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Implicit Emotional Memory and the Effects of Positive Suggestion During Colonoscopy

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Declaration

I confirm that this thesis, whilst being based upon former research by Bohin (1999) and Woodruff and Wang (2004), is all my own work with the added independent contribution of Positive Suggestion being incorporated into the paradigm. In addition, all of the detailed design and execution of the investigation was carried out by the researcher. Data collection was conducted by the researcher with the assistance of research assistants to increase rate of data collection.

Abstract

Introduction - This research aimed to investigate implicit emotional memory and the effects of positive suggestion during colonoscopy with conscious sedation. Evidence of emotional arousal in response to a word stimulus, without conscious recall, was investigated

Method - During colonoscopy, under midazolam sedation and fentanyl analgesia, participants (N=25) heard either positive suggestion or nursery rhyme titles. Measures of mood, intra-operative distress, post-traumatic stress traits and sleep disturbance of the two groups, were compared throughout three time periods.

Sedative effect on emotional memory formation was examined pre and post-procedurally, using the Skin Conductance Response (SCR) technique to compare participants' physiological reactions to nonsense-words, two emotive and one neutral. Procedural-based questionnaires and mood measures were completed one hour and two days after colonoscopy.

Results - There was a significant difference between distress levels in suggestion-groups with the positive suggestion group demonstrating less intra-operative distress. There was no significant effect of what participants heard under sedation on mood-disturbance scores across time. Neither depression nor anxiety was affected by type of audio stimuli.

Neither group showed any significant difference in levels of intrusive post-procedural memories or levels of dissociation. No participants demonstrated changes in dissociation post endoscopic examination.

SCR differences showed physiological effects of priming with emotive words. Participants demonstrating implicit memory had significantly higher sleep disturbance scores than those with explicit memory for intra-procedural events.

Conclusion –Hearing positive suggestion whilst under conscious sedation reduced intra-procedural distress and implicit memory for colonoscopy increased sleep disturbance in the days following the procedure. Evidence was found for midazolam sedation between 2-3mg impairing explicit memory whilst leaving implicit memory intact. Due to the low number of willing participants findings were tentative and difficult to generalise to a wider population.

Literature Review

"What is the Evidence for Continued Memory Under Sedation?"

Prepared for the Clinical Psychology Review (see Appendix D).

Abstract

Introduction - This review aimed to investigate the current state of research into implicit memory-formation under conscious sedation, focussing on the use of benzodiazepines.

Method - A systematic descriptive literature review was conducted to examine the formation of implicit memory under conscious sedation. Electronic databases were used (PsychINFO, PsychArticles, Embase, Web of Science, Medline, Scopus and OpenSigle).

Results - Vast heterogeneity in study data and variety in sample sizes prevented meta-analysis. All of the studies demonstrated some degree of memory-formation under anaesthesia, despite an array of potentially confounding variables and different methods of testing for implicit memory. Studies often found learning occurred under lighter sedation, particularly under lower doses of midazolam and other benzodiazepines used for conscious sedation.

Conclusion - Despite set quality inclusion criteria, some methodological weaknesses in studies may have affected results, but overall it is important for clinicians to be aware that, as implicit memories can be formed under sedation, it is essential that procedures are made as stress free as possible to prevent detrimental sequelae.

Keywords- **Sedation, Conscious sedation, Implicit memory, Priming and Amnes***

Introduction

Sedation is used to ease patients through a variety of subjectively unpleasant medical procedures, enabling clinicians to carry out a range of diagnostic and therapeutic treatments from minor dental work to major invasive surgery. The developing science of sedation, combined with modern pharmacological agents and monitoring techniques has enabled previously impossible operations to become routine by reducing both pain and anxiety in patients. Many anaesthetic agents have the added benefit of inducing anterograde amnesia whereby patients are spared memory of procedures.

The development of the Isolated Forearm Technique (IFT), where a tourniquet is applied to prevent paralysing drugs circulating to one hand, has enabled patients to communicate intra operative awareness by squeezing the hand of the researcher. Intriguingly, Russell (1989) and Wang (2003), through studies utilising IFT, discovered many patients were known to have reached high levels of consciousness intra-operatively, under general anaesthesia but appeared to show no ill effects and were often amnesic for such episodes. However, Wang (2003) has expressed concern that intra-operative wakefulness without explicit recall may give rise to subsequent psychological disturbance, the cause for which the patient is oblivious. Bonke (1990) postulated that information registered under conditions of anaesthesia, general or conscious, produces greater psychological effects than when fully conscious subjects receive the same information. Murphy and Zajonc (1993) contested that subliminal presentations can actually increase priming of emotional responses and other studies have demonstrated that noxious stimulation, i.e. stressful procedures, negative suggestion and degrading remarks, appear to be stored more easily than neutral experiences (O'Boyle, Barry, Fox, Harris, & McCreary, 1987).

Implicit memory was defined by Schacter (1987) as memories that occurred when subjects had been unconsciously influenced by a prior event, subsequent to experiments demonstrating

memory priming on amnesiacs (Graf, Squire & Mandler, 1984). Of course true amnesia is neither a common nor a stereotypical condition so the search was on to find a more reliable method for large scale testing of implicit memory.

There was a concern that interference with implicit memory formation might have a lasting effect on people's ability to function at their full potential, which long term exposure to benzodiazepines (BZs) could exacerbate (Tulving & Schacter 1990). Bishop and Curran (1995) decided to investigate the psychopharmacological effect of a particular BZ, lorazepam (LZ) on implicit memory tasks to test if subsequent impaired memory deficit could be reversed by using flumazenil (FL) as a BZ antagonist. They discovered that FL diminished implicit memory impairment and concluded that although attentional effect contributed to implicit memory it was not solely responsible.

Legrand *et al* (1995) also researched the LZ effect and concurred that whilst BZs seemed to have equally detrimental effects on explicit memory, only LZ effectively precluded implicit memory. Diversity in sedative impact was suspected to be due to the differences in absorption rates rather than variations in cognitive effects (Stewart *et al* 1996). The potential of midazolam (MZ) to selectively obliterate explicit memory was investigated (Hirshman, Passannante & Henzler, 1999) and was deemed to be the ideal compound for use in implicit memory studies.

Andrade (1996) published a paper summarising much of the then current research into anaesthesia and memory formation. The paper highlighted a consensus that low doses of anaesthetics potentially preserved implicit memory and proposed a "continuum of partial consciousness" with cognition being gradually eroded as anaesthetics diminished cortical function. The literature of the time postulated that stimuli might be encoded during light anaesthesia but memory retrieval might be hampered by the inability to recall the context of learning. Methodological difficulties were analysed and seemed to revolve around the

individuality of response to the various anaesthetic agents, the interaction of surgical stimulation and the need for a definitive measure of anaesthetic depth.

More recent studies have investigated the physiology of implicit memory. Squire's (1992) work on non-human primates, confirmed by studies on human amnesiacs, determined that the hippocampus and related areas were the sites for explicit memory. Andrade, Englert, Harper, and Edwards (2001) used the BIS monitoring technique to measure depth of sedation and concluded that learning does not occur unless surgical procedures decrease levels of anaesthesia or alter concentrations of circulating catecholamines. Positron Emission Tomography (PET) and MRI scans were used by Alkire *et al (2008)* to discover that the basolateral amygdala is the site for implicit emotional memory. They were concerned that, as the amnesic effect of general anaesthesia cannot be guaranteed, some sedative agents might compound psychological sequelae after periods of intra-operative awareness.

The condition of high levels of consciousness but with subsequent compromised explicit memory (amnesia) is common in patients sedated with intra-venous BZs. This condition is often the goal when patients need to be conscious during a procedure, in contrast to general anaesthesia. Patients undergoing such examinations will undoubtedly feel trapped in an intimidating environment with an inner conflict over knowing they must submit to the procedure whilst battling their intrinsic fear and the dread of diagnoses, as well as having to cope with any inherent discomfort and pain. Woodruff and Wang (2004) noted, using measures of behavioural distress during endoscopy that higher distress positively correlated with incidences of increased heart rate levels throughout the procedure. Indeed, Mishkin and Appenzeller (1987) had proposed a mechanism for implicit memory-formation during anaesthesia, suggesting that surgical stress causes both adrenaline and cortisol to be released which could aid the process.

Memory

Human memory comprises two distinct functional stages, namely short-term and long-term storage. More recent models, (Baddeley, 1992) refer to short-term as Working Memory. Information is held within short-term storage for about 20 seconds and then lost if not transferred to long-term memory.

Certain anaesthetic and psychotropic drugs like opiates, barbiturates and BZs are known to impact on encoding, the transfer from one memory store to another, without disrupting the functioning of working memory operations (Richardson, 1989). This may account for apparent anaesthetic amnesia or failure to recall events occurring under a state of heavy sedation. Veselis, Pryor, Reinsel, Mehta, and Pan (2008) established, by use of PET, that the Left Inferior Prefrontal Cortex (LIPFC) was the brain region associated with increased cerebral blood flow, whilst encoding. Subjects were then given low doses of propofol (injected hypnotic), thiopental (barbiturate) or a placebo and asked to perform encoding tasks. When compared with the placebo control and thiopental group, PET scans at drug infusion stage showed only the propofol group had borderline significant LIPFC activation. In contrast to BZs, propofol was not found to impede encoding but impaired recognition memory for deeply encoded words, suggesting it affects other brain regions, impacting on all other memory functions, including implicit memory.

Learning (Implicit and Explicit Memory)

Explicit recall is when one can provide evidence of memory for the content and context of an incidence of learning. Implicit recall is where learning can be demonstrated to have occurred in the absence of recollection of learning incidence, content or context (Graf and Schacter, 1985).

Therefore, implicit memory tests often use prompts or sensory cues as these memories rely on a perceptual rather than a conceptual process.

Anaesthesia presents the perfect opportunity to study these two types of memory. Due to the amnesic effect of sedatives, patients can hear, and later recall, words played to them under sedation but have no recollection of how they learned them. In contrast, explicit learning is when patients recall actually forming the memory and can sometimes explain how or why they recall intra-operative events. Conscious sedation supplies the perfect state for examining implicit memory as patients are wakeful but their explicit memory mechanisms are compromised.

Polster, McCarthy, O'Sullivan, Gray and Park (1993) suggested that conscious sedation only affects certain types of memory and, despite apparent amnesia, traces of memory persist. This leads to the possibility of unconscious memories affecting subsequent behaviour resulting in conditioning for fear or anxiety.

Procedures to Test Implicit Memory

Implicit memory has to be tested indirectly, as participants retrieve memories which they formed without awareness. Consequently, they are quizzed on the first thing that comes to mind when they are given a subtle cue. Process Dissociation Procedure (PDP), (Jacoby, 1991) is seen as the "gold standard" for testing implicit memory as it is designed to differentiate between "familiarity" and "recollection". Familiarity is when memories are automatic and formed quickly with no regard to context but recollection, or conscious learning, contextualises the memory and is a slower, strategic process. PDP experiments instruct participants to recall items from an inclusion list but reject those from an exclusion list. For example, they might be told to recall creatures they saw in a short film about Africa but exclude any shown in one of Australia e.g. crocodiles, spiders and ants might be found in both but elephants and lions would be African in origin.

