using the Internet to search for health information may be a reassurance strategy used to alleviate anxiety but appears to have the paradoxical effect of increasing distress (Starcevic & Berle, 2013). Consistent with this, health anxious individuals engage in longer and more frequent health-related Internet searches and report more negative affect such as tension, distress, and anxiety after being online (Muse, McManus, Leung, Meghreblian, & Williams, 2012; Singh & Brown, 2014). There is also evidence that health anxiety is associated with problematic health-related Internet use and possible health-related Internet addiction, characterised by increasing Internet use over time with a perceived loss of control, a sense of not being able to live without health-related Internet use, and negative impacts on social and occupational functioning due to excessive health-related Internet use (Singh & Brown, in preparation). Addictive behaviour and other mental

health problems often occur together (Pani et al., 2010), suggesting common underlying processes.

CBT has been shown to be the most effective treatment for internet addiction (Kaneez, Zhu, Tie, & Osman, 2013) and has been effective at improving symptoms associated with online addiction, such as management of time online, motivation to quit, social isolation, and abstinence of problematic use (Young, 2007). CBT has also been shown to be an effective treatment for health anxiety (Sorenson et al. 2011), as has metacognitive therapy (Bailey & Wells, 2014). Metacognitive beliefs (e.g., 'worrying about disease helps me to better cope with my anxiety for it') have been shown to correlate positively with health anxiety (Kaur, Butow, & Thewes, 2011) and cognitive processes such as worry and rumination are considered central drivers of anxiety in metacognitive theory (Wells, 2009). Associations have been demonstrated between rumination and somatic complaints (Rector & Roger, 1996) and rumination and health anxiety (Marcus, Hughes, & Arnau, 2008). Metacognitive therapy may be useful for problematic health-related Internet use given that meta-beliefs about the controllability of use and the perceived emotional consequences of non-use seem to be important features (Singh & Brown, in preparation).

The self-regulatory executive function model (S-REF: Wells & Mathews, 1994, 1996; Wells, 2009) considers attentional control as a key factor in the development and maintenance of psychological problems. In that account, emotional difficulties arise when metacognitive beliefs predispose people to engage in maladaptive and perseverative control strategies such as worry, rumination, and threat monitoring in response to negative thoughts (the so-called 'cognitive attentional syndrome'; CAS). Although adopted by the individual as potentially beneficial, the CAS has the unintentional consequence of prolonging distress and apparently reducing attentional control as they fail to disengage from perceived threat (Wells, 2009).

The Attention Training Technique (ATT; Wells, 1990) is a metacognitive treatment designed to increase cognitive flexibility and awareness so that individuals become aware of their level of control over their attention, thereby reducing the need for maladaptive coping strategies driven by the CAS. ATT has been shown to decrease health worry, illness beliefs, and body-focused attention (Papageorgiou & Wells, 1998) and decrease health anxiety and attention to bodily sensations in health anxious individuals (Weck, Neng, & Stangier, 2012). If problematic health-related Internet use is understood as a compulsive

behaviour or strategy for managing health worry then ATT may be a useful intervention for these phenomena. With that in mind, the current study was a preliminary trial (pilot RCT) to test the effects of ATT on reducing problematic health-related Internet use in health anxious individuals.

## **Method**

### *Design and hypotheses*

A randomised between-groups design comparing ATT with a waiting list (no treatment) control was used. Time (Time 1: baseline vs. Time 2: end of treatment vs. Time 3: one month follow-up vs. Time 4: three month follow-up) was a within subjects variable. The primary dependent variable (DVs) was problematic health related Internet use (measured by subscale 3 of the Online Health-related Beliefs and Behaviours Inventory; OHBBI). Secondary DVs included overall frequency and duration of health related Internet use, illness-related Internet use (measured by subscale 1 of the OHBBI), health anxiety as measured by the short Health Anxiety Inventory (SHAI) (Salkovskis, Rimes, Warwick & Clark, 2002). Secondary DVs also included participants' emotional and physical response to health-relevant unpleasant video clips ('provocation test'), as measured by skin response conductance, the Checklist for Symptoms in Daily Life (CSD; Wientjes & Grossman, 1994) and the brief State scale of the State-Trait Anxiety Inventory (STAI-6; Mardeau & Bekker, 1992). We also measured positive and negative metacognitive beliefs about worry related to health-related Internet use (measured by items adapted from the Metacognition Questionnaire-30; MCQ-30; Wells & Cartwright, 2004).

We predicted that frequency and duration of health related Internet use, illness-related Internet use, problematic health-related Internet use and health anxiety would be significantly lower in the ATT group than the control group at times 2, 3, and 4, controlling for baseline scores. We also expected change in skin response conductance, physical symptoms, and state anxiety following the symptom provocation test to be significantly lower for the treatment group than the control group at time 2 when controlling for baseline scores.

### *Power calculation*

A power calculation was completed and was based on a study by Singh and Brown (in preparation). It was not based on a previous estimate of treatment effects as there were no previous studies to base this on but was based on the number of individuals needed to be identified and tested and the kind of effect we could expect with this number of

participants<sup>4</sup>. The primary outcome was problematic internet use as measured by the problematic internet use scale on the OHBBI but as no previous research has been conducted on treatment effects, the test of efficacy could not be based on this outcome. The power calculation is detailed as follows; 275 people needed to be approached for screening, specifically targeting a sample with high levels of health anxiety. From this sample, it was assumed that 32% would meet criteria (high levels of health anxiety and problematic health-related internet use), which would yield 88 people. Assuming 25% attrition, 66 participants would be randomised. Assuming 25% attrition before follow-up, 50 participants would be included in the final analysis. Assuming power is 80% and alpha is 0.05 (two-tailed), a study with 25 participants in each group would be adequately powered to detect an effect size of 0.81. It was considered necessary to see a large effect size in order for it to be a clinically meaningful effect in a study with no treatment control group. This translated to 6 points on the SHAI (range for this population 15-49) and 2.5 points on the problematic internet use scale (range for this population 16-30).

### *Participants*

Thirty-eight participants took part (31 females, ten males; 18-41 years, mean age 23.4 years). The study involved participation across four time points and participants received eight research credits (psychology undergraduate students) or ten pounds. Thirty-four participants were students (29 undergraduate and six postgraduate students) from the University of Manchester, one was a University of Manchester staff member and two were members of the public. Twenty were White British, one was Irish, three were some Other White background, one was Caribbean, two were African, one was Indian, two were Pakistani, one was some Other Asian background, one was White and Asian, two were some Other Mixed background, three were Chinese, and one was Any Other Ethnic group.

Inclusion criteria included (1) being aged 18 years of age or older; (2) giving consent to participate in the study; (3) understanding spoken and written English; (4) scoring 15 or above on the SHAI at screening (indicating high health anxiety; IAPT-NHS, 2011); and (5) scoring 12 or above on OHBBI scale 3 at screening (indicating a score just outside the top quartile of scores on problematic health-related Internet use; Singh,

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<sup>4</sup> It was a pragmatic decision to base the power calculation on the number of participants needed to be identified and tested and it will be discussed in the critical review chapter.

2013). All participants participated in a screening phase where the SHAI and OHBBI were completed and participants were selected if they met the above criteria.

### *Measures*

#### *Online Health-related Beliefs and Behaviours Inventory (OHBBI)*<sup>5</sup>

The Online Health-related Beliefs and Behaviours Inventory (OHBBI) (Singh & Brown, In preparation; Appendix D) scales 1 (illness-related internet use) and 3 (problematic use of the Internet for health purposes), 4 (negative attitudes towards doctors), 7 (post-search doctor utilization), and 8 (anxiety post search/perceived adverse consequences of searching) (27 items) were used to assess health-related Internet use. A four-point Likert scale ranging from 1 (disagree a lot) to 4 (agree a lot) was used to rate the degree to which participants agreed with items/statements on the OHBBI scales. Research indicates that the OHBBI is a valid and reliable instrument for measuring online health-related beliefs and behavior (Singh & Brown, in preparation) Total scores<sup>5</sup> ranged from 0 to 81. Higher scores on scale 3 indicate higher levels of problematic use of the Internet for health purposes. The OHBBI also measured the frequency and duration of health-related Internet use with scales ranging from “never” to “several times a day” for frequency and “a few seconds” to “more than an hour” for duration.

#### *The Short Health Anxiety Inventory (SHAI)*

The Short Health Anxiety Inventory (SHAI; Salkovskis, Rimes, Warwick, & Clark, 2002; Appendix E) is a disorder specific scale recommended by the NHS Improving Access to Psychological Therapies (IAPT) initiative (IAPT-NHS, 2011). It is an 18-item measure related to symptoms of health anxiety independent of physical health status (items 1-14) and the perceived consequences of developing a serious illness/disease (items 15-18). It assesses worry about health, awareness of bodily sensations or changes, and feared consequences of having an illness. Each statement is scored from 0-3. The SHAI demonstrates good psychometric properties, including reliability and validity (Salkovskis, Rimes, Warwick, & Clark, 2002). IAPT suggest a cut-off score of 15 indicates health anxious patients.

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<sup>5</sup> Scale 4 (negative attitudes towards doctors), scale 7 (post search doctor utilization), and scale 8 (anxiety post search/perceived consequences of searching) were not analysed and data for these scales are not presented for the sake of brevity and due to limited time available.

### *Skin response conductance*

Changes in electrical conductance of the skin (skin response conductance) were measured using a NEULOG skin response conductance sensor. Changes in skin response conductance occur when the autonomic nervous system (ANS) is activated, indicating emotional arousal (Ravaja, 2004). It was administered before and during the 'symptom provocation task'.

### *Short form State-Trait Anxiety Inventory (STAI-6)*

The short form State-Trait Anxiety Inventory (STAI-6; Mardeau & Bekker, 1992; Appendix F) is a state measure of anxiety. It contains 6 items scored on a four point Likert-scale ranging from "not at all" to "very much". The STAI-6 is highly correlated with the 20-item STAI and has good internal consistency and reliability (Tluczek, Henriques, & Brown, 2009). It was administered immediately before and after the provocation task.

### *Checklist for Symptoms in Daily Life (CSD)*

The Checklist for Symptoms in Daily Life (CSD; Wientjes & Grossman, 1994; Appendix G) was administered immediately before and after the provocation task and measured state physical symptoms. The CSD has been found to have good validity (Grossman & de Swart, 1984) and reliability (Wientjes & Grossman, 1994). The extent to which each symptom was being experienced was measured on a 5 point Likert-scale ranging from "not at all" to "very strongly".

### *Positive and Negative Metacognitive Beliefs*

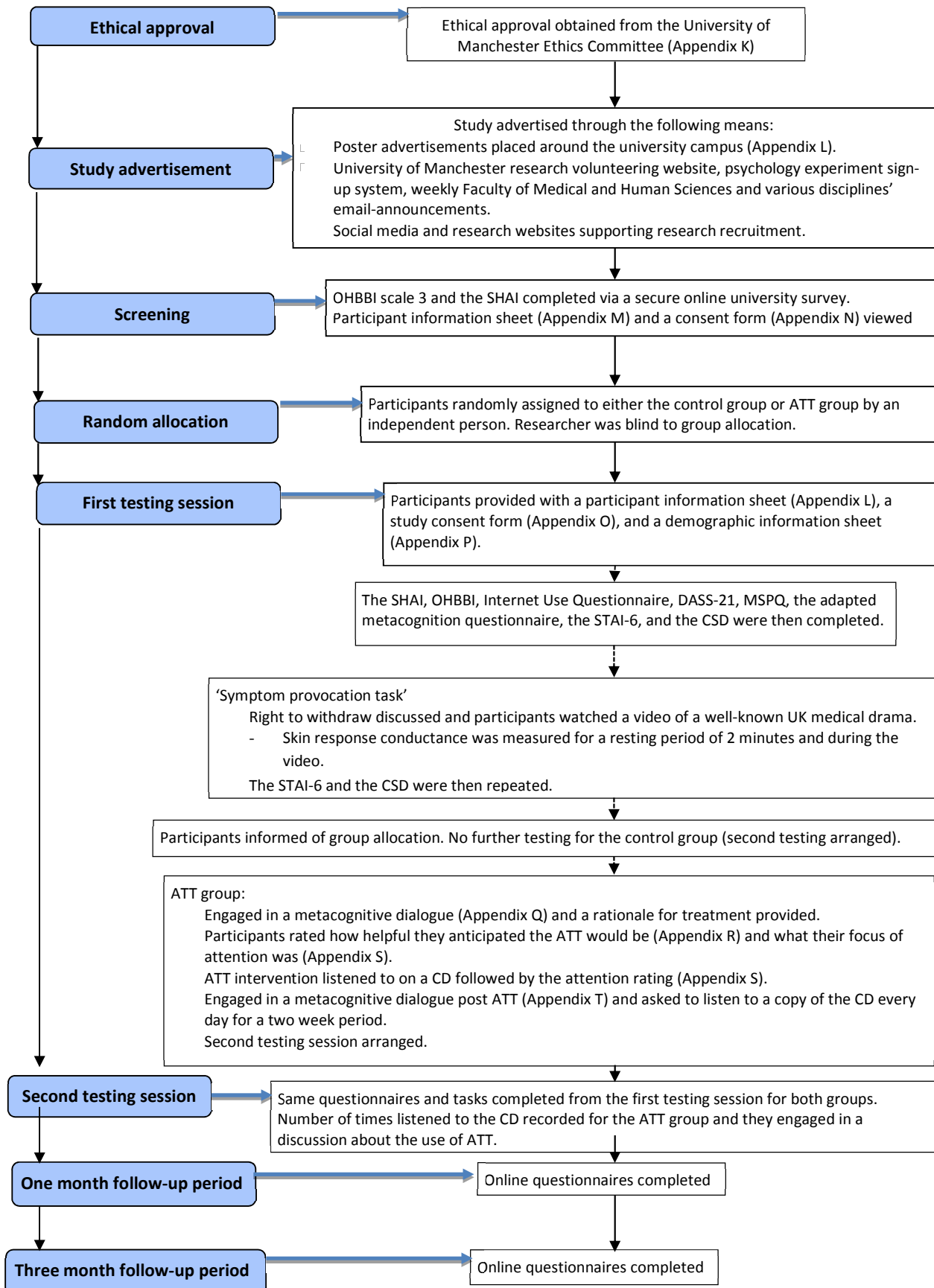
Metacognitions were assessed by administering 4 items adapted from the Metacognitions Questionnaire 30 (Wells & Cartwright, 2004; Appendix H). These items assessed negative ('I can't control my internet use' and 'I'd go crazy with worry if I can't use the internet to look up health information') and positive ('I need to check the internet for me to stay healthy' and 'I need to check the internet in order for me to cope with worries about my health') metacognitions about health-related Internet use. Items were measured on a 4-point Likert-scale which assessed the degree to which people agreed with the statements (in line with the scoring on the MCQ) ranging from 1 ("do not agree") to 4 ("agree very much").



We also measured depression, anxiety, and stress using the Depression Anxiety Stress Scales (DASS-21; Lovibond & Lovibond, 1995), general physical symptom reporting using the Modified Somatic Perception Questionnaire (MSPQ; Main, 1983) and non-health related problematic Internet use using a bespoke scale (Appendix I). Data from these measures are not presented here for the sake of brevity and clarity. Details of the questionnaires are presented in Appendix J.

Procedure

Figure 2: Procedure Diagram



### Control group procedure

Participants were asked to complete the following questionnaires: the SHAI, OHBBI, Internet Use Questionnaire, DASS-21, MSPQ, the adapted metacognition questionnaire, the STAI-6 and the CSD. Participants then took part in the symptom provocation task, which involved watching a video of a well-known UK medical drama, whilst skin response conductance was measured for a resting period of 2 minutes and during the video. Following this, the STAI-6 and the CSD were repeated. Participants were then informed that they had been allocated to the control condition and did not engage in any further testing. A second testing session was arranged.'

### Intervention group procedure

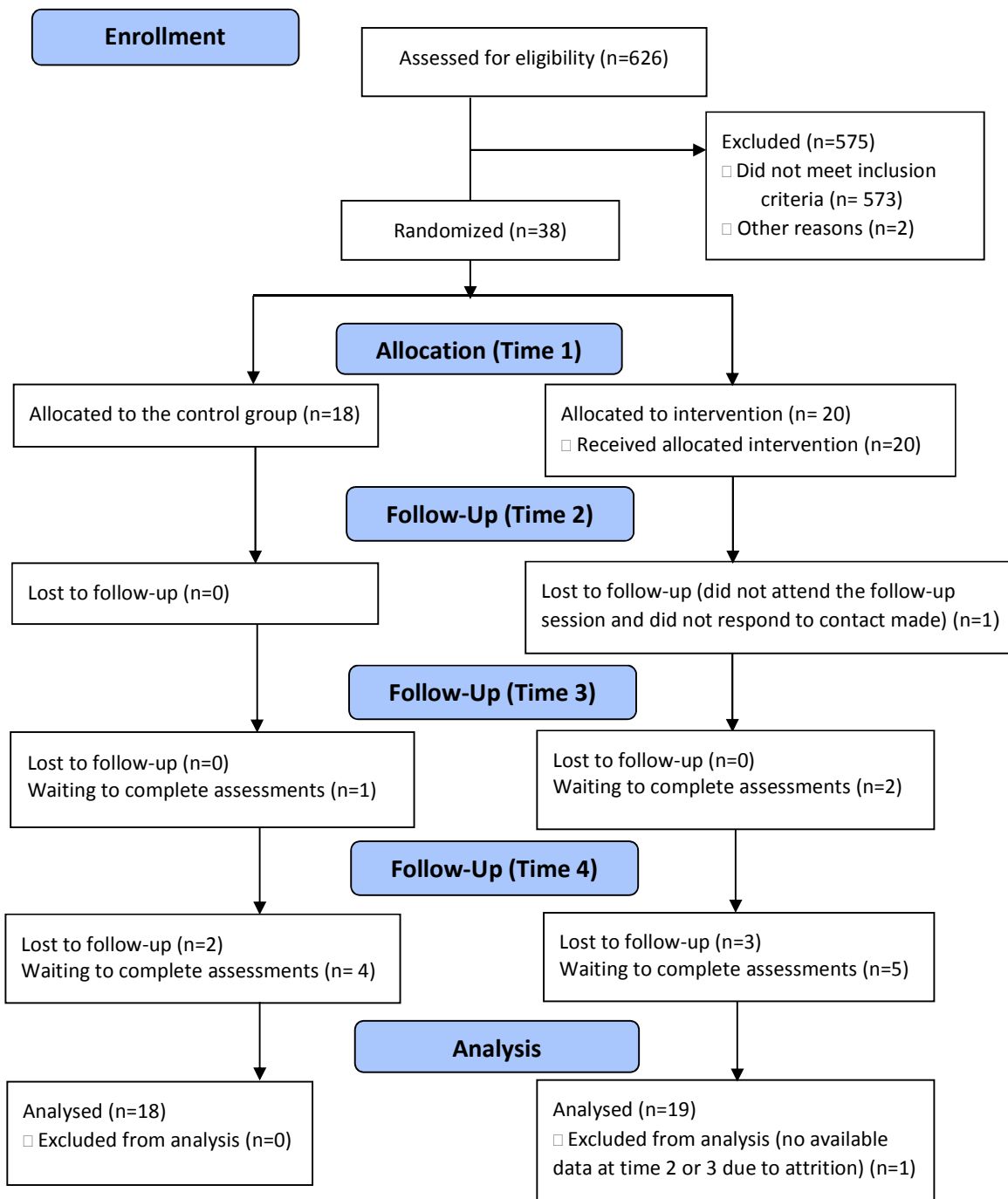
The intervention group followed the same procedure as the control group but engaged in the ATT intervention following the completion of the STAI-6 and the CSD for the second time after engaging in the symptom provocation task.

Participants engaged in a metacognitive dialogue where a rationale for the treatment was provided (Appendix Q). Metacognitive dialogue aims to raise participants' awareness of unhelpful responses to their health worries and the impact of using the internet as a means of dealing with their health concerns. A metaphor was provided to socialize participants to the model (e.g. likening the noise of a telephone ringing to the processes involved in attending to worries). The dialogue also aimed to socialise participants to the metacognitive model and help them to see the potential value in engaging with the ATT. Following this, participants were asked to rate how helpful they anticipated the ATT would be on a scale of 0 to 100 (Appendix R) and what their focus of attention was on a self-rating scale (Appendix S). They indicated the extent to which their attention was focused on themselves (i.e., focused on their thoughts, feelings, behavior or bodily sensations) or focused on external stimuli (i.e., noises in the room, the temperature of the room, the sound of the researcher's voice etc.). Following this, participants in the ATT group received the ATT intervention. This involved participants listening to a CD which asked them to practice an auditory attention exercise involving different attention exercises (selective, switching and divided attention) (Papaageorgious & Wells, 1998). The ATT aimed to increase participants' awareness of internal control mechanisms and thereby increase their ability to be flexible in how they responded to their health worries, with the aim of increased control over problematic health-related

internet use. Following this, participants rated their focus of attention on a self-attention rating scale (Appendix S) and engaged in a different metacognitive dialogue (Appendix T), which aimed to increase participants' awareness of their level of control with regards to how they responded to their thoughts or worries about their health. It also aimed to support participants in understanding how ATT could be applied to their worries about their health and any queries or beliefs that could impact on participants' ability to engage with the ATT were identified and addressed. Participants were asked to listen to the CD every day over a two week period and a second testing session was arranged.'

A total of 626 individuals completed the online screening questionnaires. Fifty-three people met criteria. Two participants were excluded as they completed the screening on more than one occasion and their scores changed considerably between the first and second screening. One participant did not attend the second session and did not complete the study despite an invitation to do so. A total of 37 participants attended two testing sessions (Time 1 and Time 2); at the time of writing, 34 participants had completed the one-month follow-up period (Time 3), and 23 had completed the three-month follow-up period (Time 4). Three participants were waiting to complete assessments at one-month follow-up and nine were waiting to complete assessments at three-month follow-up at the time of analysis. One participant was lost to follow-up at Time 2 and five participants were lost to follow-up at Time 4 (see Figure 3). As the number of participants who had completed the three month follow-up period was so low at the time of writing, data from this time point are not presented here.

Figure 3: CONSORT 2016 Flow Diagram



## Data analysis

The normality of each dependent variable was assessed numerically using the Shapiro-Wilk test, as recommended by Tabachnick and Fidell (1996) for smaller sample sizes.

Repeated measures Analysis of Variance (ANOVA) was conducted to test for between-group differences in improvement (i.e. group x time interactions). Hypotheses 1, 2 and 3 were evaluated using Analysis of Covariance (ANCOVA) comparing groups at Time 2 and Time 3 on the dependent variables controlling for Time 1 scores. Paired samples T-tests were conducted to explore if scores differed across different time points for both groups.

## Results

Results of Shapiro-Wilk tests for normality are presented in Table 3. Log or square root transformations were performed dependent on which provided the optimal solution. In the few cases where variables remained non-normal following transformations, the overall level of normality across the data for each group and time point was deemed sufficient for analysis.

Table 3: Normality for total scores for Time 1, Time 2, and Time 3 for the ATT and control groups

Variable	Non-Normal						Transformation used
	Control group: Time			ATT group: Time			
	1	2	3	1	2	3	
<i>Primary Variable:</i>							
Problematic use of the internet for health purposes (OHBBI)					✓		Square root
<i>Secondary variables:</i>							
Frequency of internet use (OHBBI)		✓	✓				Square root
Duration of internet use (OHBBI)	✓	✓	✓	✓	✓	✓	Log
Illness-related internet use (OHBBI)	✓						Log
Change in state anxiety (STAI)					✓		Square root
Change in state physical symptoms (CSD)					✓		Square root
Negative metacognitions					✓	✓	Log
Positive metacognitions						✓	Log
Change in skin response conductance		✓					Log

\* White cells indicate normality for that variable. Dependent variables in blue were unsuccessfully transformed and dependent variables in green were successfully transformed. Grey cells indicate dependent variables not measured at Time 3.

### Test of hypotheses

Descriptive statistics (see Table 4) indicate that scores either increased or remained stable for the control group across measures. In contrast, there was a general reduction across measures for the ATT group.

Table 4: Medians and interquartile range (in parentheses) across groups and time<sup>6</sup>

Dependent variables	ATT	Control	ATT	Control	ATT	Control
	Time 1		Time 2		Time 3	
Problematic use of the internet for health purposes	12.00 (5)	11.00 (6)	11.00 (4)	13.00 (5)	6.00 (6)	13.00 (4)
Frequency of internet use	3.50 (2)	3.50 (2)	2.00 (2)	3.00 (3)	1.00 (2)	3.00 (3)
Duration of internet use	0.48 (0)	0.48 (0)	0.30 (0)	0.48 (0)	0.30 (0)	0.48 (0)
Illness-related internet use	16.00 (3)	15.50 (3)	11.00 (2)	15.00 (3)	10.00 (7)	14.00 (4)
SHAI	30.50 (34)	31.00 (21)	23.00 (31)	30.00 (21)	18.00 (29)	32.00 (24)
Change in state anxiety (STAI-6)	2.24 (0.78)	2.45 (0.94)	2.00 (0.72)	2.34 (0.83)		
Change in state physical symptoms (CSD)	5.50 (10)	6.50 (12)	1.00 (2)	5.00 (8)		
Negative meta-cognitive beliefs	4 (2.75)	5 (2.25)	3.00 (2)	5 (2.00)	2.00 (1)	5 (2.50)
Positive meta-cognitive beliefs	5.00 (2.75)	6.00 (1.00)	4.00 (1)	6.00 (1.25)	3.00 (2)	5.00 (2)
Change in skin response conductance	0.24 (0.09)	0.21 (0.16)	0.18 (0.13)	0.16 (0.14)		

Repeated measures ANOVA's revealed significant main effect of time for all variables except for duration of internet use and the STAI-6. There was a significant interaction between time and group for all variables apart from the STAI-6, negative metacognitive

<sup>6</sup> Descriptive statistics for the MSPQ and DASS-21 are presented in Appendix U for the sake of brevity and clarity.



beliefs, and skin response conductance. There was a significant main effect of group for all variables except for duration of internet use, the STAI-6, CSD, and skin response conductance.<sup>7</sup>

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<sup>7</sup> The results for the MSPQ and the DASS-21 are presented in Appendix V. Significant group by time interactions were found for depression and stress but not for the MSPQ and anxiety.

Table 5: Results for repeated measures ANOVA's for main effect of time, interaction between time and group, and main effect of group

Dependent variables	Main effect of time				Interaction between time and group				Main effect of group			
	F value (df)	Significance	Partial eta squared ( $\eta_p^2$ )	Effect size	F value (df)	Significance	Partial eta squared ( $\eta_p^2$ )	Effect size	F value (df)	Significance	Partial eta squared ( $\eta_p^2$ )	Effect size
Problematic use of the internet for health purposes	*8.057 (1.630, 52.162)	p = .002	0.201	Medium	*9.962 (1.630, 52.162)	p = .001	.237	Large	17.028 (1, 32)	p = .001	.347	Large
Frequency of internet use	26.347 (2,64)	p = .001	.452	Large	10.347 (2,64)	p < .001	.244	Medium	6.809 (1,32)	p = .014	.175	Medium
Duration of internet use	1.691 (2, 64)	p = .193	.50	Large	21.142 (2, 64)	p < .001	.398	Large	3.343 (1, 32)	p = .077	0.95	Large
Illness-related internet use	*26.853 (1.783, 57.070)	p = .001	.456	Large	*20.768(1.783, 57.070)	p < .001	.394	Large	20.502 (1,32)	p = .001	.391	Large
SHAI	*38.095 (1.496, 47.857)	p < .0001	.546	Large	*33.680 (1.496, 47.857)	p < .0001	.513	Large	9.096 (1, 32)	p = .005	.221	Medium
Change in state anxiety (STAI-6)	1.277 (1, 35)	p = .266	.35	Large	1.770 (1, 35)	p = .192	.048	Small	2.695 (1, 35)	p = .110	.071	Small
Change in state physical symptoms (CSD)	8.107 (1, 35)	p = .007	.188	Medium	4.252 (1, 35)	p = .047	.108	Medium	1.266 (1, 35)	p = .268	.035	Small

Negative meta-cognitive beliefs	*18.072 (1.778, 56.908)	p = .001	.361	Large	*2.920 (1.778, 56.908),	p = .068	.084	Small	18.228 (1, 32)	p = .005	.363.	Large
Positive meta-cognitive beliefs	19.257 (2, 64)	p = .005	.376	Large	8.971 (2, 64)	p = .001	.219	Medium	9.096 (1,32)	p = .005	.221	Medium
Change in skin response conductance	13.676 (1, 35)	p = .001	0.281	Large	.099 (2, 64)	p = .755	.003	Small	.655 (1, 35)	p = .424	.018	Small

\*Mauchly's Test of Sphericity indicated that the assumption of sphericity had been violated; therefore degrees of freedom were corrected using Huynh-Feldt estimates of sphericity for all variables which violated the assumption with the exception of the SHAI, which used the Greenhouse-Geisser estimate of sphericity.

A series of ANCOVA's were conducted comparing the groups on each DV at Time 2 and Time 3 controlling for Time 1 scores (see Table 5). The ATT group was significantly better than the control group on all measures at Time 2 except for change in physiological arousal (skin response conductance). Similarly for Time 3, the ATT group scored significantly better on all measures.<sup>8</sup> Figures 4 to 10 show changes in scores for primary dependent variables.

Table 6: Results for ANCOVA's at Time 2 and Time 3 controlling for Time 1 scores

Dependent variable	Difference between the two groups at Time 2				Difference between the two groups at Time 3			
	F value (df)	Significance	Partial eta squared ( $\eta^2_p$ )	Effect size	F value (df)	Significance	Partial eta squared ( $\eta^2_p$ )	Effect size
Problematic use of the internet for health purposes	5.769 (1,34)	P= .022	.145	Medium	51.425 (1,31)	p < .0001	.624	Large
Frequency of internet use	30.309 (1,34)	p < .0001	.471	Large	18.481 (1,31)	p < .0001	.373	Large
Duration of internet use	27.585 (1,34)	p < .0001	.448	Large	22.863 (1,31)	p < .0001	.424	Large
Illness-related internet use	29.470 (1,34)	p < .0001	.467	Large	31.474 (1,31)	p < .0001	.504	Large
SHAI	27.647 (1,34)	p < .0001	.449	Large	49.250 (1,31)	p < .0001	.614	Large
Change in state anxiety (STAI-6)	4.367 (1,34)	p = .044	.114	Medium				
Change in physical symptoms (CSD)	10.746 (1,34)	p = .002	.240	Medium				
Negative Meta-cognitive Beliefs	19.967 (1,34)	p < .0001	.370	Large	14.771 (1,31)	p = .001	.323	Large
Positive Meta-cognitive Beliefs	29.110 (1,34)	p < .0001	.461	Large	13.249 (1,31)	p < .0001	.299	Large
Change in skin response conductance	.439 (1,34)	p = .512	.013	Medium				

<sup>8</sup> The results for the MSPQ and the DASS-21 are presented in Appendix W. The ATT group was significantly better than the control group for depression and stress at Time 2 but not for anxiety or physical symptoms. For Time 3, the ATT group scored significantly better on depression, stress, and anxiety but not for physical symptoms.