Word recall is often used to test implicit memory. Participants hear words under experimental conditions and demonstrate implicit memory by accurately repeating the primed word during subsequent testing. Selected words may be common or words less likely to be guessed, possibly even nonsense-words or tetragrams, groups of four consonants such as GVQP, which do not form words and are neither abbreviations nor acronyms.

A variety of indirect cues are given to test participant recall. For instance, words can be paired, with subjects expected to recall a second word on rehearing the first. Similarly, word-stem completion is when part of a word is given such as "Comp - - -" for "Comprehensive". The subject may correctly recall the word or incorrectly guess an ending such as "Computer". Likewise, word generation is when two closely associated words are given with instructions to generate a second word by filling in the blank letters, e.g. "car dr-v-r". A slightly less directed method is cued recall, when prompts for items are given, or category exemplar, when participants are asked to give an example from a category e.g. name a fruit. All of these word tests work on the principle of participants correctly repeating auditory stimuli heard under experimental conditions without realising why it is the first answer to come to their minds.

Alternatively, visual stimuli might be employed, a methodology particularly suited to children. Face, object or picture recognition is a common procedure when participants are asked to indicate photographs that seem familiar or to see how quickly they recognise an object, to test if they have been implicitly memorised during an experiment.

Sedation

Sedation is defined as "a drug-induced depression at the level of consciousness", (British Society of Gastroenterology (BSG) 2003,cited in Fullwood & Sargent, 2010). It is classified on a

four-stage scale; minimal sedation or anxiolysis, moderate or conscious sedation, deep sedation and, finally, general anaesthesia *(See Table 1).*

Table 1: Levels of sedation and analgesia (table adapted from American Society of Anesthesiologists, 2008 as cited in Fullwood & Sargent, 2010)

	Minimal sedation (anxiolysis)	**Moderate sedation and analgesia**	**Deep sedation and analgesia**	**General anaesthesia**
Responsiveness	Normal response to verbal stimulation	Purposeful response to verbal or tactile stimulation	Purposeful response to repeated or painful stimulation	Unrousable even with painful stimulation
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often required
Spontaneous ventilation	Unaffected	Adequate	May be inadequate	Frequently inadequate
Cardiovascular function	Unaffected	Usually not affected	Usually not affected	May be impaired

These degrees of sedation are achieved by using a range of drugs with varying properties, administered via a variety of methods, to achieve the required levels of anxiolysis, sedation, amnesia and patient cooperation *(See Table 2.)*

Table 2: Commonly used intravenous sedative drugs (Table adapted from Adam and Osborne, 2005, Cohen et al, 2007and Darrouji, Karma and Arora, 2009 as cited in Fullwood & Sargent, 2010)

Drug	Class	Bolus Dose	Infusion rate	Intravenous onset	Half-life	Duration
Midazolam	Benzodiazepine	50µg/kg slowly	50-100µg/kg/hr titrated to patient response	1-5 minutes	1-4 hours extended after infusion	Up to 6 hours
Diazepam	Benzodiazepine	0.15-0.2mg/kg Slowly	Not Recommended	1-5 minutes	20-50 hours	20-30 minutes
Lorazepam	Benzodiazepine	4mg 4-6 hourly	Not Recommended	5-20 minutes	13-16 hours	6-8 hours
Propofol	Alkylphenol derivative	10-20mg/kg Slowly	10-30mg/kg/hr	30 seconds	Biphasic, Initial 40 minutes; terminal 3-6 hours	3-10 minutes
Ketamine	N-meythyl-D-asparate receptor antagonist	0.5-2mg/kg Added/ dosages of 0.5mg/kg	3.0-10.0µg/kg/hr titrated to patient response	30-60 seconds	3-6 hours	5-10 minutes

Midazolam, first synthesised in 1975 by Walser and Fryer in the United States, is water soluble, short-acting and has a rapid effect. It is usually the compound of choice for conscious sedation and is often used in conjunction with fentanyl, which is a potent analgesic, approximately

100 times more powerful than morphine. Midazolam can also be used in the emergency control of seizures and for palliative care in the final days of life.

Aims

This review aimed to ascertain the clinical aspects of continued memory function during conscious sedation.

Method

A systematic review of the literature on sedation and implicit memory was carried out. The main psychological electronic databases (PsychINFO, PsychArticles, Embase, Web of Science, Medline and Scopus) were searched for appropriate articles. To keep the review contemporary, only articles published since 2000 were reviewed, however, a broader search from 1950 to 2010 was conducted to provide some historical background to the subject area and therefore not discount any potentially seminal papers published prior to the last decade.

Titles and abstracts were previewed and pertinent articles were selected for further analysis using inclusion and exclusion criteria. Relevant articles reference sections were reviewed for further potential studies and to provide a greater scope within which to contextualise the review.

Keywords input into the databases for searches were **Sedation**, **Conscious Sedation**, **Implicit Memory, Priming** and **Amnesia** (using truncation to encompass other derivatives). A full summary of searches performed can be seen in Appendix A.

Articles found were combined in Refworks (a reference management database) at which point any duplicated search results were eliminated. Then a systematic review of relevant articles was undertaken using a data extraction form (Appendix B). Articles were rated for their aims,

methodology, sampling techniques, number of participants and sample sizes, use of blinding, use of control groups, validity and reliability of results. Articles were also appraised on the presence or absence of surgery, method of anaesthetic depth measurement and type of anaesthesia.

Inclusion Criteria

Articles chosen for review were studies that looked at learning/awareness under sedation from literature published in English between the years 2000 and 2010. Preference was given to papers using Randomised Control Trials (RCT) but in studies of operations, randomisation is not always possible so some non-randomised experimental studies were also reviewed.

Exclusion Criteria

Searches were limited to peer-reviewed journal articles written in English, relating to humans, however subject age was not used as a limiting factor. Books/ book chapters were excluded as were theoretical or opinion papers, case studies and other review articles written in the same field.

From extracted information, data were synthesised into a summary table (Appendix C) encompassing a narrative description of findings. Such vast variability in the data types of study results meant a meta-analysis was not possible. For example different measures of consciousness levels were used and a variety of anaesthetic agents. There was also great variety in memory and learning tasks and statistical analyses employed to interpret results. Therefore the decision was made to conduct a descriptive systematic literature review.

Results

The preliminary search yielded 194 papers, 146 were excluded according to the search criteria. The abstracts from 48 were reviewed and 19, initially deemed relevant to the topic, were given a numerical ID and examined further. At this point, seven were excluded, three of them because they only dealt with general anaesthesia, one because it was a review and three others which focussed on visual spatial skills, cognition or observation but not implicit memory. Twelve articles were selected that matched the inclusion criteria and were incorporated in the detailed critical review. Three of the studies were clinical samples using surgical procedures and the remaining nine were experimental. Table One (Appendix C) gives summaries of the reviewed articles and their findings.

Preservation of memory

Discovering that BZs preserve implicit memory was a major leap forward in investigating the processes of memory formation and two of the reviewed studies confirmed this implicit memory retention. Both employed a within subjects factorial design to discover which types of memory were affected by midazolam. Hirshman, Passannante and Arndt (2001) (Study 7), tested paired words and word generation in free and cued recall. They used a midazolam dosage of 0.03mg/kg of body weight, to prevent explicit memory influencing results. They concluded that this was effective for investigating conceptually-based rather than sensory-based implicit memory.

The use of distractor tests was a valid method of minimising the effect of midazolam on baseline performance but the weakness of this study was the lack of measure of degree of sedation. They assumed that merely balancing midazolam dosage with body weight would have a uniform effect on each participant. Ultimately, they concluded that midazolam substantially

diminished generation effect and overall performance but perceptual identification, testing implicit memory, was unaffected.

Arndt, Passannante and Hirshman (2004) (Study 1), used category exemplars to investigate implicit memory with the same midazolam dosage as the 2001 study. Words were read from a computer screen and the experimenters observed that reading skills were not diminished by the sedative. It was a fairly robust study using a consistent protocol and a saline control in a randomised, double-blind trial. Unfortunately, its weakness was that it had no measures of depth of sedation. Additionally, limiting the study to "individuals from the University of North Carolina" suggests that participants would have been of a similar intellectual ability and probably a fairly narrow age grouping. It is important to point out that children or the elderly might have reacted differently being the groups most likely to display paradoxical effects, i.e. stimulation rather than sedation. The elderly are also more sensitive to the pharmacological effects of benzodiazepines and metabolise them more slowly (Meyler & Aronson, 2006). However, the study suggested that midazolam spares higher order cognitive functioning as indicated by the word generation accuracy of the participants.

Advancing these findings, Veselis *et al*. (2009) (Study 18) investigated anaesthetic dosages required to prevent patients processing information from the outside world to establish the point where no conscious memories are formed. They discovered that BZs affected the contextual memory (when subjects can recall a time or place associated with the memory) however, there was variation in individual responses to sedation. Their study used a continuous picture recognition task beginning after concentrations were within 5% of the predicted effective target. Their experimental study used 67 participants, both male and female, from a wide age-range (18-50), giving a good cross-sectional sample, except that they all had to be right-handed and high-school graduates.

They investigated five different drug conditions with each participant being given two sequential doses of saline (placebo), midazolam, thiopental, propofol or dexmedetomidine. Participants were connected to an electroencephalogram, which was used to measure an event-related potential (ERP) and correct explicit responses were deemed to produce a higher positive voltage or potential. They were instructed to classify the images as either "new" or "repeat" via a mouse click and the corresponding ERP recorded to isolate the exact point in time when the drug was acting upon the memory. The researchers found that explicit memory was affected most by midazolam and propofol.

Although their study focussed on segregating long term memory from working memory, its relevance to the current study is in its conclusion that all four drugs resulted in amnesia but by different mechanisms and more than just behavioural measures are needed to analyse memory functions. Their results showed more pictures were forgotten from working memory but those encoded into long-term memory were more resilient. This opens the possibility for memories formed implicitly to be equally resilient and, not being contextualised, more likely to result in psychological sequelae if patients are forming memories but they do not know why or how.

"Feeling of Knowing"

Two of the studies discovered that experimental statistics on memory-formation only tell half the story and realised the importance of analysing the perspective of those experiencing conscious sedation. They employed LZ to investigate its amnesic properties and to assess how participants perceived the effect. These studies were carried out by Izaute and Bacon, in 2005 (Study 14) & 2006 (Study 12). Their 2005 study investigated participants' ability to encode paired words, under the influence of the BZ, and to rate their confidence in their ability to do so. Participants were tested individually, in the presence of the experimenter. Two and a half hours after taking a LZ capsule they were instructed to self-rate their response to the drug indicating

their state on 16 sliding Visual Analogue Scales (VAS) e.g. “Alert to Drowsy” or “Incompetent to Proficient”.

An interesting result here was that, during post-experimental subjective evaluation, most of the placebo participants reported using mental imagery with visualisation to encode the words, a superior strategy in memory tasks, which also indicated that they remembered the act of learning. In contrast, only 33% of the experimental group reported using this method and they also demonstrated a significant decrease in memory performance, as supported by the finding of a main effect of group $F(1,28)=30.01$, $p<0.001$. This study showed that encoding still takes place under sedation but, more surprisingly, despite a belief that participants would be unaware of memory deficits, the LZ group revealed less confidence in their predicted performance levels than the placebo group.

Izaute and Bacon’s 2006 study further investigated the “feeling of knowing” in experimental and control groups studying tetragrams; four-place consonant strings such as QVMJ, two hours after taking a 0.038mg capsule of LZ. Participants had to predict their probability of memorising the letters and, whilst the LZ group recorded more actual errors, both groups had the same accuracy when predicting their results as the LZ group knew they had a memory deficit. Izaute and Bacon concluded that whilst LZ impairs episodic short-term memory the “feeling of knowing” is retained.

However, despite using sound experimental procedures, this study fell short by not using any measurement of degree of sedation and relied on a single capsule of LZ administered to all participants regardless of body weight.

Dose-dependency

Other researchers have discovered that the effects of BZs are dose-dependant. de Roode *et al*. (2000) investigated implicit recall using a word stem completion task and explicit memory by using word recall. Investigators used a target-controlled infusion of propofol as the general anaesthetic, midazolam for conscious sedation and saline as a control in order to compare the influence of the two clinically distinct levels of sedation. The depth of anaesthesia was monitored by observer assessment of alertness using a sedation scale. Blood samples were taken regularly during the experiment and analysed post procedure.

This double-blind, five-way crossover study revealed that implicit memory was significantly higher in the midazolam group ($P<0.05$) and concluded that implicit memory is retained during low-level sedation but there was little evidence for implicit memory, particularly neutral words, under higher sedation. There was no significant difference in implicit memory impairment between propofol and midazolam but the midazolam effects lasted longer due to a greater elimination half-life.

Although this study displayed rigorous scientific methodology, only 10 participants completed the experiment making it a very small sample. In addition, the participants were all male university students between the ages of 21 and 30, a very narrow grouping which might make its application to the general population questionable. However, they did conclude that depth of anaesthesia needs constant monitoring to avoid implicit memory activation and that "potentially damaging conversation" should be avoided in the presence of sedated patients

Huron, Giersch and Danion (2002) (Study 16) confirmed the findings of dose-dependency by using a measured dose of LZ, balanced to body weight, in two different dosages, 0.026mg and

0.038mg. They monitored anaesthetic effect by pupil size variation (pupillography) as well as the self-rating scale employed by Izaute and Bacon (2005).

This study found that LZ impaired episodic memory, the mental ability to relive past events, with a greater effect at a higher dosage. This was a small scale study, using only 12 volunteers, but all were tested under a placebo condition, 0.026mg/kg and 0.038mg/kg dosages of LZ. They were given two lists of 20 words under each condition, one the study list and one the distractor list. Subjects were asked to record if their response was "Remember" (explicit memory), "Know" (implicit memory) or "Guess". LZ selectively impaired explicit memory at higher dosages but proportions of "Know" and "Guess" responses were not reduced, leading to the theory that participants were able to recall information implicitly; which was acquired contextually, but not new information which required the formation of new associations. Stapleton and Andrade (2000) (Study15) investigated intra-operative learning by comparing lightly anaesthetised patients with sedated patients, undergoing oocyte collection, using propofol and alfentanil. Of the 72 women studied, 36 received anaesthetic infusion and 36 had a sedative protocol. Patients were presented with a word list before infusion and another 10 times intra-operatively. Word stem completion was tested post-operatively to assess memory for learned words, utilising words from a third list to act as a distractor. During the operation, behavioural measures of adequate anaesthesia employed were, eyelash reflex and hand squeeze to command. Propofol blood concentration was measured after presentation of the last word list. In the study 17 patients were recorded to have both eyelash reflex and response to hand squeeze command, whilst 32 remained unresponsive throughout.

Patients scored significantly more "hits" for preoperative words than distractors in the postoperative memory test ($P<0.001$). Conversely there was no significant difference between distractor "hits" and intra-operative word "hits". The robust PDP employed in this study showed a

small amount of explicit memory for intra-operative words (mean, 0.06; 95% confidence interval, 0.01-0.10) and ”weak evidence for learning” under lighter anaesthesia and sedative protocols. However, they were unable to analyse implicit memory as the scores “did not exceed zero”.

By using a hand squeezing technique, this study’s measure of consciousness was more akin to the strengths of studies employing IFT and the blood concentration levels provided a good indication of anaesthetic dose. Consequently, the authors acknowledged the complex relationship between the depth of anaesthesia, surgical stimulation and the levels of catecholamine affecting intra-operative memory formation.

Encoding of Implicit Memory .

Implicit learning usually refers to learning without awareness of what is being learned and despite knowing that higher doses of sedative will impair memory, some procedures require lighter sedation to ensure patient cooperation. Discovering the physical processes involved in implicit learning, whilst under conscious sedation, could lead to the development of strategies to avoid post-operative psychological problems. Two studies investigated the physiological impact of commonly used sedatives.

To test the effects of pharmacologically induced changes in the brain, Rammsayer, Rodewald and Groh (2000) (Study 17) studied both object and face recognition, along with a word recall task and a compensatory tracking task, under four drug conditions, halperidol, midazolam, scopolamine or a placebo. They discovered face recognition was unaffected in all conditions. However, the procedural learning task (i.e. based on information only accessible by improvement in performance), tested by using a computer mouse to track a vertical line across a screen, impairment was most pronounced with midazolam in comparison with the placebo ($p<0.001$). This was postulated to be because procedural memory, in this case acquiring motor

skills, involves the cortico-striatal brain system that is susceptible to changes in neurotransmitter systems and, as BZs act directly on the gamma-aminobutyric acid (GABA) receptor complex, a potent neurotransmitter, the researchers felt this explained the midazolam effect. This is pertinent to implicit memory studies as procedural memory is created through repetition of an activity and automatically retrieved as "experience modifies behaviour but without requiring any conscious memory content" (Squire, 2010).

Tian *et al* (2010) (Study 4) used Magnetic Resonance Imaging (M.R.I.) to monitor brain activity of their participants during word stem completion tasks under midazolam sedation and employing PDP they used a stringent set of inclusion/exclusion criteria.

When low doses of midazolam were used, all of the brain areas activated by auditory stimuli were unaffected. However, they discovered higher levels of midazolam sedation (when subjects did not respond when their name was called loudly or repeatedly) inhibited activation of the Superior Temporal Gyrus during audio stimulation. This resulted in a corresponding deterioration in implicit memory-formation, suggesting that this part of the brain is essential for this process. Unfortunately, their study only used a small sample of 12 undergraduates and the MRI lacked the resolution to identify activity in deeper regions of the brain. Despite this, they concluded that the possibility of implicit memory-formation during intra-operative events could lead to anxiety or even Post Traumatic Stress Disorder.

The Potential for Psychological Sequelae

It is prudent to discover if BZs used in conscious sedation affect the memories of children in the same way as adults. Two of the studies, carried out on children undergoing surgical procedures, confirmed this was the case. Whilst participants displayed poorer recognition on the

explicit memory task, memories were preserved for intra-procedural events and priming for the implicit memory task was unimpaired.

Pringle, Dahlquist and Eskenazi, (2003) (Study 3) observed children during lumbar puncture or bone marrow aspiration. Subsequently, Stewart, Buffet-Jerrot, Finley, Wright and Gomez, (2006) (Study19) decided to replicate and extend the study of Pringle *et al.* (2003) but elected to study myringotomy (ear tube surgery) patients as they believed this would lead to a more uniform sedative regime. To test memory these two studies used a series of degraded pictures of common objects. The children were shown the line drawings of the objects at less and less degrees of degradation until the child accurately identified the object at three separate time periods. Tests were conducted before sedation, one hour post procedure and one week later. The sedation levels were monitored by using an observation rating scale. However, as the medical procedures carried out were on children (below 18 years) there were methodological constraints leading to different drug regimes and a variety of responses to the sedatives. In fact the researchers of Study 3 had to exclude one six year old from their study when she became agitated by the sedative, displaying the previously mentioned paradoxical effect. Another confounding variable for both sets of experimenters was that some of the youngest children (three to six years) tired of the memory tasks. However, both studies concluded that midazolam, used at conscious sedation levels, preserves implicit memory for potentially stressful events.

Worryingly, Stewart *et al*. (2006) found that midazolam preserved implicit memory for potentially stressful events occurring just before surgery, such as placement of the anaesthetic mask, whilst compromising explicit memory. This led to the hypothesis that it could result in a psychological conflict, with children unconsciously recalling the events but unable to access the memory in a conscious state in order to rationalise them. For this reason, Pringle at al. suggested

that if children are able to learn under anaesthesia, the employment of psychological therapies during periods of sedation could forestall emotional complications.

Discussion

The twelve studies reviewed used very different techniques to examine the same phenomenon - the unconscious formation of memories. Between them the studies covered both males and females, in a range from three to 79 years of age, in both experimental and clinical settings. Nine different sedative agents were investigated with some using techniques to measure degree of sedation; one even measured blood samples taken throughout the experiment, whilst others assumed dosages were adequate.

Three of the studies (4,7and15) employed PDP methodologies and, throughout all of the experiments, participants faced a plethora of tests including one or more of the following; [1]word recall (3), word stem completion (3), paired words (1), picture recognition (5), face recognition (1), word generation (1), category exemplar (1), and tetragrams (1). Subjects were also requested to complete questionnaires and self-rate various aspects of their performance.

All of the studies reviewed found varying degrees of implicit memory-formation but anaesthesia levels and the anaesthetic compound selected were seen to play a role, as the different drug regimes affected the mechanisms involved in encoding memories. The general conclusion was that the highest sedation levels precluded implicit memory-formation whilst with lighter forms of sedation this ability remained intact. However, several of the studies mentioned the fact that, ethically, the investigators were only able to use neutral words to test their hypotheses, but

[1] The figures in brackets will not equal the number of studies as some experimenters used more than one measure.

suspected that words or phrases with negative connotations might be recalled more readily, even under deeper sedation. For example, Annemiek de Roode *et al*. (2009) suggested that negative conversation around patients undergoing any procedure should be avoided. Of course this would be particularly pertinent for those undergoing procedures using conscious sedation, when implicit memory-formation is most likely.

Limitations and Future Research

This review only included studies of high quality with robust experimental design and focused mainly on quantitative data. Due to such stringent inclusion criteria influential qualitative experiential pieces, offering a counter to these findings may have been overlooked. As no grey literature was included there may be an inherent publication bias in the findings. Future research may wish to build on the foundations of this review by exploring case studies and direct patient accounts of memory for intra-operative events.