Figure 4: Mean problematic use of the internet scores across 3 different time points

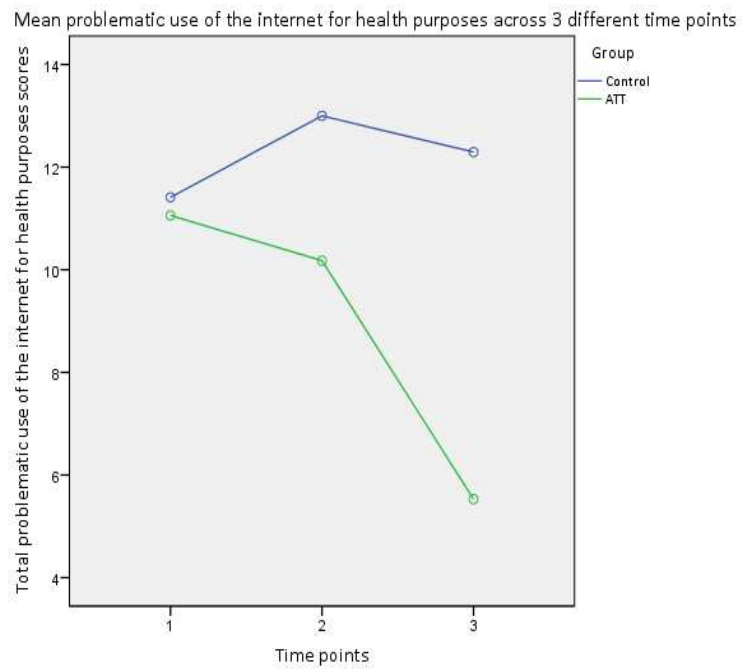


Figure 5: Mean frequency of internet use scores across 3 different time points

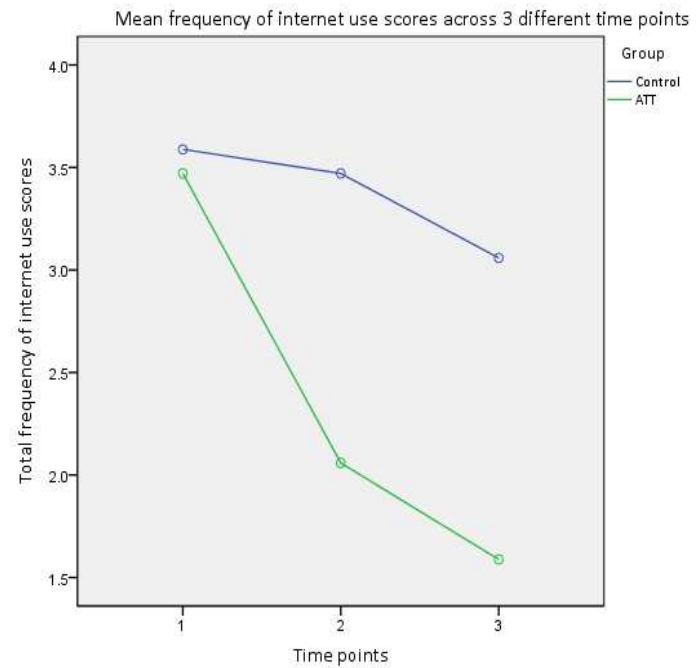


Figure 6: Mean duration of internet use scores across 3 different time points

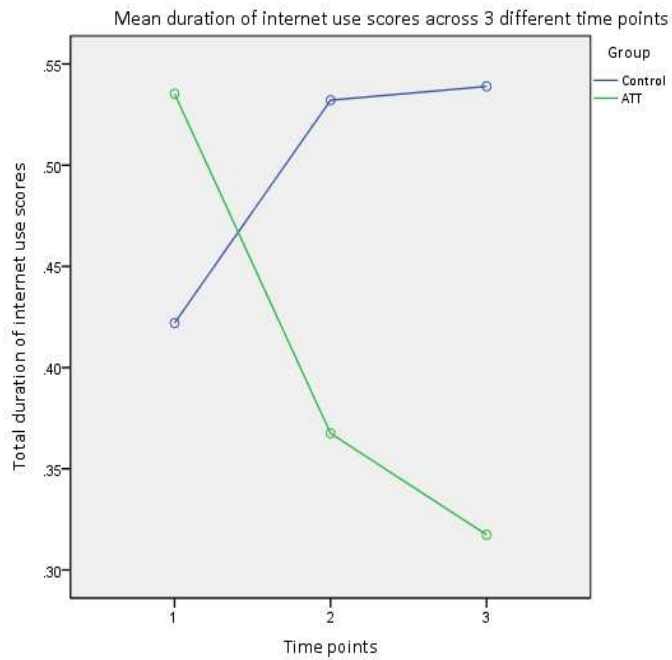


Figure 7: Mean illness related internet use scores across 3 different time points

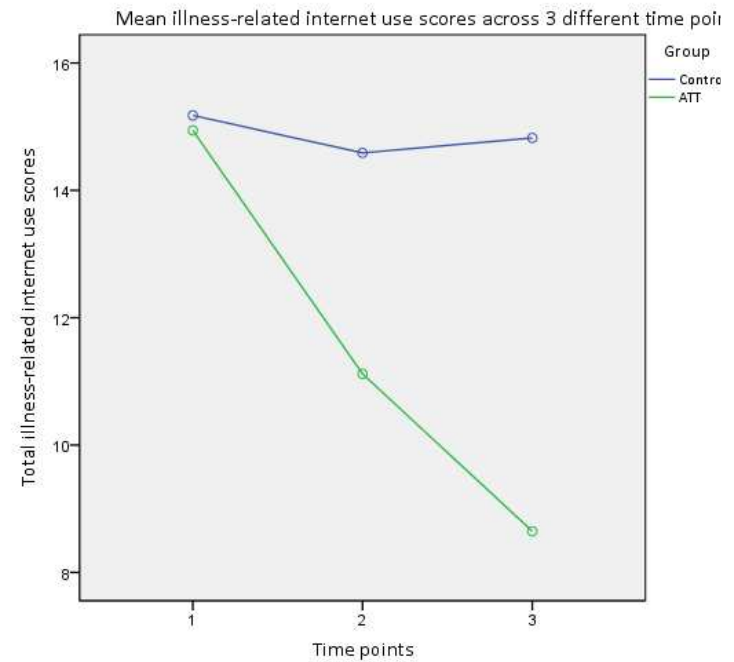


Figure 8: Mean health anxiety (SHAI) scores across 3 different time points

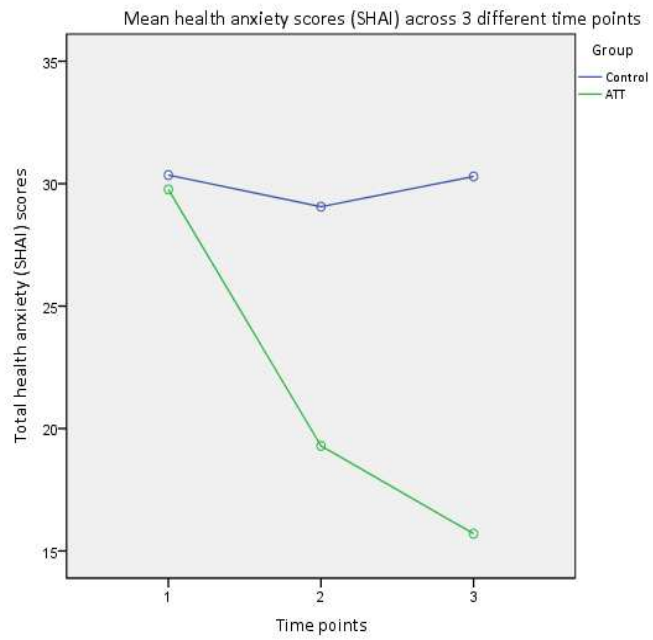


Figure 9: Mean state anxiety scores across 2 different time points

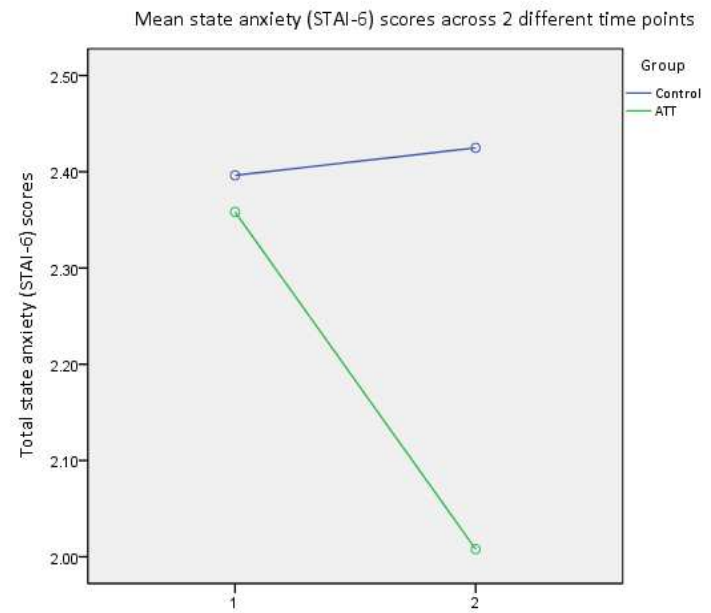
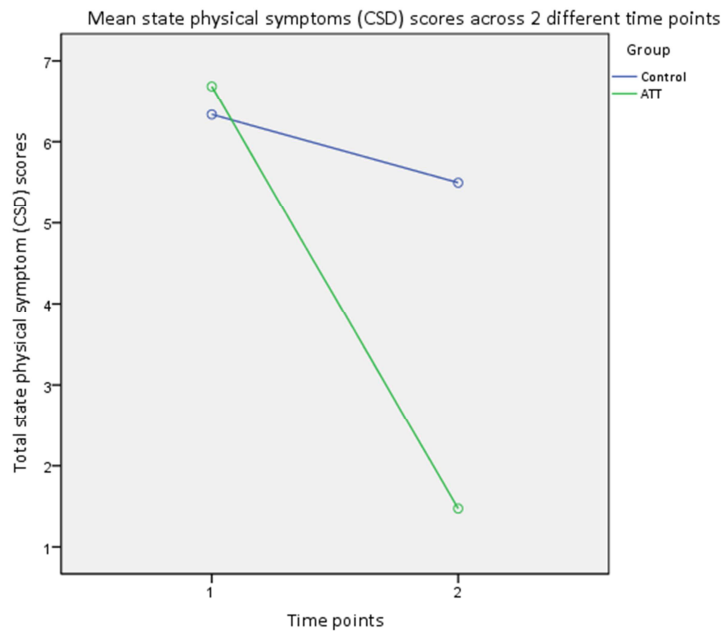


Figure 10: Mean state physical symptoms scores across 2 different time points





Paired samples t-tests were conducted to explore change on the dependent variables over time, separately for each group. As can be seen in Table 6, the ATT group improved on the majority of measures across all time points with the exception of duration of Internet use from Time 2 to Time 3, problematic use of the Internet for health purposes from Time 1 to Time 2, state anxiety from Time 1 to Time 2, and positive metacognitions from Time 2 to Time 3. The control group did not show significant change for the majority of measures across the 3 time points, with the exception of duration of internet use, negative metacognitive beliefs, and skin response conductance from Time 1 to Time 2.<sup>9</sup> Skin response conductance scores were significantly lower at Time 1 and Time 2 for both the ATT ( $p = .025$ ) and control group ( $p = .013$ ). Arousal reduced for both groups across the different time points.

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<sup>9</sup> The results for the MSPQ and the DASS-21 are presented in Appendix X. The ATT group improved significantly for the majority of measures across all time points with the exception of depression and stress from Time 2 to Time 3. The control group did not show significant change for the majority of measures across all time points with the exception of physical symptoms from Time 1 to Time 2.

Table 7: Results of the paired samples t-test exploring change over time for the ATT and control group

Dependent variable	Time Points	T-tests											
		ATT group						Control group					
		Mean	95% Confidence Interval of the Difference		t (df)	Significance (two-tailed)	Cohen's <i>d</i> and effect size	Mean	95% Confidence Interval of the Difference		t (df)	Significance (two-tailed)	Cohen's <i>d</i> and effect size
	Lower	Upper					Lower	Upper					
Problematic use of the internet for health purposes	T1 to T2	.947	-1.062	2.957	.990 (18)	p = .335	.30 (small)	-1.667	-4.225	.892	-1.374	p = .187	-.44 (small)
	T2 to T3	4.647	2.229	7.065	4.074 (16)	p = .001	1.42 (large)	.706	-1.690	3.102	.624 (16)	p = .541	.21 (small)
Frequency of internet use	T1 to T2	1.474	1.101	1.846	8.317 (18)	p < .0001	1.24 (large)	.111	-.303	.525	.566 (17)	p = .579	.08 (small)
	T2 to T3	.471	.059	.882	2.426 (16)	p = .027	.40 (small)	.412	-.219	1.043	1.383 (16)	p = .186	.32 (small)
Duration of internet use	T1 to T2	.166	.085	.247	4.304 (18)	p = .000	.95 (large)	-.108	-.163	-.054	-4.173 (17)	p = .001	-.64 (medium)

	T2 to T3	.050	-.048	.148	1.084 (16)	p = .294	.23 (small)	-.007	-.058	.044	-.285 (16)	p = .780	-.09 (small)
Illness-related internet use	T1 to T2	3.842	2.703	4.918	7.087 (18)	p < .0001	1.68 (large)	.556	-.088	1.199	1.822 (17)	p = .086	.31 (small)
	T2 to T3	2.471	.546	4.395	2.721 (16)	p = .015	.70 (medium)	-.235	-1.098	.628	-.578 (16)	p = .571	-.12 (small)
SHAI	T1 to T2	10.105	7.295	12.915	7.555 (18)	p < .0001	1.48 (large)	1.111	-1.183	3.405	1.022 (17)	p = .321	.21 (small)
	T2 to T3	3.588	1.734	5.443	4.102	p = .001	.46 (small)	-1.235	-2.3836	.365	-1.636 (16)	p = .121	-.19 (small)
Change in state anxiety (STAI-6)	T1 to T2	.35047	-.10506	.80600	1.616 (18)	p = .123	.55 (medium)	-.02858	-.41338	.35621	-.157 (17)	p = .877	-.05 (small)
Change in state physical symptoms (CSD)	T1 to T2	5.211	2.370	8.051	3.854 (18)	p = .001	1.05 (large)	.833	-2.647	4.313	.505 (17)	p = .620	.12 (small)
Negative Meta-cognitive Beliefs	T1 to T2	1.21053	.57639	1.84466	4.011 (18)	p = .001	.90 (large)	.44444	.01897	.86992	2.204	p = .042	.28 (small)
	T2 to T3	.47059	.05936	.88182	2.426 (16)	p = .027	.52 (medium)	.11765	-.32324	.55853	.566 (16)	p = .579	.07 (small)
Positive Meta-cognitive Beliefs	T1 to T2	1.52632	1.00899	2.04365	6.198 (18)	p < .0001	1.33 (large)	.05556	-.41070	.52181	.251 (17)	p = .805	.05 (small)
	T2 to T3	.52941	-.04880	1.10762	1.941 (16)	p = .070	.38 (small)	.41176	-.16476	.98829	1.514	p = .150	.28 (small)
Change in skin response conductance	T1 to T2	.05458	.00785	.10131	2.454 (18)	p = .025	.64 (medium)	.06471	.01536	.11407	2.766 (17)	p = .013	.64 (medium)

## Discussion

The results demonstrate that the ATT intervention significantly reduced health anxiety and problematic Internet use for health purposes in a group of people previously scoring high on these measures compared to the no treatment group who showed no change. The ATT intervention also had an impact on secondary outcome variables and overall seems to be effective in reducing distress, physical symptoms, and metacognitive beliefs. The results were also maintained at follow-up (discussed further below).