Clinical Implications of the Review

From the early acceptance of the validity of implicit memory (Graf 1984) and the subsequent investigations into the effect of sedation on memory, researchers have realised the imperativeness of discerning the mechanisms and consequences of implicit memory formation. As work has been carried out to ascertain the nature, the processes and the implications of implicit memories, each team of researchers has approached the topic from a new perspective but have consolidated the original concept that implicit memory is a measurable phenomenon and a full understanding is essential.

As recovery from surgery can be potentially traumatic, memory for intra-operative events implicit or otherwise may have a bearing on a patient's well-being (Andrade, 2007). If recollection

of surgery occurs and there are negative memories of the event it may impact on a patient's psychological health as Levinson (1965) attempted to demonstrate. The impact of negative emotional memories formed intra-operatively in relation to Post-Traumatic Stress Disorder may also merit further investigation. Conversely, given that priming can occur under light anaesthesia, the avoidance of negative remarks and unnecessary comments about the patient should be considered in all cases but particularly during conscious sedation. Alternatively, positive suggestion during surgery may also be worth investigating or indeed masking the sounds of operational procedures by playing music or relaxing sounds to patients.

Therefore, the research undertaken in this thesis, aims to discover how implicit memories for potentially distressing events might affect subsequent psychological well-being and if these can be ameliorated by positive suggestion .

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APPENDIX A

Search Summary [3]

DATABASE	KEY SEARCH TERMS	LIMITS	TOTAL FOUND
PsychInfo and PsychArticles and PsychExtra	Sedation AND Implicit Memory	Full text, Peer Reviewed 2000-2010 Adult, Human, English Language and Exclude Book Reviews	14
	Sedation AND Implicit Memory AND Priming AND Amnes*	Full text, Peer Reviewed 2000-2010 Adult, Human, English Language and Exclude Book Reviews	6 (4 Relevant)
Medline and Embase	Conscious Sedation AND Implicit Memory	Full text, Peer Reviewed 2000-2010	21 (11 Relevant) [3 Duplicates]
Scopus	Conscious Sedation AND Implicit Memory	2000-2010	125
	Conscious Sedation AND Implicit Memory AND Recall AND Priming AND Amnes*	2000-2010	17 (10 Relevant) [5 Duplicates]
Web of Science	Conscious Sedation AND Memory	Full text, Peer Reviewed 2000-2010	34
	Conscious Sedation AND Implicit Memory	Full text, Peer Reviewed 2000-2010	4 (2 Relevant)
OpenSigle	Conscious Sedation AND Implicit Memory		0

[3] Search results accurate as of 4th September 2010. Searches in bold are those that yielded papers relevant to the review. Papers form other searches used to inform background to review.

APPENDIX B

Data Extraction Form

Article Number		***Author(s)***		***Journal Title***	
Article Title					
Date of Publication	**Volume**	**Number**	**Pages**	**Source of Funding**	**Source/ Database(s)**
Keywords		**Study Type**		**Aims (Are Aims Relevant?)**	
Sampling Type	**Participants (n=)**	**Participants Age**	**Number of Conditions**	**Anaesthesia Used**	
Control Y/N **Random Y/N** **Blind Y/N**	**Confounding Variables**	**Type of Surgery**	**Level of sedation** **General Anaesthesia** **Conscious Sedation**		
Method (Are Valid Measures Used?)	**Measures of Consciousness Levels Used** **Y/N**	**Method of Anaesthesia Monitoring**			
Inclusion/ Exclusion Criteria **Y/N**	**Inclusion…**	**Exclusion…**	**N/A**		
Analysis Used					
Results					
Conclusions					
Other Observations					
Ratings	**Quality of Research** **Excellent** **Good** **Fair**	**Relevance to Review** **High** **Medium** **Low**	**Selected for Review** **YES NO**		

APPENDIX C

Table 1. Summary of main characteristics of studies reviewed.

Study ID[3]	Author	Number of Participants	Type of Sedation Used	Level of Sedation Used	Memory/Learning Task	Memory Formation	Experimental or Naturalistic Setting	Effect of Sedative on Implicit Memory
1*	Arndt, Passannante and Hirshman (2004)	48	Midazolam or Saline Control	0.03mg/Kg body weight	Free recall Category Exemplar (Implicit) Category Cued (Explicit)	YES	Experimental	Midazolam reduced explicit memory but not implicit memory
2*	de Roode et al (2000)	13	Propofol or Midazolam	Varied from Level 1 (asleep) to Level 4 (lethargic)	Recall and word stem completion	YES	Experimental	Implicit Memory retained during low level sedation
3*	Pringle, Dahlquist and Eskenazi (2003)	26	Midazolam	Conscious Sedation	Pictorial identification from degraded pictures forming into full images	YES	Naturalistic: Bone Marrow Aspiration or Lumbar Puncture	Implicit memory scores unaffected but explicit memory scores deteriorated significantly
4*	Tian et al (2010)	12	Midazolam	Mild or Deep Conscious Sedation	Word Stem completion	YES	Experimental	Mild Midazolam did not abolish implicit memory. Higher levels reduced scores on task
5	Boucart et al (2007)	36	Diazepam	Placebo or 0.1mg/Kg body weight or 0.3mg/Kg body weight or	Picture identification and observation	N/A	Experimental	Therapeutic levels of diazepam impair observation
6	Mintzer and Griffiths (2003)	48	Lorazepam or Scopolamine	Placebo or Lorazepam (2mg/ 70kg) or Scopolamine (0.6mg/70kg)	Letter sequences & Patterns (working memory task) Word Recognition (explicit memory) Assigning compass directions (Implicit Memory tasks) Stroop colour test Psychomotor experiments	N/A	Experimental	Both drugs impaired implicit memory. Implicit memory priming was not assessed in the study
7*	Hirshman, Passannante and Arndt (2001)	32	Midazolam and Saline Control	0.03 mg/Kg body weight	Paired words and generating a second word with missing letters	YES	Experimental	Midazolam diminished generation effects in free and cued recall

Study ID[3]	Author	Number of Participants	Type of Sedation Used	Level of Sedation Used	Memory/Learning Task	Memory Formation	Experimental or Naturalistic Setting	Effect of Sedative on Implicit Memory
8	Ghoneim (2004)	N/A	N/A	N/A	N/A	N/A	N/A Review Article	N/A
9	Kerssens, Ouchi and Sebel (2005)	90	Propofol or Isoflurane	General Anaesthesia	Word stem completion and interview of recall for intra-operative events	NO	Naturalistic: various elective surgeries	Conscious required for memory formation. No-one consciously recalled intra-anaesthetic period
10	Clark, Voss Barnard and Sleigh (2003)	Group 1 =33 Group 2=26	Propofol	moderate to deep sedation	Free association, word pair testing and PDP	NO	Naturalistic: Heart surgery	No memory formation under moderate to deep propofol sedation
11	Kerssens et al (2002)	65	Propofol and alfentanil	Titrated to BIS 60-70	Word stem completion and PDP	YES	Naturalistic: Mixed surgeries	Weak explicit memory. Memory formation more likely in patients with good pre-operative memory
12*	Izaute and Bacon (2006)	28	Lorazepam	Placebo or 0.038 mg/kg body weight	Four letter nonsense strings and Feeling of Knowing estimates	YES	Experimental	Lorazepam participants demonstrated an impairment of episodic short term memory but not on personal predictions of feeling of knowing
13	Pompeia et al (2008)	14	Lorazepam	Placebo or 2mg	Digital symbol substitution, prose recall, Corsi blocks test and self report of sedation level	N/A	Experimental	Focused on attention, alertness and visual-spatial cognitive abilities rather than memory
14*	Izaute and Bacon (2005)	30	Lorazepam	Placebo or 0.038 mg/kg body weight	Learning word pairs and rating confidence in ability to recall words. Free recall test	YES	Experimental	Abilities on tasks impaired by Lorazepam. Accuracy in judgement of learning un-affected by Lorazepam
15.*	Stapleton and Andrade (2000)	72	Propofol and Alfentanil	50% sample sedated 50% anaesthetised lightly (Change in hospital policy)	Word stem completion with PDP. ½ words presented preoperatively ½ presented during operation	YES	Naturalistic: Oocyte Collection	Implicit and explicit memory for preoperative words. Small amount of explicit recall for intra-operative words. No correlation for these memories with anaesthetic depth

Study ID[3]	Author	Number of Participants	Type of Sedation Used	Level of Sedation Used	Memory/Learning Task	Memory Formation	Experimental or Naturalistic Setting	Effect of Sedative on Implicit Memory
16*	Huron, Giersch and Danion (2002)	12	Lorazepam	Placebo or 0.026 mg/kg body weight or 0.038 mg/kg body weight	Learning word lists and judge "remember", "know" or "guess" in response to a test word list	YES	Experimental	Lorazepam selectively impaired "remember" responses at higher doses. "Guess" (i.e. Implicit memory) were not reduced
17*	Rammsayer, Rodewald and Groh (2000)	80	Haloperidol or Midazolam or Scopolamine	Placebo or 3 mg Haloperidol or 11mg Midazolam or 1mg Scopolamine	Object and face recognition. Immediate and delayed word recall	YES	Experimental	All 3 drugs detrimental to Word recall (affected most by Midazolam) Face recognition unaffected with all 3 drugs. Object recognition affected most by Midazolam. Procedural learning impaired by all 3 drugs but most pronounced with Midazolam
18*	Veselis et al (2009)	67	Two sequential doses of either Thiopental or Propofol or Midazolam or Dexmedetomidine	Placebo (Saline) Thiopental or Propofol or Midazolam or Dexmedetomidine All compounds adjusted for body weight and age	Continuous picture recognition task. Examining long term memory and working memory	YES	Experimental	Active drugs increased reaction times and impaired memory equally. Midazolam had a greater effect
19*	Stewart et al (2006)	23	Midazolam	Placebo or Midazolam (0.5mg/Kg body weight)	Memory for pictures encoded prior to surgery	YES	Naturalistic: Myringotomy (Ear tube surgery)	Midazolam group poorer recognition on explicit task but equivalent priming on implicit task

[3]All studies marked with * were included in data for the review.

APPENDIX D

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***Abstract*. A concise and factual abstract is required (not exceeding 200 words). This should be typed on a separate page following the title page. The abstract should state briefly the purpose of the research, the principal results and major conclusions. An abstract is often presented separate from the article, so it must be able to stand alone. References should therefore be avoided, but if essential, they must be cited in full, without reference to the reference list.**

STYLE AND REFERENCES: Manuscripts should be carefully prepared using the Publication Manual of the American Psychological Association, 5th ed., 1994, for style. The reference section must be double spaced, and all works cited must be listed. Please note that journal names are not to be abbreviated.

Reference Style for Journals: Cook, J. M., Orvaschel, H., Simco, E., Hersen, M., & Joiner, Jr., T. E. (2004). A test of the tripartite model of depression and anxiety in older adult psychiatric outpatients, *Psychology and Aging*, 19, 444-45.

For Books: Hersen, M. (Ed.). (2005). Comprehensive handbook of behavioral assessment (2 Volumes). New York: Academic Press (Elsevier Scientific).

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Research Report

Implicit Emotional Memory and the Effects of Positive Suggestion During Colonoscopy

1.0 Introduction

1.1 Nature of Endoscopy

An endoscope is a long, thin, flexible tube with a light and a camera attached to one end that sends images to a monitor. It has a side channel where various instruments can be passed through to the site of operation, for example to perform a biopsy, insert a stent or remove gallstones. Endoscopes were first used in the 1970's purely as a diagnostic tool; nowadays their therapeutic use is increasingly common. Colonoscopy can be performed under sedation. A sedative can be injected, usually by cannula through the back of the hand, to cause drowsiness. Midazolam, a benzodiazepine, is usually the preferred compound due its short half-life.

1.2 Psychological Impact of Endoscopy

Conditions leading to the need for surgical intervention, fear of the unknown and concerns over the medical outcome are undoubtedly traumatic. Even routine surgical procedures can have psychological sequelae for some people.

Patients undergoing endoscopy are likely to feel trapped in an unnatural procedure, in an intimidating environment with an inner conflict over knowing they must submit to the procedure whilst battling their intrinsic fear and the dread of the diagnoses, as well as having to cope with discomfort and pain. Osterman and van der Kolk, (1998) noted that "inescapable stress is particularly conducive to the development of PTSD symptoms". Furthermore, Woodruff and Wang (2004), by using measures of behavioural distress, noted that the procedure is stressful, particularly when the endoscope is navigated around the first bend of the colon. This higher distress positively correlated with incidence of increased heart rate levels throughout the procedure.

1.3 Memory and Conscious Sedation

1.3.1 Memory models.

One definition of memory is "the mental process of acquiring and retaining information for later retrieval, and the mental storage system that enables these processes (Ashcraft, 1994). Figure 1 is one of the earliest and most simplistic diagrammatical representations of this storage system.

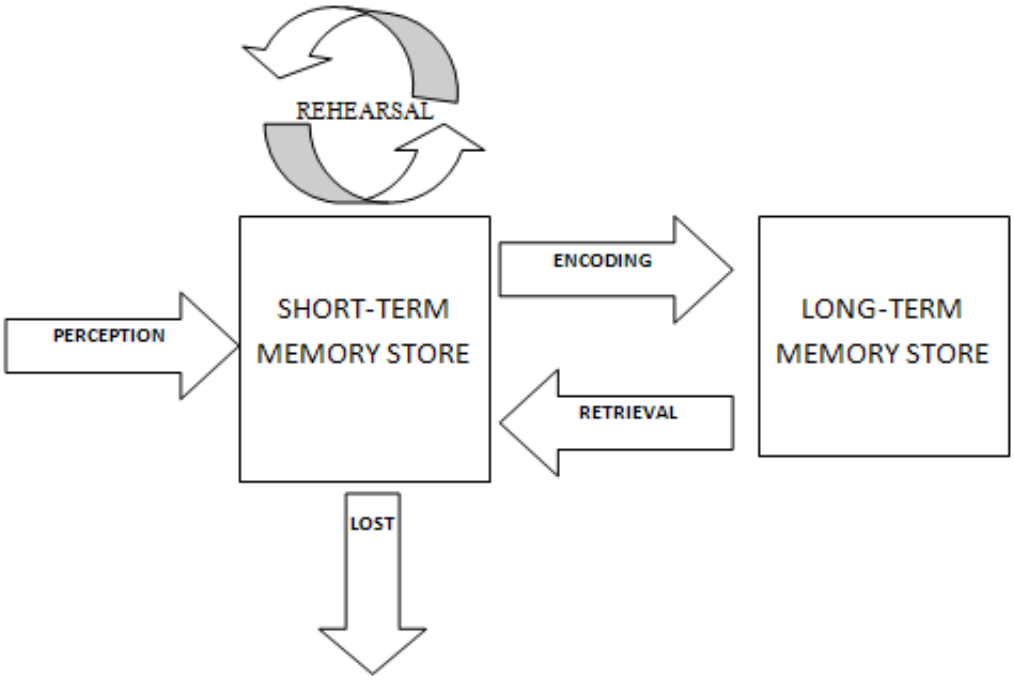

Figure 1. Two store memory model adapted from Atkinson & Shiffrin (1971)

The encoding process can be disrupted by several factors including drugs, alcohol and more pertinent to this study, stress or benzodiazepines. Other models have evolved from this but to review these is beyond the scope of this thesis.

A more detailed explanation of what happens when trauma disrupts the encoding process was put forward by Brewin, Dalgleish and Joseph (1996) who proposed a model for posttraumatic stress disorder (PTSD) formation outlined in figure 2.

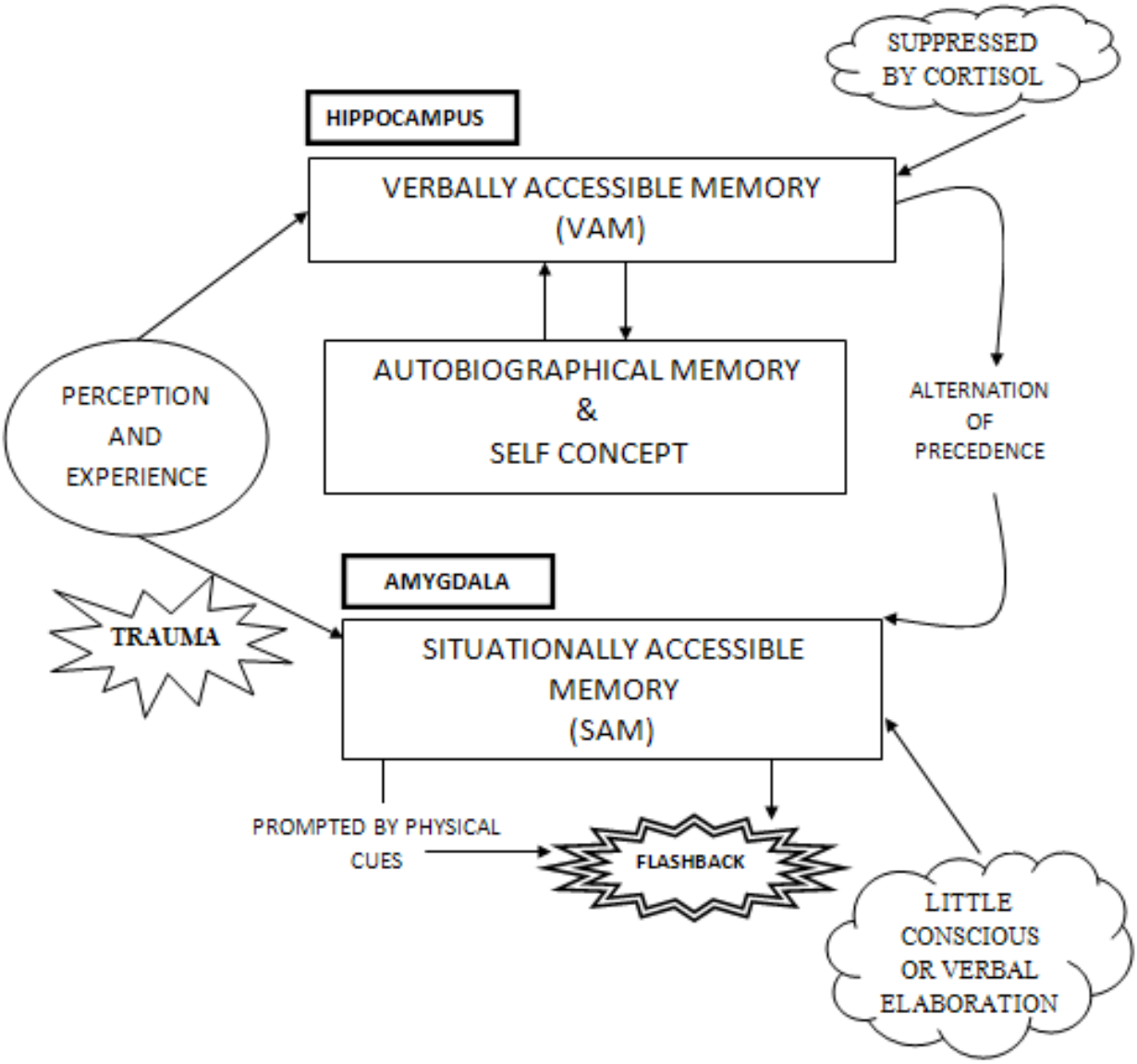

Figure 2. Dual representation theory, adapted from Brewin, Dalgleish and Joseph (1996)

In conjunction with research utilising brain imaging this model has identified the anatomical areas of the brain where these processes are thought to occur. It pertains to a pathway for normal memory process utilising the hippocampus and prefrontal cortex. This enables memories to be consciously retrieved and verbally comprehended. Under stress a different system is utilised, in a more primitive part of the human brain, the limbic system. Here, the amygdala encodes fragmented memories under heightened arousal that are not verbally accessible but can be triggered automatically when the person is in a context similar to that where the trauma occurred.

This links in with the notion proposed by LeDoux (1992) that there is a neurological pathway that allows sensory data associated with an emotionally significant event to be stored in memory without being cortically processed. This may be very important as agents such as benzodiazepines interfere with the cortical processing of memories (Rammsayer, Rodewald & Groh , 2000)

1.3.2 Explicit and implicit memory.

Explicit recall is when one can provide evidence of memory for the content and context of an incidence of learning. Implicit recall is where learning can be demonstrated to have occurred in the absence of recollection of learning incidence, content or context (Graf & Schacter, 1985).

Russell (1989) and Wang (2003) discovered many patients reached high levels of consciousness intra-operatively, under general anaesthesia, but appeared to show no ill effects and were often amnesic for such episodes. However, conscious sedation presents a different challenge and Wang (2003) expressed concern that intra-operative wakefulness, without explicit recall, may give rise to subsequent psychological disturbance, the cause for which the patient is oblivious. This condition of high levels of consciousness but with

compromised explicit memory (amnesia) is the goal for endoscopy patients, sedated with intra-venous benzodiazepines, since they usually need to be conscious and cooperative during the procedure.

Woodruff and Wang (2004) predicted, from previous studies utilising midazolam, that no patients would have explicit recall for intra-procedural events, whilst Veselis *et al*. (2009) stated, "recollection of a memory in a context of time and place is the memory process most affected by midazolam". However, a sub-sample of 49 participants from their study was examined for qualitative episodes of intra-colonoscopy experiences. 67% of this sample, despite adequate levels of analgesia, recalled the procedure as very painful and had explicit recall for people talking to them.

1.4 Positive Suggestion

Most of the current research has focussed on pre-surgery relaxation tapes (Ghonheim, Block, Sarasin, Davis, & Marchman, 2000) or hypnosis employing guided imagery and age regression during sedation (Faymonville *et al* ,1995). Both of these methods were found to lower pre-surgical anxiety, reduce pain, lessen the need for post operative medication and speed recovery. However, little research has been carried out into positive suggestion under conscious sedation.