Cognitive theories of health anxiety suggest that individuals with health anxiety have a tendency to be hypervigilant and have an attentional bias toward bodily symptoms (Barsky, 1992; Barsky & Wyshak, 1990). Additionally, health anxiety is characterized by misinterpretations of symptoms or sensations as problematic or dangerous in nature (Barsky, 1992). Hypervigilance, attentional bias, and misinterpretations of bodily sensations have been considered to mediate the relationship between health concerns and health anxiety (Ferguson et al., 2000). There is a need for cautious interpretation but changes on the metacognitions measure could be considered within the context of changes in attentional bias, whereby if individuals have greater levels of attentional control, they may be less likely to have an attentional bias, may be less vigilant to changes in bodily sensations, and this may impact on misinterpretation of symptoms.

Cognitive models of health anxiety implicate cognitive appraisal as being significantly involved in the development and maintenance of health anxiety (Warwick & Salkovskis, 1990) and catastrophic cognitive misinterpretation in response to illness-related information is suggested to be important (Salkovski, 1996). Marcus and Church (2003) suggest that health anxious individuals hold dysfunctional illness-related beliefs where the content of cognitions distinguishes those who are health anxious from those who are not. Specific misappraisals are therefore a key component and target of therapy, aiming to reduce health anxious symptoms (Barsky and Ahern, 2004). Although cognitive content and cognitive appraisal has been considered as a central component and important treatment consideration in pathology in general and in health anxiety, there has been a shift in psychological models and theories (Bailey & Wells, 2013). Metacognitive theory proposes that it is cognitive processes rather than cognitive content which drives emotional disturbance (Wells, 2009).

Although the most effective psychological treatments for health anxiety have been CBT, the level of improvements across those interventions have been inconsistent

with recovery rates identified between 30% and 50% (olde Hartman et al., 2009), and similar rates of attrition from treatment (Greeven et al., 2007). Kaur, Butow, and Thewes (2011) indicate that heightened attentional focus on threat is related to metacognition in health anxiety, which may impact upon how health-related information is processed. ATT has been implicated in significant change in health anxious individuals and has reduced health-related worry, threat monitoring, and illness beliefs (Papageorgiou & Wells, 1998). Additionally, ATT has been shown to reduce attention to bodily sensations and health-related anxieties (Weck, Neng, & Stangier, 2012). The findings of this study support the importance and relevance of cognitive processes and ATT in health anxiety and PIU, which implicates the importance of the focus on cognitive processes in assessment and treatment.

Metacognitive therapy is different to traditional CBT in that it focuses upon the higher order processes of worry to increase cognitive flexibility and attentional control rather than challenging the content of people's threat-related beliefs. From this perspective, ATT is designed to increase cognitive flexibility and attentional control, thereby reducing the need for maladaptive coping strategies such as worry and rumination, which are driven by the CAS (Wells, 1990). One possible change process in this context is the effect of the intervention on people's beliefs about the need for, and controllability of their internet use. However, it is not clear if this was the mechanism responsible for the observed changes in problematic Internet use and health anxiety. The changes on the metacognitions measure could indicate that this was the source of the improvement, or this may have been effect rather than cause. Further research is required to examine this further.

Bailey and Wells (2013) found that metacognition was correlated with health anxiety and identified different metacognitive predictors of health anxiety. This included negative metacognitive beliefs about uncontrollability and danger, beliefs about the need for thought control, and cognitive confidence. The ATT in this study aimed to increase participants' awareness of internal control mechanisms and thereby increase their ability to be flexible in how they responded to their health worries, with the aim of increased control over problematic health-related Internet use. Although this was measured as an explicit outcome, participants often commented about increased insight into the level of control they had with regard to how they responded to worries about their health. In line with previous research (Bailey & Wells, 2013), this could be considered in the context of 'cognitive confidence' and if this aspect of metacognition is related to health anxiety, this

adds value to the positive findings on the reduction of PIU and health anxiety within this study. Interpretations about 'cognitive confidence' should be interpreted with caution as this was not measured as an outcome but this may be an important consideration for further research.

Change in physiological arousal in response to the health-relevant stressor did not change as a result of the ATT but state physical symptoms improved. Taken together, these findings suggest that participants in the ATT group interpreted their arousal (or perhaps their ability to cope with it) in a less threatening manner than the control group after the intervention. Alternatively, a placebo effect may have been present, with participants believing they should be reporting fewer effects related to the health-relevant stressor. A further explanation for the lack of change in arousal may be that participants habituated to the health-relevant stressor the second time they were exposed to it, as the same video clip was viewed at Time 1 and Time 2, which may be a limitation of the study design. Further research could show comparison against an active control e.g. relaxation or placebo to investigate this further and should consider the use of different health-relevant stressors to avoid habituation.

It was a pragmatic choice to provide proof of concept that ATT is better than no intervention as opposed to a different intervention or different control i.e. a sham or placebo intervention or more involved control. A real world comparison of no intervention may be a GP informing a patient who presents with health anxiety and uses the internet to search for health information to stop using the internet. Therefore a superior control may be treatment as usual (TAU), but in practice the effects of this may not be that different to not receiving an intervention. TAU was not considered as an appropriate control in this study as the researcher was not a GP and therefore this may have lacked face validity. It would have been difficult for the control condition to incorporate TAU without being more resource intensive, and this was not an option at this early stage of research. Additionally, it was not considered an option to contrast ATT with a different intervention as it is more appropriate to compare the efficacy of ATT compared with no intervention before comparing it with a different intervention.

A striking finding is that improvements in problematic Internet use and health anxiety were maintained over time for the ATT group. For problematic Internet use there was no difference in scores for the ATT group between Time 1 and Time 2 but a significant change in scores between Time 2 and Time 3. This suggests a bigger effect of the intervention over time, suggesting that the effects of the intervention may need time

to develop and then impact on an individual's symptoms and behavior. It may be that this is because participants continue to use the intervention over time, or it may be that they have had more time to accumulate evidence against the belief that their Internet use is out of control. It may add clinical value if people are informed that effects increase over time in order to create a positive and realistic expectation of the outcome.

Duration of internet use did not improve from Time 2 to Time 3 for the ATT group. This could be because a certain level of use is appropriate and does not lead to distress, health anxiety, or an increase in physical symptoms. Frequency of internet use did continue to reduce over time, however, which is the more clinically relevant variable in this context.

Research incorporating longer follow-up periods are required to measure the true effect of ATT. Time 4 data informally suggest that the effects remain but this was not analysed due to a small data set. A short duration of follow-up for the present study makes it impossible to know if the effects of the intervention endure. The short follow-up period is a limitation of the study design, which was made for pragmatic reasons in the context of time limitations for the Clinical Psychology Doctoral thesis.

With reference to clinical implications, the ATT was delivered over a 30 minute session, participants were required to listen to a CD over a two week period and returned for a second testing session, which involved discussions about the effectiveness of the ATT and identified and targeted unhelpful beliefs or behaviours in relation to the ATT. These discussions lasted approximately 15 minutes and in total the intervention was approximately 45 minutes in duration. In terms of clinical applications, the ATT and possibly other metacognitive strategies are less resource intensive and are considerably shorter in duration compared to traditional CBT approaches. If interventions can be delivered in this context this would impact on the demand on resources of services and individual staff within services. Additionally, individuals would be treated quicker and therefore would experience difficulties for a shorter length of time. As a result, difficulties may be less engrained if treatment is quicker, more effective, and if the effects of an intervention pertain over time.

In the context of existing service models in primary care i.e. IAPT, challenges may exist in providing effective CBT interventions within a limited time available to clinicians. As the ATT and potentially other metacognitive interventions are shorter in duration and therefore less resource intensive, metacognitive interventions have the potential to be used efficiently and effectively within existing service models.

The metacognitive approach to emotional difficulties is a trans-diagnostic model, which asserts that common underlying processes are present across all emotional disturbance. Therefore, metacognitive interventions may impact upon different emotional difficulties that an individual presents with as well as their initial presenting difficulty i.e. emotional difficulties not specifically stated as a target for intervention.

Future researchers could expand the findings of this study by replicating findings with larger clinically appropriate samples. Longer follow-ups and more rigorous controls could also be a focus for future research. Despite the limitations of this study, these findings can be considered as an important initial step in this area and an important contribution to the literature. If replicated, they suggest that ATT and other metacognitive interventions might be relevant for treating health anxiety and problematic internet use.



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## Chapter 3: Critical Appraisal

### Introduction

The following paper presents a critical appraisal, which includes the evaluation and appraisal of the systematic review and empirical paper (chapters 1 and 2 of this thesis). It contains reflections on the processes involved in completing this work within the context of a Doctorate in Clinical Psychology thesis, including consideration of organization and planning, application and interpretation of the systematic review, and empirical study. Additionally, issues identified as important within the systematic review and empirical study will be discussed as will the strengths and limitations of the research.

The current thesis provides a review of the relationship between problematic Internet use (systematic review) and the first known experimental investigation of the effects of the Attention Training Technique (ATT) on reducing problematic health-related Internet use in health anxious individuals (empirical study).

## **Systematic Review**

### *Topic selection*

The research project was initiated by a scoping exercise which reviewed the literature in the area of health-related problematic Internet use (PIU). Given that discussions with the research team in the context of supervision had focused upon the possibility of delivering an intervention to individuals who presented with PIU and health anxiety, it was considered important to review clinical applications of health-related problematic Internet use (PIU) within the literature. Existing or experimental treatments of health-related PIU were deliberated as a potential topic, however the scoping exercise did not yield an appropriate number of papers to inform a meaningful systematic review. The focus of the search then explored interventions for PIU in general, which broadly yielded studies focusing on cognitive-behavioural treatments and a small number of different interventions such as psychotherapeutic approaches and family therapy. An additional finding from this search revealed that PIU was poorly defined within the literature and was typically understood within the context of behavioural addiction, where lack of impulse control is considered to be a key feature. It was decided that although this topic would provide potentially useful evidence regarding existing treatments for PIU, it may be difficult to draw conclusions from the literature given the lack of consensus regarding the clinical profile of PIU. Following this, it seemed more efficacious to examine characteristics of PIU in order to facilitate an understanding of the mechanisms involved in PIU. This would potentially inform important theoretical and clinical applications. From the various characteristics that this scope yielded such as social withdrawal, problematic sleep, and depressive symptoms, impulsivity was consistently presented as a key feature of PIU. Finally, the focus of the review was agreed and a systemic search of the literature to examine the relationship between PIU and impulsivity commenced.

### *Search terms*

In order to identify appropriate search terms to for the review, key concepts were identified including 'internet', 'id disorder', 'cyberchondria', 'impulsivity', 'inhibition' and 'metacognition'. Medical Subject Headings (MeSH) terms were used to identify any further synonyms within each database to ensure the search would capture relevant studies. The next step involved selecting appropriate truncation for each term. Once an

inclusive list of search terms had been produced, guidance was sought from the research team to ensure that search terms were comprehensive and well considered. This did not yield any further search terms. The search was run within the identified databases, which yielded a manageable number of articles.

#### *Inclusion and exclusion criteria*

English language articles were included only. Papers had to describe quantitative empirical studies published in a peer reviewed journal that included measures of PIU and impulsivity and which provided data about the relationship between the two. This included both correlational and case control studies where people with PIU were compared to those without PIU or to another clinical population. Samples where PIU was exclusively identified as online gaming were excluded as the clinical features, mechanisms, and functions involved in online gaming were considered to be different to those involved in more general PIU. Kiraly et al. (2014) suggests that it is important to distinguish between PIU and online gaming as they are two different types of behaviours, which are conceptually distinct. The decision to exclude populations exclusively identified as online gaming was made post hoc after the initial inclusion and exclusion criteria had been established.

#### *Quality assessment*

A number as quality assessment tools were considered and there appeared to be scarcity of valid and reliable tools appropriate for use with non-intervention studies. This finding was supported by a review of quality assessment tools completed by Jarde, Losilla, and Vives (2012). From the reviewed tools, the Downs and Black checklist (1998) was deemed the most appropriate for use with the methodological designs of the studies included in the review (case control and correlational). Additionally the tool is considered to have high internal consistency and good test-retest and inter-rater reliability (Downs & Black, 1998). The tool was modified as not all items were relevant to the identified studies.

The quality rating process involved two distinct stages. The first stage involved all included studies being second-rated by an independent researcher and a high degree of agreement was found (0.9, Cohen's kappa; Cohen, 1960). The process of sharing ratings and identifying and discussing discrepancies was a useful part of the review process. Discrepancies in ratings were discussed Divergent ratings usually related to one rater



giving higher quality ratings based on rational and logical assumptions about the information presented in the articles i.e. that participants in different groups completed the study at the same time unless otherwise specified. Lower ratings were provided by the other rater based on the lack of detailed information regarding the same criteria and assumptions were not used to rate quality. As it was difficult to ascertain quality of specific items due to the lack of detail provided in some studies, these studies received a lower quality rating. These ratings may therefore not accurately represent study quality but instead may represent the foresight of the authors to include detailed information.

#### *Analysis within the review*

It would have been an option to complete a meta-analysis for all studies with a correlational design to obtain a pooled estimate of effect. However, the reviewed articles comprised correlational and case control designs and used different measures of impulsivity (questionnaire based and cognitive tasks), where the construct of impulsivity was measured differently and therefore was asking a different question about the relationship between PIU and impulsivity.

Higgins and Green (2011) describe a common criticism of meta-analyses, indicating that if studies are diverse, then a meta-analysis may be meaningless, and may disguise real differences in effects. Higgins and Green (2011) explain that diversity in the comparisons being made in studies is of particular importance and suggest that combining all studies into a meta-analysis may therefore not be advantageous or logical.

Although a meta-analysis was considered appropriate for a selection of studies in the review, it was decided that it may be more meaningful to complete a systematic review and consider the findings of the reviewed articles separately rather than aggregate the results into a single finding and combine outcomes which may have been too diverse.

#### *Theoretical and clinical implications*

The review found a consistent relationship between impulsivity and PIU in studies using different measures of impulsivity, a majority of clinical and student populations and in both case control and correlational studies.

Metacognitive treatment is designed to increase cognitive flexibility and awareness so that individuals become aware of their level of control over their attention thereby reducing the need for maladaptive coping strategies driven by the CAS (Wells,

2009). With this in mind, impulsivity may well be a key feature of PIU that would be an appropriate focus of treatment using metacognitive intervention. The proneness to behave impulsively when distressed (Cyders & Smith, 2008), may indicate a tendency to engage in problematic behaviours (Billieux et al., 2010). This may relate to PIU as a means of regulating emotion. With the consideration of the relationship between impulsivity and PIU, treatment could focus on increasing attentional flexibility and control so that when distressed, individuals are more able to inhibit an impulse to use the internet. Metacognitive intervention may therefore be relevant for treating PIU considering its relationship with impulsivity.

## **Empirical paper**

Paper two provides an investigation of the effects of a metacognitive intervention (Attention Training Technique; ATT) on reducing problematic health-related Internet use in health anxious individuals. The main findings demonstrated a reduction in health anxiety and PIU in individuals previously scoring highly on measures of health anxiety and PIU.