Positive suggestion is a constructive statement made to an individual with the aim of improving well-being, particularly during times of stress. Reassurance should be helpful in attempting to ameliorate problems and although any physical awareness, particularly pain would still be an issue, if the patient heard positive comments and motivational recordings throughout the procedure it could be both reassuring and distracting. In effect this study is proposing a technique to enhance sedation in the way that hypnosis can be utilised to promote extreme relaxation. In their retrospective study, Faymonville *et al*. (1997) found that

"hypnosis used in surgical patients as an adjunct to conscious sedation was associated with improved intra-operative patient comfort and with reduced anxiety, pain, and intra-operative requirements for anxiolotic and analgesic drugs".

Orndorf and Deutch (1981) theorised that in a highly emotional or stressful situation, suggestions may bypass the conscious mind and go directly to the subconscious. The subconscious accepts these suggestions uncritically and literally. If a suggestion is positive, people will be cooperative and demonstrate appropriate behaviour. Positive suggestions can also be made on a subconscious level when someone is in a hypnotic state, since "the common clinical dosage (of sedative) does not affect their hearing capability" (Kelly, Walsh, Norman and Cunningham 1999).

However the subconscious can be seen only as a theoretical construct and a less refined model of cognitive processing. An alternative explanation would be to consider the impact of an event or sedative agent on the memory encoding process and ones executive functioning ability to rationalise a positive suggestion without question. There are many cognitive theories to explain this phenomenon which are beyond the scope of this thesis. However, the current research considers Brewin, Dalgleish and Joseph's (1996) model (outlined in the previous section on memory models) as the basis for conceptualising the processing of positive suggestion and encoding information under conscious sedation or during stressful intra-operative events.

1.5 Skin Conductance as a Measure of Emotional Arousal

During emotional arousal an increase in sweating response is common, particularly regarding anxiety. An increase in sweating leads to an increase in skin conductance that can be measured. Lader and Noble (1975) noted conductance fluctuations which happen

apparently independently of an identifiable external influence increase in frequency as the level of anxiety increases.

Skin conductance response (SCR) is a measure of the transient changes in skin conductance which often accompany discrete experiences. Although the physiological bases of skin conductance changes are not fully understood there is considerable evidence to suggest sweat glands are involved in the process (Boucsein,1992). Sweat glands are distributed over the majority of the body surface but it is the hands that are particularly responsive to emotional stimuli (Pinel, 2003).

1.6 Previous Studies

Bohin (1999) conducted a preliminary study into whether traumatic responses to gastroscopy using midazolam could result in implicit emotional learning and manifest as elevated post procedural anxiety depression and sleep disturbance. Bohin utilised a comparison study between participants undergoing gastroscopy with either midazolam sedation or a local anaesthetic throat spray. Measures used were the Hospital Anxiety and Depression Scale (HADS), a sleep questionnaire, a behavioural distress rating scale (BDS) and the Eysenck Personality Inventory (EPI). Bohin's study failed to find any significant differences between highly distressed participants under midazolam sedation, with or without explicit recall for the procedure, on measures of anxiety, depression or sleep disturbance.

This was followed by Woodruff and Wang's (2004) study into the memory effects of midazolam in the context of colonoscopy on a sample of 60 participants. Auditory verbal stimuli chosen for their salience with this experience were played during the procedure to ascertain if they could become associated with the distress of colonoscopy under conscious sedation. Response to stimuli was measured using skin conductance response (SCR) to the verbal stimuli based on the hypothesis that evidence of emotional learning would be in the

form of increased SCR following colonoscopy to the word presented during the colonoscopy. Both post-colonoscopy and one week later, 100% of the sample demonstrated impaired explicit memory for the word stimuli; however, 80% had explicit recall of pain and early indications suggested some implicit emotional learning occurred for the test word "scrate".

1.7 The Current Study

The present study built on the work of Woodruff and Wang (2004) by replicating elements of their study. In addition, the present study included an intervention component, investigating the effects of intra-procedural positive suggestion on post procedural levels of dissociation, depression and anxiety, as well as its impact on scores on a mood measure post-colonoscopy. Aspects of Bohin's study were adapted and utilised in the proposed research to allow analysis of intra operative distress using the BDS and derive an overall intra-procedural trauma rating and distress level group calculated in line with Bohin's (1999) methodology.

1.7.1 Aims.

The main aim of this study was to investigate the benefits of positive suggestion during the anxiety provoking and potentially uncomfortable experience of routine endoscopic examination. Woodruff and Wang (2004) noted that prior to colonoscopy participant anxiety self-ratings were at a mean of 5.4 out of 10 (SD=2.81). The same study also found that 22% of the sample recalled the procedure being either "painful" or "very painful" despite the amnesic and sedative properties of midazolam.

The study compared baseline and post-operative measures of mood and PTSD traits (i.e. dissociation) of patients experiencing or not experiencing intra-operative positive suggestion. The data were analysed to ascertain if positive suggestion was beneficial for

patients. A further aim of the study was to establish the extent to which conscious sedation impacted on explicit memory and to determine the incidence of emotional implicit learning in this state of consciousness.

It was thought important to ascertain the extent of distress and incidence of post operative sequelae, due to any implicit memories formed under conscious sedation, for this group of patients who often need to undergo this type of examination on a regular basis.

The study bears upon the importance of links between psychology and medicine for the well-being of patients. Any evidence of a reduction in the incidence of distress was discussed in detail with medical staff and techniques put forward for consideration as standard procedure.

1.7.2 Hypotheses.

The current study therefore aimed to test the following hypotheses.

1. Colonoscopy causes psychological disturbance during the days following the procedure.

2. Hearing positive suggestion will reduce intra-procedural distress.

3. Hearing positive suggestion will reduce measures of psychological disturbance at follow-up in comparison with the control intervention.

4. Word stimuli heard during colonoscopy will generate an enhanced SCR, when replayed post-procedure, as the result of associative aversive conditioning.

2.0 Methodology

2.1. Study Design

This study used a double blind randomised investigation employing a repeated-measures, between-groups design. The dependent variables of psychological disturbance, intra-procedural distress and skin conductance were measured to test the effect of the independent variables of positive suggestion, nursery rhyme titles (control) and nonsense words, utilising audio stimuli, before, during and after a colonoscopy procedure.

Participants were randomly allocated across the six groups detailed in Table1 below. The presentation of words pre-colonoscopy were counterbalanced across the sample but each participant heard the same word presentation order at follow up as they did prior to their colonoscopy.

Table 1- Table of test group and study design

Test Group	Pre-colonoscopy (Time A) SCR's	Intra-operative	Post-colonoscopy Follow-up visit (Time B) SCR's
Group 1a	Word A, Word B & Word C	Word A only, followed by nursery rhyme titles	Word A, Word B & Word C
Group 1b	Word A, Word B & Word C	Word A only, followed by positive suggestions	Word A, Word B & Word C
Group 2a	Word A, Word B & Word C	Word B only, followed by nursery rhyme titles	Word A, Word B & Word C
Group 2b	Word A, Word B & Word C	Word B only, followed by positive suggestions	Word A, Word B & Word C
Group 3a	Word A, Word B & Word C	Word C only, followed by nursery rhyme titles	Word A, Word B & Word C
Group 3b	Word A, Word B & Word C	Word C only, followed by positive suggestions	Word A, Word B & Word C

Hypothesis one, " colonoscopy causes psychological disturbance during the days following the procedure", was tested as part of the repeated measures aspect of the design. Levels of dissociation were measured pre and post colonoscopy and the scores compared. In addition, self-rated distress levels were measured before and after the procedure.

Hypothesis two was tested by measuring intra-procedural distress and comparing the 'b' groups (those receiving positive suggestion) with the 'a' groups (those hearing nursery rhyme titles as a control). It was predicted that those hearing positive suggestion, groups 1b, 2b, and 3b, would have less distress than 1a, 2a and 3a respectively.

Hypothesis three again used a repeated measures approach to test if positive suggestion reduces psychological disturbance by comparing pre and post colonoscopy scores of anxiety, depression, general mood states, avoidance, hyperarousal and intrusion. Scores for the 'b' groups, who received positive suggestion, were compared with the 'a' groups who heard nursery rhyme titles as a control. It was predicted that those hearing positive suggestion, groups 1b, 2b, and 3b, would demonstrate more positive mood traits than groups 1a, 2a and 3a respectively.

Finally, hypothesis four was tested by exposing the participants to three nonsense words pre-colonoscopy and their baseline SCR was measured. Participants were then exposed to just one of the three words (in groups 1, 2 and 3 respectively) during the procedure. SCR was measured post-colonoscopy when they were again exposed to all three words. It was predicted that SCR score would be higher for the word they were exposed to during the procedure, indicating a conditioned aversive effect.

2.2 Participants

Study participants consisted of colonoscopy patients who were sedated by means of a single bolus of midazolam followed an injection of fentanyl (for more information on dosages see table 4 in results section). Inclusion criteria were as follows:

1. Patients who had given informed consent.
2. Patients over 18 years – for reasons of informed consent
3. Patients undergoing colonoscopy under conscious sedation

Participants were excluded from the study on the basis of the following criteria:

1. Patients with a previous history of PTSD
2. Patients with hearing problems, dementia, or a history of drug or alcohol abuse.
3. Patients with brain injury or brain impairment.
4. Patients who did not have English as their first language.
5. Patients who received a diagnosis of life-threatening illness

Working on the assumption of a normal distribution and moderate effect-size (0.25) variables of a 3x2 repeated measures ANOVA were entered into a computer program G* Power 3.0.10. (Faul, Erdfelder, Lang & Buchner, 2007). The moderate effect size for SCR measured memory priming was based on that established by Woodruff and Wang (2004). Working with a traditional α=0.05 and entering 1-β (power) as 0.8, a minimum sample of 42 participants was found to be required for this model, utilising three groups undergoing one re-test of the SCR measures from their baseline. Therefore the current study aimed to recruit 42 participants.

2.3 Questionnaire Measures

To examine the effects of positive suggestion, scores for mood measures across three time periods were compared between half of the sample hearing positive suggestion during the procedure and the control half who heard nursery rhyme titles. Mood was measured using the Profile of Mood-states (Brief form) [POMS-BF] (McNair, Heuchert, & Shilony, 2003) and the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983). Other co-variables measured were the Behavioural Distress Rating Scale, Eysenck Personality Inventory (EPI) (Eysenck, 1964) and, post-colonoscopy, the Impact of Event Scale Revised [IES-R] (Weiss & Marmar, 1997). Levels of dissociation pre and post-procedure were compared using the Dissociative Experiences Scale II [DES II] (Carlson & Putnam, 1993). A questionnaire was devised by the researcher, to test both implicit and explicit recall 60minutes after the colonoscopy and at follow-up. The procedure's impact on participant's sleep was also examined via questionnaire at the follow-up visit.