### *Recruitment*

It was not anticipated that recruiting a large enough sample would be problematic and based on previous research (Singh & Brown, in preparation), it was established that 275 participants would need to be screened in order to recruit an appropriate number of participants. By the end of recruitment, 626 individuals had been screened and 37 participants were tested and completed both the initial and second testing session. The increased number of individuals needed for the screening increased the amount of resources required and meant that it was necessary for the researcher to continue testing for a considerably longer period of time than had initially been anticipated. Additionally, a score of 13 or above on the Online Health-related Beliefs and Behaviours Inventory (OHBBI) was part of the initial inclusion criteria. However, as recruitment was slower than anticipated, inclusion criteria was changed to include scores of 12 or above on the OHBBI scale 3 (indicating a score just outside the top quartile of scores on problematic health-related Internet use; Singh, 2013). Scores of 12 represent individuals scoring highly on the OHBBI, therefore the researchers were confident that all participants had increased levels of PIU.

### *Power calculation*

There were no previous studies on which to base an effect size in relation to treatment effects. Therefore a pragmatic decision was made about the number of individuals that could be realistically identified and tested in the time available. We then calculated the kind of effect that would need to be seen in order to have an 80% chance of detecting it. A power calculation was carried out but was based on the numbers of participants that would need to be identified and tested and the type of effect we would need to see in order to have an 80% chance of detecting it.

### *Study design*

In retrospect it may have been better to design this study as a feasibility trial rather than a test of efficacy. It was not clear if the intervention could be delivered as intended based on feasibility work but the research team was confident that the intervention could be delivered within the context of an RCT using a student population. Based on Singh and Brown's work (in preparation) sensible assumptions were made about recruitment, retention and the numbers needed to be screening to see an effect. As feasibility studies are considered to be an essential step in the development and evaluation of an intervention (MRC, 2000), it may have been a more prudent decision to complete a feasibility trial. However, completing a pilot RCT as a preliminary test of the intervention has demonstrated that it is feasible to complete a formal RCT within this area of research. As a result of this study, the number of individuals needed for it to be feasible to complete an RCT is known. It may have been more appropriate to frame the research as a pilot RCT within the thesis and I have referenced the preliminary nature of the trial with regards to the setup of the study. A student population was chosen in contrast to a clinical sample as it was deemed more appropriate as a preliminary test of intervention to evaluate the intervention in a non-clinical sample.

### *Measures*

The Online Health-related Beliefs and Behaviours Inventory (OHBBI) (Singh & Brown, In preparation; Appendix E) scales 1 (illness-related Internet use) and 3 (problematic use of the Internet for health purposes), 4 (negative attitudes towards doctors), 7 (post-search doctor utilization), and 8 (anxiety post search/perceived adverse consequences of searching) were used to assess health-related Internet use. The measure was selected due to demonstrated psychometric properties (Singh & Brown, in preparation) and its relevance in assessing health-related PIU. On reflection it may not have been necessary to use scales four, seven, and eight as they were not entered into the analysis as scales one and three were considered most appropriate within the context of the study to measure health related-PIU.

The Short Health Anxiety Inventory (SHAI; Salkovskis, Rimes, Warwick & Clark, 2002; Appendix F) was used as it is a disorder specific scale recommended by the NHS Improving Access to Psychological Therapies (IAPT) initiative (IAPT-NHS, 2011).

Additionally, the SHAI demonstrates good psychometric properties, including reliability and validity (Salkovskis, Rimes, Warwick & Clark, 2002). IAPT suggest a cut-off score of 15 indicates health anxious patients and this guidance was used in the study.

Changes in skin response conductance were measured using a NEULOG skin response conductance sensor. Changes in skin response conductance occur when the autonomic nervous system (ANS) is activated, indicating emotional arousal (Ravaja, 2004). It was administered before and during the 'symptom provocation task' and was considered appropriate to measure physiological arousal. The symptom provocation task involved participants watching a short video clip of a well-known UK medical drama. The same video clip was played at Time 1 and Time 2 and change in skin response conductance reduced from Time 1 to Time 2 for both the ATT and control group. This suggests that participants habituated to the stressor. If this is indeed the case, a different health-related video clip should have been played at Time 2 to avoid habituation.

The short form State-Trait Anxiety Inventory (STAI-6; Mardeau & Bekker, 1992; Appendix J) was chosen as it measures state anxiety. It is highly correlated with the 20-item STAI and has good internal consistency and reliability (Tluczek, Henriques, & Brown, 2009). It was administered immediately before and after the provocation task included at Time 1 and Time 2 and was deemed appropriate for use to capture state anxiety in relation to a health-relevant stressor included in the provocation task.

The Checklist for Symptoms in Daily Life (CSD; Wientjes & Grossman, 1994; Appendix K) was administered immediately before and after the provocation task and was used because it is a reliable and valid measure of state physical symptoms. (Grossman & de Swart, 1984; Wientjes & Grossman, 1994).

Metacognitions were assessed by administering 4 items adapted from the Metacognitions Questionnaire 30 (Wells & Cartwright, 2004; Appendix L). As there are no existing measures of metacognition specifically focused on health-related Internet use, it was considered appropriate to adapt the Metacognitions Questionnaire 30, which demonstrates good psychometric properties (Typaldou, 2010).

This Internet Use Questionnaire (Appendix G) was an idiosyncratic measure of Internet use. Existing measures such as the Generalized Problematic Internet Use Scale 2 (GPIUS2) was not sensitive enough to distinguish health-related PIU from other subtypes of PIU, and was therefore not deemed appropriate for use in the study.

The Depression Anxiety Stress Scales (DASS) (Lovibond & Lovibond, 1995; Appendix H) was selected as a measure of affect with good psychometric properties (Clara, Cox, & Enns, 2001; Daza et al., 2002; Crawford & Henry, 2003).

The Modified Somatic Perception Questionnaire (MSPQ; Main, 1983; Appendix I) was selected to identify somatic complaints that may be associated with psychological responses such as anxiety and depression. It was selected due to good internal consistency and validity and sound discriminant validity (Main, 1983; Deyo, Walsh, Schoenfeld, & Ramamurthy, 1989).

### *Population*

It was decided to use a non-clinical population to test the effectiveness of ATT as it was preliminary research that had not evaluated the use of ATT for individuals with health anxiety and PIU. Prior to establishing the effectiveness of treatments in clinical populations, it seems appropriate to use non-clinical samples in preliminary research and then go on to replicate findings with clinical populations. In the context of the thesis, it was considered that the use of students would yield appropriate numbers for recruitment and potential risk to participants and to the researcher would be minimised and managed more effectively as testing would be carried out on University property, where support could easily be accessed if required.

### *Control group*

A waiting list (no treatment) group was selected as a measure of control. A number of alternatives were considered when identifying an appropriate control group including an active control such as a relaxation group, treatment as usual (TAU), and a waiting list condition. It was a pragmatic choice to use the waiting list group as a control as it was considered most likely to simulate what an individual with PIU and health anxiety would be given if they presented with symptoms. It was also acknowledged that this choice of control would be most likely to show an effect which felt appropriate given that we are at the proof on concept stage and hoped to demonstrate the sensitivity of the effect. There are however a number of limitations associated with the use of a waiting list control. Firstly ethical considerations are raised as individuals presenting with difficulties are not provided with an intervention that may potentially have benefit. Secondly, it is difficult to establish how closely the waiting list condition correlates to someone who presented to their GP for example with health anxiety and PIU in real life. Thirdly, it may have been more appropriate to have a TAU condition as opposed to a waiting list condition but this

raises questions about the face validity of the condition, which would attempt to replicate a GP informing individuals not to use the internet to research health-related information. Finally, the waiting list condition does not control for non-specifics of expectation, hope, and social contact and therefore it would be important to replicate the findings of this study using a TAU condition where the researcher presents themselves in a manner similar to a GP to increase face validity.

#### *Follow-up*

The length of follow-up was selected for pragmatic reasons to fit within the time constraints and limitations of the thesis. It would be advantageous to replicate the findings of the study using longer follow-up periods to examine if effects pertain over a longer period of time.

#### *Multiple testing*

Numerous t-tests were conducted within the analysis, which increases the likelihood that a significant result is obtained by chance (type I error). Corrections can be applied to multiple tests by adjusting alpha to accommodate the chance of type I error i.e. Bonferroni corrections to adjust the significance level dependent on the number of tests that are carried out in the analysis ( $\alpha/n$ ). The reason for performing Bonferroni adjustments is to decrease the likelihood of type I errors. However, type I errors cannot decrease without increasing the risk of type II errors (Rothman, 1990), which are no less false and problematic than type I errors. Using Bonferonni adjustments increases the probability of type II errors, which may mean that important differences are considered non-significant (Perneger, 1998). Type I errors can have negative implications for clinical practice and in research i.e. appropriate care being denied if an intervention was considered not compatible with a certain difficulty if based on a Bonferroni adjustment and an effective treatment seen as being no better than placebo (Perneger, 1998). Perneger (1998) suggests that Bonferroni adjustments do not guarantee a sensible interpretation of the results and are problematic because corrections are based upon the idea that the interpretation of a finding is dependent on the number of other tests performed. Perneger (1998) indicates that describing which statistical tests were completed and the reasons why and discussing possible interpretations of each result,

should provide the reader with the opportunity to approach and reach a reasonable and considered inference without the use of Bonferroni adjustments.

Royall (1997) explains the important difference with reference to what the data describes and how this is interpreted. Interpretation depends on both the presented data and considerations such as if a finding is plausible and whether the significant result was within the expected direction. (Perneger, 1998). Bonferroni corrections can be very conservative so it can make it hard to find a result with a small sample size when there might be significant findings i.e. type II error. Cohen (1994) and Perneger (1998) suggest that Bonferroni adjustments have limited applications and advise that they should not be used when assessing evidence in relation to specific hypotheses.

Another alternative to address the issue of multiple testing may be to use a certain significance level for the primary outcome and a more stringent significance level for the secondary outcomes i.e.  $p=0.05$  for the primary outcome and use Bonferroni corrections for the secondary outcomes or  $p=0.05$  for the primary outcome and  $p=0.01$  for secondary outcomes. With consideration to the issues of multiple testing and the methods for dealing with multiple testing, the results of the thesis were consistent across all outcomes and were within the predicted direction. The risk of conducting Bonferroni corrections would be that where the intervention had affected change, results would become not significant and the risk of finding a type II error would increase. So for that reason the goal was to balance the risk of type I and type II error. We considered using  $p=0.05$  for primary outcomes and  $p=0.01$  for secondary outcomes but decided that as this would only alter a very small number of results (making them non-significant) and in light of the consistent findings within the predicted direction, this may increase the likelihood of type II error. Additionally, it was considered that the likelihood of committing type I error was extremely small.

Cohen (1994) describes a case for insisting on a specific alpha value to indicate a significant result when the result is something that is known to be true and argues that null hypotheses significance testing do not provide information in the way many researchers assume they do and it impedes the growth of scientific knowledge.

### *Conclusions*

The key findings of this study demonstrate the effectiveness of ATT in reducing health anxiety and problematic Internet use in health anxious individuals. Secondly the findings



indicate that the effect of ATT pertains over time. The findings do not provide evidence of a causal link and it is not clear if people with PIU become more impulsive or if impulsivity makes it more likely that individuals will engage in Internet use. Findings from the systematic review demonstrate that impulsivity is implicated in PIU and can make individuals more likely to use the internet but a question exists over if ATT reduces impulsivity or changes the perceived need to use the Internet i.e. is PIU an impulse control problem or a worry management strategy. If PIU is indeed an impulse control problem this suggests that individuals cannot inhibit their attentional control and so find themselves engaging in behaviours which are problematic. Establishing a clearer theoretical understanding is important and may be achieved by isolating components of impulsivity and examining how this impacts on PIU.

Despite the challenges in establishing a causal link based on the findings from the study, it is clear that ATT is effective at reducing health anxiety and PIU and those effects endure over time. Metacognitive interventions may provide a simpler, briefer, and more effective treatment compared to traditional CBT approaches. If individuals are indeed identified as health anxious, the findings raise questions in relation to whether we should be asking people about PIU and if this is identified as problematic, should we be treating these individuals differently. Although it is unclear if ATT is effective for health anxiety more generally, the results are promising and point to the use of ATT and potentially other metacognitive interventions for treating health anxiety and PIU.

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*Examples:* Reference to a journal publication: Van der Geer, J., Hanraads, J. A. J., & Lupton R. A. (2000). The art of writing a scientific article. *Journal of Scientific Communications*, 163, 51-59.

Reference to a book: Strunk, W., Jr., & White, E. B. (1979). *The elements of style*. (3rd ed.). New York: Macmillan, (Chapter 4).

Reference to a chapter in an edited book: Mettam, G. R., & Adams, L. B. (1994). How to prepare an electronic version of your article. In B.S. Jones, & R. Z. Smith (Eds.), *Introduction to the electronic age* (pp. 281-304). New York: E-Publishing Inc.

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- Full postal address

All necessary files have been uploaded, and contain:

- Keywords
- All figure captions
- All tables (including title, description, footnotes)

Further considerations

- Manuscript has been 'spell-checked' and 'grammar-checked'
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- All references mentioned in the Reference list are cited in the text, and vice versa
- Permission has been obtained for use of copyrighted material from other sources (including the Internet)

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## Appendix B: Table 1. Quality Ratings

Table 1: Quality Ratings

	Balconi, and Finocchiaro (2016)	Cao et al. (2007)	Zhou et al. (2016)	Zhou et al. (2014)	Zhou et al. (2010)	Li et al. (2016)	Choi et al. (2014)	Dalbudak et al. (2013)	Hwang, et al. (2014)	Lim et al. (2015)
1. Is the hypothesis/aim/objective of the study clearly described?	1	1	1	1	1	1	1	1	0	1
2. Are the main outcomes to be measured clearly described in the Introduction or methods section?	1	1	1	1	1	1	1	1	1	1
3. Are the characteristics of the patients included in the study clearly described?	1	1	1	1	1	1	1	1	1	1
4. (5) Are the distributions of principle confounders in each group of subjects to be compared clearly described?	1	1	2	2	2	1	1	0	1	1
5. (6) Are the main findings of the study clearly described?	0	1	1	1	1	1	1	1	1	1
6. (7) Does the study provide estimates of the random variability in the data for the main outcomes?	0	1	1	1	1	1	1	1	1	1
7. (9) Have the characteristics of patients lost to follow-up been described?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

8. (10) Have actual probability values been reported (e.g. 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?	1	0	1	1	1	1	1	1	1	0
9. (11) Were the subjects asked to participate in the study representative of the entire population from which they were recruited?	0	1	0	0	0	0	0	0	0	0
10. (12) Were those subjects who were prepared to participate representative of the entire population from which they were recruited?	0	1	0	0	0	0	0	0	0	0
11. (15) Was an attempt made to blind those measuring the main outcomes of the intervention. Yes=1, No=0, Unable to determine=0	1	0	0	0	0	0	0	1	0	N/A
12. (18) Were the statistical tests used to assess the main outcomes appropriate?	1	1	1	1	1	1	1	1	1	1
13. (20) Were the main outcome measures used accurate (valid and reliable)?	1	1	0	0	0	0	1	0	0	1
14. (21) Were the patients in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?	1	1	0	0	0	1	0	1	0	1

15. (22) Were study subjects in different intervention groups (trials and cohort studies) or were the cases and controls (case control studies) recruited over the same period of time?	0	1	0	0	0	0	0	1	0	0
16. (25) Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?	0	1	0	0	0	1	0	0	0	0
17. (27) Did the study have sufficient power to detect a clinically important effect where the probability value for a difference being due to chance is less than 5%?	1	1	0	0	1	1	0	1	1	0
18. Overall quality rating	62.5%	87.5%	53.1%	53.1%	59.4%	68.6%	56.3%	68.8%	50%	60%

	Lin et al. (2015)	Park et al. (2013)	te Wild, et al. (2010)	Wee et al. (2014)	Yau et al. (2013)	Zhang et al. (2015)	Chen et al. (2015)	Lin et al. (2011)	Billieux et al. (2010)	Burnay et al. (2015)	Yau et al. (2015)
1. Is the hypothesis/aim/objective of the study clearly described?	1	1	1	1	0	1	1	1	1	1	1
2. Are the main outcomes to be measured clearly described in the Introduction or methods section?	1	1	1	1	1	1	1	1	1	1	1
3. Are the characteristics of the patients included in the study clearly described.	1	0	1	1	1	0	0	1	0	0	1

4. (5) Are the distributions of principle confounders in each group of subjects to be compared clearly described?	2	1	1	2	1	1	1	1	2	1	1
5. (6) Are the main findings of the study clearly described?	1	1	0	1	1	1	1	1	1	1	1
6. (7) Does the study provide estimates of the random variability in the data for the main outcomes?	1	0	1	1	1	1	1	1	1	1	0
7. (9) Have the characteristics of patients lost to follow-up been described?	N/A	N/A	N/A	N/A	N/A	N/A	0	N/A	N/A	N/A	N/A
8. (10) Have actual probability values been reported (e.g. 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?	1	0	0	1	1	0	0	0	0	1	1
9. (11) Were the subjects asked to participate in the study representative of the entire population from which they were recruited?	0	0	0	0	0	0	0	0	0	0	0
10. (12) Were those subjects who were prepared to participate representative of the entire population from which they were recruited?	0	0	0	1	0	0	0	1	0	0	0
11. (15) Was an attempt made to blind those measuring the main outcomes of the intervention. Yes=1, No=0, Unable to determine=0	0	N/A	0	0	0	N/A	N/A	1	N/A	N/A	0

12. (18) Were the statistical tests used to assess the main outcomes appropriate?	1	1	0	1	1	1	1	1	1	1	1
13. (20) Were the main outcome measures used accurate (valid and reliable)?	0	1	0	0	0	1	0	1	1	0	0
14. (21) Were the patients in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?	0	0	0	0	1	0	1	1	0	0	1
15. (22) Were study subjects in different intervention groups (trials and cohort studies) or were the cases and controls (case control studies) recruited over the same period of time?	0	0	0	0	0	0	0	1	0	0	0
16. (25) Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?	0	0	0	0	0	1	0	0	1	1	0
17. (27) Did the study have sufficient power to detect a clinically important effect where the probability value for a difference being due to chance is less than 5%?	0	1	0	0	1	1	1	1	0	1	Unable to rate
18. Overall quality rating	53.1 %	46.7 %	31.2 5%	65.6 %	56.2 5%	60%	50%	81.2 5%	56.7 %	60%	50%

				Mottram and Fleming (2009)	Meerkerk et al. (2010)	Wu et al. (2013)
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1. Is the hypothesis/aim/objective of the study clearly described?	0	1	1
2. Are the main outcomes to be measured clearly described in the Introduction or methods section?	1	1	1
3. Are the characteristics of the patients included in the study clearly described.	1	1	1
4. (5) Are the distributions of principle confounders in each group of subjects to be compared clearly described?	0	0	1
5. (6) Are the main findings of the study clearly described?	1	1	0
6. (7) Does the study provide estimates of the random variability in the data for the main outcomes?	1	1	1
7. (9) Have the characteristics of patients lost to follow-up been described?	N/A	N/A	N/A
8. (10) Have actual probability values been reported (e.g. 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?	0	1	0
9. (11) Were the subjects asked to participate in the study representative of the entire population from which they were recruited?	0	0	0
10. (12) Were those subjects who were prepared to participate representative of the entire population from which they were recruited?	0	0	0
11. (15) Was an attempt made to blind those measuring the main outcomes of the intervention. Yes=1, No=0, Unable to determine=0	N/A	0	N/A
12. (18) Were the statistical tests used to assess the main outcomes appropriate?	1	1	1
13. (20) Were the main outcome measures used accurate (valid and reliable)?	1	1	1
14. (21) Were the patients in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?	0	1	0
15. (22) Were study subjects in different intervention groups (trials and cohort studies) or were the cases and controls (case control studies) recruited over the same period of time?	0	1	0

16. (25) Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?	0	0	0
17. (27) Did the study have sufficient power to detect a clinically important effect where the probability value for a difference being due to chance is less than 5%?	1	1	1
18. Overall quality rating	46.7%	68.8%	53.3%

## Appendix C: Behaviour Research and Therapy Author Guidelines

### Guide for Authors



#### Introduction

The major focus of *Behaviour Research and Therapy* is an experimental psychopathology approach to understanding emotional and behavioral disorders and their prevention and treatment, using cognitive, behavioral, and psychophysiological (including neural) methods and models. This includes laboratory-based experimental studies with healthy, at risk and subclinical individuals that inform clinical application as well as studies with clinically severe samples. The following types of submissions are encouraged: theoretical reviews of mechanisms that contribute to psychopathology and that offer new treatment targets; tests of novel, mechanistically focused psychological interventions, especially ones that include theory-driven or experimentally-derived predictors, moderators and mediators; and innovations in dissemination and implementation of evidence-based practices into clinical practice in psychology and associated fields, especially those that target underlying mechanisms or focus on novel approaches to treatment delivery. In addition to traditional psychological disorders, the scope of the journal includes behavioural medicine (e.g., chronic pain). The journal will not consider manuscripts dealing primarily with measurement, psychometric analyses, and personality assessment.

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#### **Contact details**

Any questions regarding your submission should be addressed to the Editor in Chief:

Professor Michelle G. Craske

Department of Psychology

310 825-8403

Email: [brat@psych.ucla.edu](mailto:brat@psych.ucla.edu)



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If there is more than one appendix, they should be identified as A, B, etc. Formulae and equations in appendices should be given separate numbering: Eq. (A.1), Eq. (A.2), etc.; in a subsequent appendix, Eq. (B.1) and so on. Similarly for tables and figures: Table A.1; Fig. A.1, etc.

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### ***Acknowledgements***

Collate acknowledgements in a separate section at the end of the article before the references and do not, therefore, include them on the title page, as a footnote to the title or otherwise. List here those individuals who provided help during the research (e.g., providing language help, writing assistance or proof reading the article, etc.).

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## Appendix D: Online Health-Related Beliefs and Behaviours Inventory (OHBBI)

### OHBBI

#### Frequency and Duration of Health-Related Internet Use

- 1) In the last 2 weeks, how often have you used the Internet to search for health-related information? Please tick the option below that best fits.

Several times a day

Daily

Every 2 days

Every 2-4 days

Once a week

Less than once every 2 weeks

Never

- 2) When you have used the Internet during the past 2 weeks to search for health-related information, how long have you spent doing this? Please tick the option below that best fits.

A few seconds

A few minutes

Quarter hour

Half an hour

Forty five minutes

An hour

More than an hour

We are interested in your use of the Internet for health purposes. Below are a number of statements on this topic. Please read each statement carefully and indicate the extent to which you agree/disagree with it on the scale provided by placing a tick in the relevant box. Please complete every question.

	Disagree a lot	Disagree a little	Agree a little	Agree a lot
1) I often feel anxious before going on the internet for health purposes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2) I am likely to visit a doctor after a health related internet search	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3) The health information I read on the internet increases my worry/anxiety	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4) I go on the internet for health information because I find it difficult not knowing what is wrong with me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5) . My doctor is unhelpful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6) I am often convinced that I have a serious illness after reading health information on the internet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7) My use of the internet for health purposes negatively affects my social, work and/or academic life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8) When I search the internet for health purposes/information, I am there for a long time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9) The health information on the internet makes me feel more uncertain about my health issue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10) I can no longer control my use of the internet for health purposes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11) I dislike my doctor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12) I often feel the need to visit a doctor because I require reassurance about something I have read online	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13) I often visit a doctor after searching online because something I read alarmed me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. I find it difficult to reduce the amount of time I spend using the Internet for health purposes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. I feel that if I do not search on the internet for health information, I may develop an illness/my current illness may worsen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. A large proportion of my total internet time is for health purposes/information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. I often feel more anxious after going on the internet for health purposes than I did before I searched	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. My doctor does not spend enough time with me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

19. When I use the internet for health purposes, I am often looking for information about symptoms/illnesses I currently have or am concerned about getting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. If I cannot look for health information on the Internet I feel restless and irritable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. I feel I have to convince the doctor that I have something wrong with me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. I use the Internet to diagnose what is causing my symptoms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. I avoid health information on the Internet because I know it will only make me feel anxious	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. I start by searching the internet for information about symptoms and end up reading about serious illnesses	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25. When I am searching for health information on the internet, I am searching for my own symptoms/health issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26. The health information on the internet makes me think I have a serious health issue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
27. If I did not have the internet available for health purposes, my life would be significantly altered for the worse	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Appendix E: Short Health Anxiety Inventory (SHAI)

### HAI

---

name: \_\_\_\_\_

date: \_\_\_\_\_

Each question in this section consists of a group of four statements. Please read each group of statements carefully and then select the one which best describes your feelings, over the past six months (or other agreed time period). Identify the statement by ringing the letter next to it, i.e. if you think that statement *a.*) is correct, ring statement *a.*). It may be that more than one statement applies, in which case, please ring any that are applicable.

1.
  - a.) I do not worry about my health.
  - b.) I occasionally worry about my health.
  - c.) I spend much of my time worrying about my health.
  - d.) I spend most of my time worrying about my health.
  
2.
  - a.) I notice aches/pains less than most other people (of my age).
  - b.) I notice aches/pains as much as most other people (of my age).
  - c.) I notice aches/pains more than most other people (of my age).
  - d.) I am aware of aches/pains in my body all the time.
  
3.
  - a.) as a rule I am not aware of bodily sensations or changes.
  - b.) sometimes I am aware of bodily sensations or changes.
  - c.) I am often aware of bodily sensations or changes.
  - d.) I am constantly aware of bodily sensations or changes.
  
4.
  - a.) resisting thoughts of illness is never a problem.
  - b.) most of the time I can resist thoughts of illness.
  - c.) I try to resist thoughts of illness but am often unable to do so.
  - d.) thoughts of illness are so strong that I no longer even try to resist them.
  
5.
  - a.) as a rule I am not afraid that I have a serious illness.
  - b.) I am sometimes afraid that I have a serious illness.
  - c.) I am often afraid that I have a serious illness.
  - d.) I am always afraid that I have a serious illness.

6. a.) I do not have images (mental pictures) of myself being ill.  
b.) I occasionally have images of myself being ill.  
c.) I frequently have images of myself being ill.  
d.) I constantly have images of myself being ill.
7. a.) I do not have any difficulty taking my mind off thoughts about my health.  
b.) I sometimes have difficulty taking my mind off thoughts about my health.  
c.) I often have difficulty in taking my mind off thoughts about my health.  
d.) Nothing can take my mind off thoughts about my health.
8. a.) I am lastingly relieved if my doctor tells me there is nothing wrong.  
b.) I am initially relieved but the worries sometimes return later.  
c.) I am initially relieved but the worries always return later.  
d.) I am not relieved if my doctor tells me there is nothing wrong.
9. a.) if I hear about an illness I never think I have it myself.  
b.) if I hear about an illness I sometimes think I have it myself.  
c.) if I hear about an illness I often think I have it myself.  
d.) if I hear about an illness I always think I have it myself.
10. a.) if I have a bodily sensation or change I rarely wonder what it means.  
b.) if I have a bodily sensation or change I often wonder what it means.  
c.) if I have a bodily sensation or change I always wonder what it means.  
d.) if I have a bodily sensation or change I must know what it means.
11. a.) I usually feel at very low risk for developing a serious illness.  
b.) I usually feel at fairly low risk for developing a serious illness.  
c.) I usually feel at moderate risk for developing a serious illness.  
d.) I usually feel at high risk for developing a serious illness.
12. a.) I never think I have a serious illness.  
b.) I sometimes think I have a serious illness.  
c.) I often think I have a serious illness.  
d.) I usually think that I am seriously ill.

- 13.** a.) if I notice an unexplained bodily sensation I don't find it difficult to think about other things.
- b.) if I notice an unexplained bodily sensation I sometimes find it difficult to think about other things.
- c.) if I notice an unexplained bodily sensation I often find it difficult to think about other things.
- d.) if I notice an unexplained bodily sensation I always find it difficult to think about other things.
- 14.** a.) my family/friends would say I do not worry enough about my health.
- b.) my family/friends would say I have a normal attitude to my health.
- c.) my family/friends would say I worry too much about my health.
- d.) my family/friends would say I am a hypochondriac.

For the following questions, please think about what it might be like if you had a serious illness of a type which particularly concerns you (e.g. heart disease, cancer, multiple sclerosis & so on). Obviously you cannot know for definite what it would be like; please give your best estimate of what you *think* might happen, basing your estimate on what you know about yourself and serious illness in general.

- 15.** a.) if I had a serious illness I would still be able to enjoy things in my life quite a lot.
- b.) if I had a serious illness I would still be able to enjoy things in my life a little.
- c.) if I had a serious illness I would be almost completely unable to enjoy things in my life.
- d.) if I had a serious illness I would be completely unable to enjoy life at all.
- 16.** a.) if I developed a serious illness there is a good chance that modern medicine would be able to cure me.
- b.) if I developed a serious illness there is a moderate chance that modern medicine would be able to cure me.
- c.) if I developed a serious illness there is a very small chance that modern medicine would be able to cure me.
- d.) if I developed a serious illness there is no chance that modern medicine would be able to cure me.
- 17.** a.) a serious illness would ruin some aspects of my life.
- b.) a serious illness would ruin many aspects of my life.
- c.) a serious illness would ruin almost every aspect of my life.
- d.) a serious illness would ruin every aspect of my life.



- 18.** a.) if I had a serious illness I would not feel that I had lost my dignity.
- b.) if I had a serious illness I would feel that I had lost a little of my dignity.
- c.) if I had a serious illness I would feel that I had lost quite a lot of my dignity.
- d.) if I had a serious illness I would feel that I had totally lost my dignity.

## Appendix F: State-Trait Anxiety Inventory

### STAI-6

A number of statements that people have used to describe themselves are given below. Read each statement and then circle the most appropriate number to the right of the statement to indicate how you feel right now, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which best describes your present feelings best.

	Not at all	Somewhat	Moderately	Very much
1. I feel calm	1	2	3	4
2. I am tense	1	2	3	4
3. I feel upset	1	2	3	4
4. I am relaxed	1	2	3	4
5. I feel content	1	2	3	4
6. I am worried	1	2	3	4

Please make sure you have answered all the questions.

## Appendix G: Checklist for Symptoms in Daily Life (CSD)

### CSD

To what extent are you experiencing the following symptoms right now?

	Not at all	A little bit	Moderate	Rather strongly	Very strongly
Nausea					
Stomach cramps					
Shivering					
Stomach feels blown up					
Tingling in feet					
Tingling in legs					
Tingling in arms					
Tingling in fingers					
Tingling in face					
Unable to breathe deeply enough					
Suffocating feeling					
Need for air					
Pressure on chest					
Rapid heart rate					
Feeling of heat					
Pounding heart					
Irregular heart beat					
Feeling of head warmth					
Dizziness					
Blacking out					

Fainting					
Feeling of unrest, panic					
Feeling anxious					
Tenseness					
Confused or dreamlike feeling					
Fits of crying					
Toe or leg cramps					
Hands tremble					
Chest pain around heart region					
Stiffness in fingers or arms					
Cold hands or feet					
Pressure or knot in throat					
Faster/deeper breathing than normal					
Tiredness					
Headaches					

**Appendix H: Positive and negative beliefs about the process of worry related to health-related internet use questionnaire**

This questionnaire is concerned with beliefs people have about their Internet use. Listed below are a number of beliefs that people have expressed. Please read each item and say how much you generally agree with it by circling the appropriate number. Please respond to all the items, there are no right or wrong answers.