2.3.1 The Eysenck Personality Inventory: Form A (Eysenck & Eysenck, 1964).

The Eysenck Personality Inventory (EPI) determines an individual's personality type. It measures levels of extroversion on the extroversion-introversion (E) continuum as well as neuroticism on the neuroticism-emotional stability (N) scale. To screen out scores arising from socially desirable answering strategies, a lie score (L) is generated by the measure. The reliability data for the EPI indicate the measure has good re-test reliability at nine-months, with coefficients of 0.97 and 0.88 for extroversion and neuroticism respectively.

Table 2 - Table of split-half reliability coefficients for forms A and B of EPI.s

	Normals	Neurotics	Psychotics
Extroversion Form A V Form B	0.757	0.750	0.741
Neuroticism Form A V Form B	0.811	0.873	0.906

Eyesenck and Eysenck (1963a) demonstrated the validity of the EPI by noting participants' independent introversion and extroversion judgements positively correlated with their EPI scores.

Woodruff and Wang's (2004) hypothesised personality type may impact on patient's anxiety and behavioural distress. They postulated that neurotic introvert personality types would have higher anxiety levels throughout the procedure and be more likely to be susceptible to implicit emotional memory formation and therefore a potential covariate.

The EPI was selected to measure personality types in the sample and to establish any covariance with other dependent variables. Form A was selected for the current study as a deliberate contrast with the original study that used Form B. Exploiting the EPI's potential as a predictor of emotional conditioning, it was used to see if trends established by Woodruff and Wang (2004) could again be found with the alternate form of the EPI . It was self-administered 60 minutes post-colonoscopy to establish personality baseline from the scores on the E, N and L domains and, given the relative stability of personality traits over time, was only conducted once.

2.3.2 The Hospital Anxiety and Depression Scale (Zigmond and Snaith, 1983).

This self-reported mood measure is designed for hospital outpatient use. It is not a diagnostic tool but indicates depression and anxiety levels across the previous seven-days. In the current study this covered the week prior to colonoscopy and then the time post-colonoscopy at the follow-up session. HADS scores were repeated 60minutes post-operatively to see if participants' views of their previous week altered, following an invasive medical investigation.

The measure comprises 14 statements, seven of which are used to ascertain the depression score and seven that determine the anxiety score. Each statement has four options on a 0-3 Likert scale with differing degrees of emotional response to the statement. The maximum score for both depression and anxiety is 21. Scores of 8-10 are deemed borderline and scores over 10 indicate a probable clinical level of anxiety or depression.

Zigmond and Snaith (1983) demonstrated the HADS had concurrent validity across 100 medical outpatients and that the subscales significantly correlated with five similar psychiatric anxiety/depression measures utilising five-point scales. The anxiety scale yielded a correlation of r=0.54 and depression r=0.79 both of which are significant. An unpublished study by the test's authors stated that test-retest reliability of the HADS could only be determined in "healthy" respondents as people with mood disorders fluctuate too much day-to-day. Within their healthy sample there were significant correlations for scores on both scales at re-test (Cronbach's alpha was anxiety: r=0.89 and depression: r=0.92).

Moorey *et al*. (1991) established the two subscales have an internal consistency with Cronbach's alphas of 0.93 for anxiety and 0.90 for depression. The scales are deemed to have good face validity and construct validity (ibid). Via a factor analysis of 568 cancer

patients, Moorey *et al*. (1991) ascertained two factors accounting for 53% variance and all items loaded as expected except item 7 which loaded onto both factors.

2.3.3 The Profile of Mood-states Brief Form (McNair, Lorr, Heuchert & Droppleman, 2003).

The POMS-BF is a brief version of the full POMS, devised for quicker, self-reported, administration and designed to be less demanding for medical or elderly patients who often found the original too challenging due to physical or cognitive complications. The POMS-BF is a measure of 30 items. Individuals are asked the degree to which they experience the single mood adjectives on a five-point Likert scale ranging from 0 ("Not at All") to 4 ("Extremely"). Five items load onto each of six mood factors: Tension/Anxiety, Depression/Dejection, Anger/ Hostility, Vigour/Activity, Fatigue/Inertia and Confusion/Bewilderment. Selected from the full POMS, the chosen adjectives had the highest mean loadings on the six factors.

Six independent factor analytic studies have been conducted in the development and validation of the POMS (McNair, Lorr, Heuchert & Droppleman, 2003). The first three studies used the four-point rating system. Study 4 was the first factor analysis of the five-point scale and successfully replicated the six mood factors for the measure amongst 235 normal male college students. The concept of a "Right Now" time-set was used to ask respondents to rate mood at the current moment in time rather than over the past week. Studies 5 and 6 were extended replications utilising hospital outpatients and provided the normative sample data. All six studies yielded a good approximation of the measure's factor structure. Items that correlated significantly with a factor in several studies were deemed more dependable estimates, with any correlation of 0.30 or higher in the oblique factor

matrices deemed significant. With the exception of "Confusion/Bewilderment", all items included in the current scoring of the POMS correlated significantly with a factor in at least three of the six factor analyses.

Across the normative sample, all the indices of the extent to which a single item within the six mood scales measure the same factor are 0.9 or greater, giving the measure a high level of internal consistency. The reliability was increased by increasing the number of items per factor and changing to a five-point scale. For the six factors test-retest reliability estimates range from r=0.65 to r=0.74. These are stated as lower bound estimates and the obtained stability coefficients, in this relatively brief time between test and retest, reflect the fluctuating nature of mood in comparison to measures of more stable characteristics like personality.

2.3.4 Dissociative Experiences Scale II [DES II] (Carlson and Putnam, 1993).

The DES II is a self-administered series of 28 statements, and the respondent circles the percentage of time they have each experience. A popular measure of dissociation in traumatised people it includes questions about non-pathological dissociation, for example daydreaming and more pathological forms such as evidence of dissociation in identity. Carlson and Putnam (1993) reviewed the evaluation studies available and indicated good test-retest reliability (r=0.84, n=26 and r=0.96, n=30). Internal reliability is reported as good, with split-half correlation coefficients of 0.83 (n=73) and 0.93 (n=46) with a Cronbach's Alpha of 0.95 (n=321).

A meta-analysis conducted by Van Ijzendoorn and Schuengal (1996) confirmed the measure to have high convergent and predictive validity supporting the assertion of Carlson

and Putnam (1993) that the measure had good convergent validity as well as good discriminative validity.

The DES II is a revised version of the DES, but the minor revisions are deemed not to have an effect on the fundamental psychometric properties of the scale. The most notable revision from its predecessor is the response scale changing from a visual analogue scale to a numerical scale, thus making the newer version considerably easier to score.

2.3.5 Impact of Event Scale Revised [IES-R] (Weiss and Marmar, 1997).

The Impact of Event Scale devised by Horowitz, Wilner, and Alvarez (1979) is a widely used self-report measure of specific responses to trauma, comprising 15 questions and two subscales examining intrusion and avoidance. Respondents relate the frequency of symptoms pertaining to a given life event. The options available are, "Not at all" (scoring 0), "Rarely" (1) ,"Sometimes" (3) and "Often" (5). Scores on the Intrusion Scale can range from zero to 35 and from zero to 40 on the Avoidance Scale - a total IES score of zero to 75.

The validity of this measure was published prior to the formal recognition of Posttraumatic Stress Disorder (PTSD) and therefore, following the acknowledgement of the three clusters of PTSD in DSM-IV (American Psychiatric Association, 2000), it was apparent the measure was compromised as it only accounted for two factors of the three associated with PTSD. The scale was therefore revised to include "Persistent hyperarousal". Weiss and Marmar (1997) added six items to capture this factor. The original items and initial two subscales were left reasonably unaltered in the IES-R. A question to look at flashbacks was included in the intrusion subscale and one item about sleep, split in to two items, one remaining on the intrusion subscale and one loading on to the hyperarousal subscale was added. The IES-R is therefore a 22-item self-reported measure with eight items on a subscale

measuring “avoidance” and now eight items measuring “intrusion”. Six items make up the hyperarousal subscale.

Weiss and Marmar (1997) reported psychometric data from two samples: firstly, emergency personnel exposed to a freeway collapse and secondly, workers involved with the Northridge earthquake in 1994. The IES-R showed high internal consistency, with coefficient alphas ranging from 0.87 to 0.92 for intrusion, 0.84 to 0.85 for avoidance and 0.79 to 0.90 for hyperarousal. Test–retest correlation coefficients were established from the two samples, coefficients ranged from 0.57 to 0.94 for the intrusion subscale, 0.51 to 0.89 for the avoidance subscale, and 0.59 to 0.92 for the hyperarousal subscale.

A principal components factor analysis with varimax rotation, revealed a strong single factor that accounted for 49% of the variance. Weiss and Marmar (1997) suggested not all subjects were necessarily experiencing high, or even medium, symptom levels.

Creamer, Bell and Failla (2003) conducted a further study into the psychometric properties of IES-R with 120 veterans with a confirmed PTSD diagnosis and 154 members of a community sample with varying PTSD symptomatology. The scale showed high internal consistency (alpha=0.96). The correlation between the IES-R and the PTSD Checklist (Weathers, Litz, Herman, Huska, & Keane, 1993) was high (r=0.84). This study did not offer credence to the three-factor solution regarding the three subscales; however, it proposed either a single, or a two-factor solution (intrusion/hyperarousal and avoidance), as the best account of the data. The authors did acknowledge correlations among the subscales were higher in the community sample than the treatment sample, indicating the measure may be more sensitive to a more generalised traumatic stress construct, regarding those with lower levels of symptoms. Since the present study was not looking to use the measure as a

diagnostic tool but as an indication in overall variances in the impact of an event on participants, the IES-R was more than psychometrically sufficient.

2.3.6 Sleep questionnaire.

This measure was used in a study by Bohin (1999), investigating the psychological sequelae of endoscopy. It was devised by Morris (1994 unpublished) as cited in Bohin (1999) for use in a study at the University of Hull's Psychology Department. The measure is designed to evaluate both quantity and quality of sleep, whilst acknowledging normal sleep habits. Not only does it measure sleep-patterns but also asks respondents about their dreams. As in the Bohin (1999) study, the current research aimed to look at any sleep disturbance occurring following an endoscopic examination. This was to further test the hypothesis of Bohin that, as conscious sedation drowsiness has similarities to sleep, a state dependent learning hypothesis may predict sleep disturbance.

As yet the questionnaire has not been validated against other standardised sleep scales. Although comparative data between this measure and others of a similar nature, for example the Sleep Disturbance Questionnaire would be useful for the purposes of both Bohin's study and the current study, such validation was not deemed essential. This questionnaire was designed to give an overall sleep-disturbance score that was calculated as shown in Table 3.