	<b>Do not agree</b>	<b>Agree slightly</b>	<b>Agree moderately</b>	<b>Agree very much</b>
<b>1. I can't control my health-related internet use</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>2. I need to check the internet for me to stay healthy</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>3. I'd go crazy with worry if I can't use the internet to look up health information</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>4. I need to check the internet for health information in order for me to cope with my worries</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>

## Appendix I: Internet Use Questionnaire

### Internet Use Questionnaire

We are interested in your Internet use. Please answer the following questions.

- 1) Are you concerned about your use of the Internet for the following purposes?

Please tick all that apply.

Health-related information

Social media

Gambling

Pornography

Gaming

- 2) Do you have problems controlling your Internet use for the following purposes?

Please tick all that apply.

Health-related information

Social media

Gambling

Pornography

Gaming

- 3) Would you like to reduce your Internet use but struggle to do so for the following types of Internet use? Please tick all that apply.

Health-related information

Social media

Gambling

Pornography

Gaming

**Appendix J: Short form Depression Anxiety Stress Scales-21 (DASS-21) and the Modified Somatic Perception Questionnaire (MSPQ)**

DASS21	<i>Date:</i>
<p>Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you <i>over the past week</i>. There are no right or wrong answers. Do not spend too much time on any statement.</p> <p><i>The rating scale is as follows:</i></p> <p>0 Did not apply to me at all            1 Applied to me to some degree, or some of the time            2 Applied to me to a considerable degree, or a good part of time            3 Applied to me very much, or most of the time</p>	
1 I found it hard to wind down	0 1 2 3
2 I was aware of dryness of my mouth	0 1 2 3
3 I couldn't seem to experience any positive feeling at all	0 1 2 3
4 I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion)	0 1 2 3
5 I found it difficult to work up the initiative to do things	0 1 2 3
6 I tended to over-react to situations	0 1 2 3
7 I experienced trembling (e.g., in the hands)	0 1 2 3
8 I felt that I was using a lot of nervous energy	0 1 2 3
9 I was worried about situations in which I might panic and make a fool of myself	0 1 2 3
10 I felt that I had nothing to look forward to	0 1 2 3
11 I found myself getting agitated	0 1 2 3
12 I found it difficult to relax	0 1 2 3
13 I felt down-hearted and blue	0 1 2 3

14	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15	I felt I was close to panic	0	1	2	3
16	I was unable to become enthusiastic about anything	0	1	2	3
17	I felt that I wasn't worth much as a person	0	1	2	3
18	I felt that I was rather touchy	0	1	2	3
19	I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat)	0	1	2	3
20	I felt scared without any good reason	0	1	2	3
21	I felt that life was meaningless	0	1	2	3

#### *Depression Anxiety Stress Scales (DASS-21)*

The Depression Anxiety Stress Scales (DASS) (Lovibond & Lovibond, 1995; Appendix H) uses a 4-point severity/frequency scale measuring depression, anxiety, and stress over the past week. It comprises 21 items with 7 items per scale. Research indicates good reliability (Clara, Cox, & Enns, 2001; Daza et al., 2002; Crawford & Henry, 2003): Depression (range=.91 to .97); Anxiety (range=.81 to .92); and Stress (range=.88 to .95).

#### *Modified Somatic Perception Questionnaire (MSPQ)*

The Modified Somatic Perception Questionnaire (MSPQ; Main, 1983; Appendix I) is a 13 item self-report measure of physical symptoms. The MSPQ can help to identify somatic complaints that may be associated with psychological responses such as anxiety and depression. Items are scored on a four point Likert-scale and higher scores represent higher frequency of somatic symptoms. The MSPQ has good internal consistency and validity and sound discriminant validity within different groups of pain sufferers (Main, 1983; Deyo, Walsh, Schoenfeld & Ramamurthy, 1989)



## MSPQ

Please describe how you have felt during the PAST WEEK by making a check mark (✓) in the appropriate box. Please answer ALL questions. Do not think too long before answering.

	Not at all	A little/slightly	A great deal/quite a bit	Extremely/could not have been worse
Pounding in head				
Mouth becoming dry				
Flatulence (wind)				
Heart beating louder				
Sweating in a particular part of the body				
Blurring of vision				
Breathing becomes faster				
Sweating all over				
Heart rate increasing				
Stomach churning				
Difficulty in breathing				
Muscles twitching or jumping				
Feeling hot all over				
Feeling faint				
Butterflies in stomach				
Muscles in neck aching				
Tense feeling in jaw muscles				
Blushing				
Dizziness				
Diarrhoea				

Tense feeling across forehead				
Hands shaking				
Heart missing beats				
Pulse in neck				
Everything appearing unreal				
Desire to pass water				
Legs feel weak				
Nausea				
Pain or ache in stomach				
Difficulty in swallowing				
Feeling hot in a particular part of the body				
Breathing becomes shallow				
Desire to defecate (open bowels)				

**Appendix K: Approval Letter from the University of Manchester Research Sub-Committee**

Dear Sara

**Research Subcommittee - 17th November 2014**

Thank you for submitting your revised proposal to the Research Sub-Committee meeting on 17<sup>th</sup> November 2014. The committee were satisfied that the revisions made were appropriate and in accordance with the feedback from the meeting of 6<sup>th</sup> October 2014 and you may now proceed with your research as set out in your revised proposal.

For the purposes of ethical scrutiny by relevant NHS and/or University bodies, this letter may be taken as confirmation that your research proposal has been independently reviewed and that it is considered to meet necessary scientific and methodological standards.

On behalf of the Research Subcommittee, we wish you good luck with your research work.

Yours sincerely

**Dr Anja Wittkowski**  
**Senior Lecturer in Clinical Psychology**  
**Chair of Research Sub-Committee (Panel B)**

A hard copy of this letter will be posted to you today

**Tracey Hepburn**

*ClinPsyD Programme Secretary*

Section for Clinical and Health Psychology , 2nd Floor, Zochonis Building, University of Manchester, Oxford Road, Manchester, M13 9PL  
**Tel: 0161 306 0400**

## Appendix L: Advertisement

The University  
of Manchester

MANCHESTER  
1824

Section for Clinical and Health Psychology

School of Psychological Sciences

University of Manchester

2<sup>nd</sup> Floor Zochonis Building

**THIS PROJECT HAS BEEN APPROVED BY THE UNIVERSITY OF MANCHESTER  
ETHICS COMMITTEE**

**Do you worry a lot about your health?**

**Do you spend a lot of time looking at health  
information on the Internet?**

We are looking for people aged 18+ like this to take part in a study looking at ways to help people cope better with anxiety about their health and reduce the amount of time they spend looking for health-related information on the Internet. We require English speakers and participants with no major sensory impairments.

Before the testing session you will be asked to complete some short online screening questionnaires. People who complete the screening process will be entered into a prize draw, which will be drawn when recruitment for the study ends. Participants who score within a certain range on these questionnaires will be invited to take part in the study and will be allocated to a treatment group or a delayed intervention condition. All participants will be asked to attend two testing sessions. At each testing session you will be asked to complete some questionnaires and view some video clips. Following these sessions, participants will be asked to complete online questionnaires at a one month and three month follow-up period. Testing time for each experimental session will be no longer than one hour. All experimental sessions will take place in the Zochonis building or the Coupland 1 building at the University of Manchester. You will be reimbursed for your time and effort. Psychology undergraduates will be able to receive credits for participation.

If you are interested in taking part, please log onto the following web page:

<https://apps.mhs.manchester.ac.uk/surveys//TakeSurvey.aspx?SurveyID=m4MJ3p33>

Sara Bardsley

[sara.bardsley@postgrad.manchester.ac.uk](mailto:sara.bardsley@postgrad.manchester.ac.uk)

Project Supervisors:

Dr Richard Brown

[Richard.J.Brown@manchester.ac.uk](mailto:Richard.J.Brown@manchester.ac.uk)

Prof Adrian Wells

[Adrian.Wells@manchester.ac.uk](mailto:Adrian.Wells@manchester.ac.uk)

Log onto to: Web page info: <a href="https://apps.mhs.manchester.ac.uk/surveys//TakeSurvey.aspx?SurveyID=m4MJ3p33">https://apps.mhs.manchester.ac.uk/surveys//TakeSurvey.aspx?SurveyID=m4MJ3p33</a>	Log onto to: Web page info <a href="https://apps.mhs.manchester.ac.uk/surveys//TakeSurvey.aspx?SurveyID=m4MJ3p33">https://apps.mhs.manchester.ac.uk/surveys//TakeSurvey.aspx?SurveyID=m4MJ3p33</a>	Log onto to: Web page info <a href="https://apps.mhs.manchester.ac.uk/surveys//TakeSurvey.aspx?SurveyID=m4MJ3p33">https://apps.mhs.manchester.ac.uk/surveys//TakeSurvey.aspx?SurveyID=m4MJ3p33</a>	Log onto to: Web page info <a href="https://apps.mhs.manchester.ac.uk/surveys//TakeSurvey.aspx?SurveyID=m4MJ3p33">https://apps.mhs.manchester.ac.uk/surveys//TakeSurvey.aspx?SurveyID=m4MJ3p33</a>	Log onto to: Web page info <a href="https://apps.mhs.manchester.ac.uk/surveys//TakeSurvey.aspx?SurveyID=m4MJ3p33">https://apps.mhs.manchester.ac.uk/surveys//TakeSurvey.aspx?SurveyID=m4MJ3p33</a>	Log onto to: Web page info <a href="https://apps.mhs.manchester.ac.uk/surveys//TakeSurvey.aspx?SurveyID=m4MJ3p33">https://apps.mhs.manchester.ac.uk/surveys//TakeSurvey.aspx?SurveyID=m4MJ3p33</a>
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## Appendix M: Participant Information Sheet

### **Participant Information Sheet (PIS)**

#### *Reducing health worry and searching the internet for health information*

You are being invited to take part in a research study as part of a student project. People who worry about their health are usually more anxious and often use the internet to research symptoms. There is evidence that using the internet to search for health-related information can become a problem. This study aims to reduce the amount of time people spend searching the internet for health information and see how this impacts on their health anxiety. The initial phase of the study will involve taking part in a screening process where you will be asked to complete some online questionnaires. People who complete the screening process will be entered into a prize draw, which will be drawn when recruitment for the study ends. If you wish to be entered into the prize draw you will be asked for your email address, which will be held securely. All email addresses will then be allocated a unique number, which will be used in a random draw when the study ends. If you meet criteria for the study based on your responses on these questionnaires you will be eligible to take part in the study. You will then you will be randomly allocated to one of two groups: a group where you will receive training to help you to reduce your health worries and use of the internet for health purposes or a delayed training group where participants will be able to access training materials at the end of the study. Participants who complete the study will receive either 8 credits for their participation or will receive £10 .

Please read the following information about the study carefully and ask if there is anything that is not clear or if you would like more information. Please take the time to decide whether or not you wish to take part.

#### **What is the purpose of the study?**

The purpose of this study is to understand more about health anxiety and health-related internet use. The study aims to reduce the amount of time people spend searching the internet for health information and see how this impacts on their health anxiety. We wish to understand if the training can reduce the amount of time people spend searching the internet for health information. We also wish to understand if reducing the amount of time that people spend searching for online health information reduces the amount of anxiety people experience and how it impacts on their mood.

#### **Why have I been invited to take part in this study?**

You have been invited to take part because you have expressed an interest in this study. We need 66 people to take part in the study overall.

#### **Do I have to take part?**

No, you do not have to take part in the study if you do not want to. Taking part in the research is voluntary; this means it is completely up to you to decide whether or not to join the study. Your decision to participate in this study will not be connected with your involvement with the University of Manchester either now or in the future. If you decide to take part and sign the consent form but change your mind later, you are free to withdraw at any point during the study without giving a reason and without any consequence to your current or future time at the University of Manchester.

#### **What will participation involve?**

If you agree to take part in the study, I will ask you to sign a consent form and you will be asked to complete two short questionnaires. If you score within certain ranges on these questionnaires you will be invited to take part in the study and you will be allocated to either a training condition (where you will receive training to help you to reduce your health worries and use of the internet for health purposes) or a delayed training condition. Participants will have the chance to receive the training now or to access the training materials in three months' time (delayed training condition). You will then be invited to attend two testing sessions at the University of Manchester. Each testing session will last approximately 1 hour and will involve the completion of some questionnaires. If you have been allocated to the training now condition you will receive training to help you reduce your health worries and use of the internet for health purposes and you will be asked to listen to a CD at home as part of the training. Participants who have been allocated to the delayed training condition will not receive the training as part of the study but will have the opportunity to access training materials once the study has finished. All participants will also be asked to view a montage of video clips from a television medical drama that may be considered to be unpleasant or distressing by some people and we will look at your physical responses to this. This will involve placing harmless and painless sensors on your fingers, which will pick up how much your finger is sweating.

Participants will also be asked to complete some online questionnaires one month and three months after the second testing session.

**What are the possible disadvantages and risks of taking part?**

You may find the video clips and some of the questions on the questionnaires upsetting. A selection of the questions can be viewed by following this link (x). An example of the types of material you will be asked to view if you take part in the study, which are taken from a television medical drama and could be considered as unpleasant or distressing by some people can be accessed by following this link <https://onedrive.live.com/redirect?resid=fe04a97f44dad04b!114&authkey=!AN5dLYHW3sYsGGw&ithint=folder%2cmp4>. Having looked at these, please decide whether you would feel ok to answer similar questions and see similar pictures during the study; if you think you would be unduly distressed please do not take part in the study. The researcher will not review questionnaire responses for several weeks after completion and therefore will not be in a position to follow up any responses on the questionnaires. As such, if you have any concerns about your mental or physical health you should contact your GP. You will also be provided with a list of possible sources of support that you can access if you choose to.

**What are the possible benefits of taking part?**

If you are allocated to the training condition, you may learn techniques that help you to manage anxiety about your health and your use of the internet to search for health-related information. This is no guarantee that these will be helpful, however. If you are allocated to the delayed training condition, you will be able to access the training materials at the end of the follow-up period, which you may find helpful. The information we get might also help to treat other people who have anxiety about their health and use the internet to search for health-related information with better treatment in the future.

**Will my taking part in the study be kept confidential? What will be done to ensure confidentiality?**

Your confidentiality will be maintained throughout. All electronic and paper-based data will be stored securely at the University of Manchester on dedicated university servers, on the researcher's laptop in an encrypted file and in secure locked filing cabinets at the University of Manchester. Participant data will not be linked with participant names and each participant will be identified through a unique code. For the purposes of supervision, sessions where training takes place will be audio recorded. This is for the purposes of quality control as it allows my supervisors, Professor Adrian Wells and Dr Richard Brown, to confirm that I am carrying out the study appropriately. This will be done on a secure device that can only be accessed via a password, which will only be known to the researcher. Once it has been recorded it will be immediately transferred to an encrypted device and will only be used for the purposes of supervision by the researcher, Dr Richard Brown and Prof Adrian Wells.

**What will happen if I do not want to carry on with the study?**

You can withdraw from the study completely at any time without giving a reason and without any adverse consequence to yourself. No further data will be collected from the moment you withdraw.

**What if I have any questions?**

If you have any questions or you have a concern about any aspect of the study, please do not hesitate to contact me on the following email address [sara.bardsley@postgrad.manchester.ac.uk](mailto:sara.bardsley@postgrad.manchester.ac.uk)

**What will happen to the results of the research study?**

We hope to publish the research in a peer-reviewed academic journal and possibly presented at academic conferences. The results will also form the student Doctoral thesis.

**Who has reviewed the study?**

The study has been reviewed by The University of Manchester Research Sub-Committee and by the University Ethics Committee.

**What if there is a problem?**

It is unlikely that anything would go wrong but if there is a problem, you may contact me in the first instance or you can contact **my supervisor (Dr Richard Brown; richard.J.brown@manchester.ac.uk)**. Any complaint you have about the study will be resolved with you promptly and information will be provided by phone or in writing to inform you of how the complaint has been addressed.

If myself or my supervisor are unable to resolve your concern and you remain unhappy, or if you do not want to contact either of us directly please contact a University Research Practice and Governance Co-ordinator on 01612757583 / 01612758093 or by email to [research-governance@manchester.ac.uk](mailto:research-governance@manchester.ac.uk).

The University of Manchester is providing insurance cover for this research. In the event that something does go wrong as a result of taking part in this research, you may have grounds for claiming compensation.

If you feel that you have suffered any distress as a result of taking part in the screening stage of this study, you can contact the University of Manchester Counselling Service on 0161 275 2864, or visit them in person at:

University of Manchester Counselling Service  
5th Floor, Crawford House  
Precinct Centre  
Booth Street East  
Manchester  
M13 9QS

Alternatively the Samaritans have a 24 hour phone line: 0161 236 8000

**Further information**

If you have any questions or require any additional information please do not hesitate to contact me at:

**Sara Bardsley:** [Sara.bardsley@postgrad.manchester.ac.uk](mailto:Sara.bardsley@postgrad.manchester.ac.uk)

**You can also contact Dr Richard Brown ([richard.J.brown@manchester.ac.uk](mailto:richard.J.brown@manchester.ac.uk)) or Prof Adrian Wells ([Adrian.Wells@manchester.ac.uk](mailto:Adrian.Wells@manchester.ac.uk)) if you have any concerns:**

**I GIVE CONSENT FOR THE LEAD RESEARCHER, SARA BARDSLEY, TO CONTACT ME TO DISCUSS MY PARTICIPATION IN THIS STUDY. Please provide your email below:**

**Email:**

Sign

Name and Surname

Date (dd/mm/yyyy)

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## Appendix N: Consent Form: Screening

### CONSENT FORM: Screening

**Study title:** *Reducing health worry and searching the internet for health information*

**Principle Investigator:** *Sara Bardsley*

#### PLEASE INITIAL BOX

1. I confirm that I have read and understand the Information Sheet dated \_\_\_\_\_ for the above study and have had the opportunity to consider the information.
2. I confirm that I have had the opportunity to ask questions about the study and that these questions have been answered satisfactorily.
3. I understand that participation is completely voluntary and that I am free to withdraw at any time without giving reason.
4. Participation in the study will not be anonymous as the researcher will meet personally with all participants but will be confidential.
5. I understand that the data collected may be published (anonymously) as part of a research project. My identity will not be revealed.
6. I agree to take part in the above study.

Name of Participant:

Signature:

Date:

Name of Researcher:

Signature:

Date:

CONSENT FORM: Study

**Study title:** *Reducing health worry and searching the internet for health information*

**Principle Investigator:** *Sara Bardsley*

PLEASE INITIAL BOX

1. I confirm that I have read and understand the Information Sheet dated \_\_\_\_\_ for the above study and have had the opportunity to consider the information.
2. I confirm that I have had the opportunity to ask questions about the study and that these questions have been answered satisfactorily.
3. I understand that participation is completely voluntary and that I am free to withdraw at any time without giving reason.
4. Participation in the study will not be anonymous as the researcher will meet personally with all participants but will be confidential.
5. I understand that the data collected may be published (anonymously) as part of a research project. My identity will not be revealed.
6. I consent to sessions being audio recorded so that the researcher's supervisors, Dr Richard Brown and Professor Adrian Wells, can confirm that the study is being carried out correctly.
7. I agree to take part in the above study.

Name of Participant:

Signature:

Date:

Name of Researcher:

Signature:

Date:

8.

## Appendix P: Demographic Information Sheet

The University of Manchester,  
Oxford Road,  
Manchester, M13 9PL  
[www.manchester.ac.uk](http://www.manchester.ac.uk)

**MANCHESTER**  
1824

The University  
of Manchester

### Demographic Questionnaire

**Study title:** *Reducing health worry and searching the internet for health information*

**Principle Investigator:** *Sara Bardsley*

Demographic	Information					
Gender (please circle)	Male		Female		Do not wish to say	
Date of birth (dd/mm/yyyy)						
Ethnicity (please circle)	<b>EUROPEAN WHITE</b>	<b>BLACK OR BLACK BRITISH</b>	<b>ASIAN</b>	<b>MIXED</b>	<b>OTHER ETHNIC GROUPS</b>	<b>DO NOT WISH TO SAY</b>
	British	Caribbean	Indian	White and black Caribbean	Chinese	
	Irish	African	Pakistani	White and black African	Any other ethnic group (please specify)	
	Other white background (please specify)	Other black background (please specify)	Bangladeshi	White and Asian		
			Other Asian background (please specify)	Other mixed background (please specify)		
Chosen university course						
Academic year						

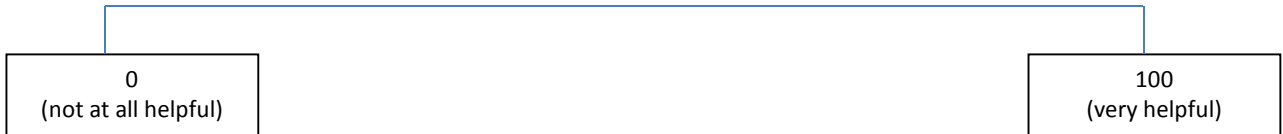
**Appendix Q: Pre ATT Metacognitive Dialogue: Example conversation led by the researcher**

<b>Dialogue</b>
Why have you decided to participate in this study? <i>(Participant explains why).</i>
What kinds of thoughts enter your mind to trigger Internet use? <i>(Participant explains the types of thoughts that trigger their internet use).</i>
Is it a 'what' type of thought e.g. What if I'm ill? <i>(Participant clarifies this).</i>
That's called a trigger thought. When you get a thought like that what do you do? <i>(Participant responds).</i>
It sounds like you do a lot with that thought and make it important as when you have that thought you engage in a whole range of behaviours.
So when you notice a physical symptom or have a thought about your health do you ever just leave it alone or do you analyse and worry about it? <i>(Participant responds).</i>
Then how long does it go on for? <i>(Participant responds).</i>
Could you spend less time on that? <i>(Participant responds).</i>
Is using the Internet a way that you try and deal with your worries about your health? <i>(Participant responds).</i>
How effective has this been so far for you? <i>(Participant responds).</i>
Would it help if you discovered that you could leave such a thought alone so that you did not need to engage in worry and use the Internet? <i>(Participant responds).</i>
We can practice a technique that will help you to see that you have a choice about how you respond to your trigger thoughts. If a thought comes into your mind or you become aware of a physical symptom treat it as noise. You don't need to try to stop a thought or get it out of your awareness.
A trigger thought is like a phone ringing. If a phone rings you don't have to answer it. If you leave it alone, eventually it will stop ringing. Trigger thoughts are like a phone, if you leave them alone, eventually they will stop calling for your attention. Have you ever tried this with a trigger thought? <i>(Participant responds).</i>
I wanted to practice a technique with you called the ATT. It is going to teach you that you have control over how you respond to your thoughts and that you can be flexible and have choices no matter what is going on around you.
Would this be helpful for you to try?
I'm going to play a CD for you. On the CD is a man's voice and he will give you instructions to focus your attention on different noises. I want you to do is listen to his voice and follow his instructions. If any thoughts, feelings or bodily sensations pop up for you, I want you to treat them like noise, leave them alone and refocus your attention on the sounds that you are being instructed to listen to.

### Appendix R: Credibility check rating scale

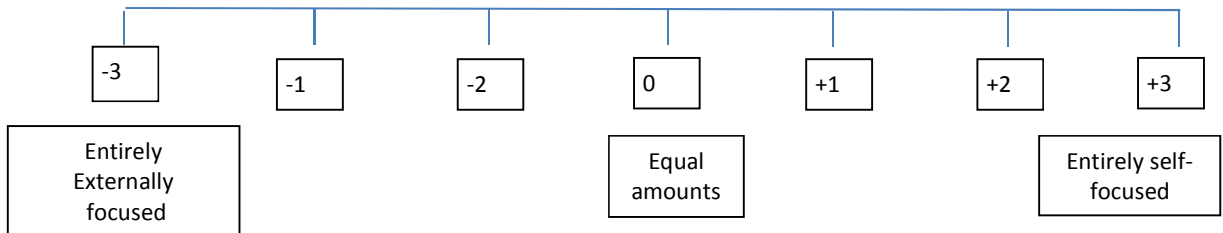
Participants rated the credibility of the ATT on the scale below. If participants rated the credibility at 30 or less, metacognitive dialogue was recommenced to address ambivalence and increase perceived credibility.

“How helpful do you think it will be for you to practice this technique? Can you give me a number on a scale from 0, not at all helpful, to 100, representing very helpful?”



## Appendix S: Focus of attention rating scale

“At this moment in time how much is your attention focused on yourself or on your external environment?  
Please indicate by giving me a number on the scale:”



**Appendix T: Post ATT Metacognitive Dialogue: Example conversation led by the researcher**

<b>Dialogue</b>
How did you find that? <i>(Participant responds)</i> .
Were you able to move your attention around to the different sounds? <i>(Participant responds)</i> .
Did thoughts and feelings pop into your mind as you were doing the technique? <i>(Participant responds)</i> .
<i>(If participant responded yes)</i> . How did you deal with them? <i>(Participant responds)</i> .
<i>(If participant indicates thought suppression or avoidance strategy)</i> . You don't need to do that, you can treat those thoughts and feelings like a telephone. So when your thoughts or feelings pop into your mind, you don't have to block them out or try to get rid of them. You can treat them like noise and eventually they will stop calling for your attention.
Whatever is going on around you, you can still make choices.
What has this technique taught you about the amount of control that you have? <i>(Participant responds)</i> .
How do you think you could apply this technique to your trigger thoughts when they arise? <i>(Participant responds)</i> .
For homework I would like you to listen to the CD once a day and when trigger thoughts pop into your head, treat them as noise and leave them alone. You can choose how you respond to them so that you don't have to spend time worrying about them or use the internet.

**Appendix U: Medians and interquartile range (in parentheses) across groups and time**

Table 8: Medians and interquartile range (in parentheses) across groups and time

<b>Dependent variables</b>	<b>ATT</b>	<b>Control</b>	<b>ATT</b>	<b>Control</b>	<b>ATT</b>	<b>Control</b>
	<b>Time 1</b>		<b>Time 2</b>		<b>Time 3</b>	
MSPQ	*3.16 (1.71)	*3.16 (1.73)	*2.65 (1.27)	*2.65 (1.67)	*2.00 (1.57)	*2.83 (2.20)
Depression	*2.83 (1)	*2.45 (1)	*1.73 (1)	*2.74 (1)	*1.73 (1)	*2.45 (1)
Anxiety	*2.45 (1)	*2.83 (1)	*2.00 (1)	*2.74 (1)	*1.41 (1)	*2.45 (1)
Stress	*3.13 (1)	*3.31 (1)	*2.45 (2)	*3.39 (1)	*2.45 (1)	*3.32 (1)



**Appendix V: Results for repeated measures ANOVA's for main effect of time, interaction between time and group and main effect of group**

Table 9: Results for repeated measures ANOVA's for main effect of time, interaction between time and group and main effect of group

Dependent variables	Main effect of time				Interaction between time and group				Main effect of group			
	F value (df)	Significance	Partial eta squared ( $\eta_p^2$ )	Effect size	F value (df)	Significance	Partial eta squared ( $\eta_p^2$ )	Effect size	F value (df)	Significance	Partial eta squared ( $\eta_p^2$ )	Effect size
MSPQ	10.328 (2, 64)	$p = .001$	.244	Medium	F (2, 64) = 1.411 (2, 64)	$p = .251$	.042	Medium	2.541 (1,32)	$p = .121$	.074	Small
Depression	10.922 (2, 64)	$p = .001$	.254	Large	7.385 (2, 64)	$p = .001$	.118	Medium	= 1.620 (1,32)	$p = .212$	.048	Small
Anxiety	5.405 (2, 64)	$p = .007$	.144	Medium	1.137 (2,64)	$p = .327$	.034	Small	4.538 (1, 32)	$p = .041$	.124	Medium
Stress	7.144 (2, 64)	$p = .002$	.183	Medium	8.585 (2,64)	$p = .001$	.212	Medium	11.389 (1,32)	$p = .002$	.262	Large

**Appendix W: Results for ANCOVA's at Time 2 and Time 3 controlling for Time 1 scores**

Table 10: Results for ANCOVA's at Time 2 and Time 3 controlling for Time 1 scores

Dependent variable	Difference between the two groups at Time 2				Difference between the two groups at Time 3			
	F value (df)	Significance	Partial eta squared ( $\eta^2_p$ )	Effect size	F value (df)	Significance	Partial eta squared ( $\eta^2_p$ )	Effect size
MSPQ	1.738 (1,34)	p = .196	.049	Small	2.827 (1,31)	p = .103	.084	Small
Depression	5.589 (1,34)	p = .024	.141	Medium	20.703 (1,31)	p = .001	.400	Large
Anxiety	2.648 (1,34)	p = .113	.072	Small	5.307 (1,31)	p = .028	.146	Medium
Stress	16.452 (1,34)	p < .0001	.3261	Large	22.500 (1,31)	p < .0001	.421	Large

**Appendix X: Results of the paired samples t-test exploring change over time for the ATT and control group**

Table 11: Results of the paired samples t-test exploring change over time for the ATT and control group

Dependent variable		T-tests											
		ATT group						Control group					
	Time Points	Mean	95% Confidence Interval of the Difference		t (df)	Significance (two-tailed)	Cohen's <i>d</i> and effect size	Mean	95% Confidence Interval of the Difference		t (df)	Significance (two-tailed)	Cohen's <i>d</i> and effect size
			Lower	Upper					Lower	Upper			
MSPQ	T1 to T2	.42403	.10351	.74457	2.779 (18)	p = .012	.43 (small)	.24333	.03627	.45040	2.479 (17)	p = .024	.28 (small)
	T2 to T3	.31039	.04040	.58037	2.437 (16)	p = .027	.33 (small)	.06440	-.27788	.40669	.399 (16)	p = .695	.06 (small)
Depression	T1 to T2	.672	.196	1.149	2.964 (18)	p = .008	.77 (medium)	.061	-.151	.272	.605 (17)	p = .553	.08 (small)
	T2 to T3	.318	-.052	.688	1.820 (16)	p = .88	.40 (small)	.028	-.170	.226	.302 (16)	p = .767	.04 (small)
Anxiety	T1 to T2	.336	.019	.653	2.229 (18)	p = .039	.36 (small)	.131	-.169	.431	.921 (17)	p = .370	.18 (small)
	T2 to T3	.256	.085	.426	3.183 (16)	p = .006	.32 (small)	.048	-.387	.483	.235 (16)	p = .817	.05 (small)
Stress	T1 to T2	.659	.285	1.032	3.702 (18)	p = .002	.73 (medium)	-.178	-.536	.181	-1.046 (17)	p = .310	-.27 (small)
	T2 to T3	.216	-.118	.549	1.372 (16)	p = .189	.24 (small)	.179	-.033	.391	1.786 (16)	p = .093	.27 (small)