Table 3: Sleep questionnaire scoring

Item Responses	Score
Better	*-2*
Slightly Better	*-1*
No change	*0*
Slightly worse	*+1*
Worse	*+2*
Talking in Sleep "Yes"	*1*
Talking in Sleep "No"	*0*
Restlessness "Yes"	*1*
Restlessness "No"	*0*
Change in amount of dreams "Yes"	*1*
Change in amount of dreams "No"	*0*

2.3.7 Post-colonoscopy questionnaire.

Adapted from Bohin (1999), who used a questionnaire post-gastroscopy to examine the effects of midazolam on a person's memory, the current researcher adapted some of the items to test memory for events more specific to a colonoscopy.

The measure is intended as a repeated measures memory scale designed to assess how much of the colonoscopy examination was recalled up to 60 minutes after the procedure and to note any changes from this baseline with respondents' answers at follow-up.

The questionnaire asks if participants recall having the injection, and if they can describe certain features of their colonoscopist, including gender, ethnicity, hair and scrubs colour. They are asked if they can recall endoscope insertion and to estimate the length of the

procedure. Pain perception is rated on a four-point Likert scale and distress on a five-point Likert scale. These questions, requiring more subjective evaluations, were not included in the memory score. Responses to questions regarding memory for the procedure were converted into scores by giving values of zero for no recollection, one for partial recall and two for full recall. This gave a score range of 0-12. Qualitative information on "blanks" in memory for the procedure were also analysed to look for frequency of the phenomenon and common themes in first aspects recalled following a "blank"

2.4 Intra-Procedural Measure

2.4. 1 Behavioural distress rating scale.

The BDS used in the study was a modified replication of the BDS used by Woodruff & Wang (2004), which was itself an adaptation of the BDS designed by Bohin (1999) to measure the level of trauma for patients undergoing upper-gastro-endoscopy. The adapted scale rated behavioural indicators of distress including grimacing, vocalised distress, plus upper and lower body-tension. The occurrence and level of these behaviours were recorded every minute for 15minutes. At "Minute 1", "Minute 6" and "Minute 13" participants' heart rates, monitored by a finger-pulse oximeter attached to the right index finger, were noted to observe which procedural interval produced the largest change in pulse rate.

BDS responses were observed and recorded by the researcher every minute for a 15-minute period. The measure was scored as outlined in Table 4.

Table 4: BDS Scoring

Behaviour	Score (for occurrence each minute)
Head Movement (Slight)	*1*
Head Movement (Moderate)	*2*
Head Movement (Strong)	*3*
Vocalised Distress (Slight)	*1*
Vocalised Distress (Moderate)	*2*
Vocalised Distress (Strong)	*3*
Arm Movement (Slight)	*1*
Arm Movement (Moderate)	*2*
Arm Movement (Strong)	*3*
Leg Movement (Slight)	*1*
Leg Movement (Moderate)	*2*
Leg Movement (Strong)	*3*
Eyes Watering	*1*
Face Flushed	*1*
Face Pale	*1*
Grimacing	*1*
Lower Body Tense	*1*
Upper Body Tense	*1*

2.5 Stimulus Presentation and Materials

To determine if any implicit emotional memory was encoded during the colonoscopy procedure, a skin conductance response (SCR) monitor was used to measure participants' response to nonsense words presented prior to the procedure and again at a follow-up visit no more than two days post-procedure. The main independent variable was the nonsense word heard during the period of midazolam sedation and the main dependent variable was SCR. The equipment utilised included both audio and psychophysiology recording instruments.

2.5.1 Audio equipment.

Initially, word stimuli were read out by the researcher and recorded digitally via an Olympus Digital Voice Recorder (model No.DS-2400). The recorded words were then downloaded to a PC and edited using wave-editing software, Nero Wave Editor 3.0, to make 12 audio stimuli files. The wave-editing software was used to repeat the nonsense words the required number of times, vary the presentation order and accurately match timings of pauses across all variations of the audio files.

Six audio files, for participants to hear pre-procedure, were separately burned onto six identical blank audio CDs. The six CDs were mixed, then labelled 1 to 6, thus blinding the researcher to the content of the CD. The word sequences were as follows;

1) *Brust, pote, scrate, moof, pote, scrate, moof*
2) *Brust, scrate, moof, pote, scrate, moof, pote*
3) *Brust, moof, scrate, pote, moof, scrate, pote*
4) *Brust, pote, moof, scrate, pote, moof, scrate*
5) *Brust, scrate, pote, moof, scrate, pote, moof*
6) *Brust, moof, pote, scrate, moof, pote, scrate*

The nonsense word “brust” was used as a dummy word to replicate the Woodruff and Wang (2004) study and to account for the likelihood of the participant having a greater physiological response to the first sound heard.

The words following “brust” were presented in all possible combinations, across the six CDs, to control response patterns due to sequence order effect. The audio data from each CD were downloaded to a laptop (Toshiba Satellite Pro L-500-1VW) without being heard by

the researcher, and files labelled CD1 to CD6. These were downloaded in WAV format and saved to a "stimulus" folder, created by the researcher, in the root directory where the SCR measuring software was installed on the laptop.

Another six CDs were created in the same manner and randomised after recording to be labelled discs A-F, each containing one of the following stimulus presentations:

A) 1 minute silence, "Scrate" (repeated once every 10seconds for 5 minutes) then "Mary had a little lamb", "Jack and Jill went up the hill", "Hey diddle diddle" (repeated every 10 seconds for 5 minutes)

B) 1 minute silence ,"Pote" (repeated once every 10 seconds for 5 minutes) then "Mary had a little lamb", "Jack and Jill went up the hill", "Hey diddle diddle" (repeated every 10 seconds for 5 minutes)

C) 1 minute silence, "Moof" (repeated once every 10 seconds for 5 minutes) then "Mary had a little lamb", "Jack and Jill went up the hill", "Hey diddle diddle" (repeated every 10 seconds for 5 minutes)

D) 1 minute silence, "Scrate" (repeated once every 10 seconds for 5 minutes) then "This is going really well", "You are doing fine", "We are making real progress" (repeated every 10 seconds for 5 minutes)

E) 1 minute silence, "Pote" (repeated once every 10 seconds for 5minutes) then "This is going really well", "You are doing fine", "We are making real progress" (repeated every 10 seconds for 5 minutes)

F) 1 minute silence "Moof" (repeated once every 10 seconds for 5 minutes) then "This is going really well", "You are doing fine", "We are making real progress" (repeated every 10 seconds for 5 minutes)

The minute's silence was to allow for all playbacks in the procedure to begin immediately after injection of midazolam and allow time for the sedative to take effect before any audio was heard by the participant. These CDs were played using a Bush Personal CD player (Model number CDW113) and a pair of large, padded, closed-back headphones.

One disc was played to participants during their colonoscopy, allocated by a random sequence created using free Internet software from http://www.randomization.com (Dallal, 2008). The software allowed for the target number of participants to be divided into seven blocks to produce equal repetitions of discs A to F in a random sequence.

2.5.2 Psychophysiology equipment.

This study used the Contact Precision Instruments (CPI) "PsychLab" Version 8 (2009) equipment and software. The SCR hardware device (SC5) could be powered by the USB port of any IBM PC compatible desktop or laptop computer. Skin conductance was measured via 8mm diameter silver/silver chloride electrodes. SC5 uses a high-resolution, 24-bit digital converter that samples at a rate of 80Hz. The A-D converter immediately digitises SC data at the point of measurement reducing the possibility of interference. SC5 uses a self-calibrating circuit that, when used in conjunction with PsychLab software, allows for automatic evaluation of phasic SCR. After calibration, 24-bit code accurately represents SC measures across red and black terminals. DC coupling with constant voltage electrode excitation (0.5V DC) is used to measure skin conductance.

SCR is measured in Micro-Siemens and the accuracy of SC5 is +/- 0.1 Micro-Siemens. It has a range of 0-100 Micro-Siemens, the response frequency is DC-10Hz and its relative accuracy is 5.9e-6 Micro-Siemens.

The PsychLab software used in the study was PsychLab Acquire v.8.3.18 and PsychLab Data Analysis v1.0. Both programs use PsychLab Command Code (PCC) a computer language that PsychLab Acquire uses to organise stimulus events programmed by the researcher during the recording of skin conductance. PCC is also utilised by PsychLab Data Analysis to process the raw data captured by the acquisition software.

Other equipment included two, double-sided, sticky electrode collars (Mansfield R&D TD-22 Electrode Collars) per participant for each incident of SCR measurement. Sterilising alcohol wipes were used to prepare participants' fingers and emery board file to smooth any skin calluses, if required, prior to attaching electrodes. To aid conduction measurement, an electrolyte cream was applied to the electrodes before placement on the participant's skin.

2.5.3 Nonsense words.

As this study was a partial replication of Woodruff and Wang (2004), it utilised the same stimulus words. These words were selected for the original study, as they were more readily associated with the colonoscopy procedure. The words "scrate" and "pote" were chosen as they stemmed from real words associated with the procedure, i.e. "scrape" and "poke". For ethical reasons, Woodruff & Wang (2004) were unable to use real words so homophonic nonsense words were generated by altering one letter. A pilot study found that university students associated the nonsense words with the root words. A control nonsense word, "moof", that was neutral, in relation to words associated with colonoscopy, was also utilised in the study.

2.5.4 Positive suggestions.

A positive suggestion is defined as a constructive statement aimed to improve well-being. In times of stress, it is hypothesised, these suggestions are processed subconsciously in an uncritical manner (Orndorf & Deutch, 1981).

The positive suggestions half the patients heard during the procedure were the phrases, "This is going really well", "You are doing fine" and "We are making real progress". These phrases were selected as they were relevant to the procedure and offered personal reassurances to the individual undergoing the colonoscopy.

2.5.5 Nursery rhyme titles.

The control group in the current study heard nursery rhyme titles read in a neutral way. This was preferred to silence in case it was purely the human voice that impacted on positive perception of the procedure rather than the content of the speech. Only the titles were used, as opposed to the full rhymes, as the progression of listening to a children's nursery rhyme may evoke positive memories and/or have a soothing effect.

The titles were "Hey Diddle Diddle", "Jack and Jill Went Up the Hill" and "Mary Had a Little Lamb". These were selected as they closely matched the syllable length of the positive suggestions heard by the other half of the sample. This ensured the amount and rhythm of voice heard for each group was comparable.

2.6 Procedure

2.6.1 Ethics approval.

Ethical approval was given by the National Research Ethics Service Leicestershire, Northamptonshire & Rutland Ethics Committee 2 on 11th June 2010. The study was authorised to run in routine colonoscopy clinics held at a regional centre for endoscopy by the Hospitals NHS Trust Research and Development Department (R&D) on 17th September 2010. In December 2010, a non-substantial amendment was granted by the department, to allow a Clinical Studies Officer to be recruited to help with the extensive data collection process. For further assistance, a third-year undergraduate psychology student was approved by R&D in February 2011. Ethics approval letters and confirmation of extra researchers have been included in Appendix A.

2.6.2 Recruitment.

Recruitment was from an outpatient population on a consultant surgeon's colonoscopy lists for Wednesday and Thursday afternoons (from September 2010 to April 2011). Lists typically consisted of five outpatients due for colonoscopy utilising midazolam sedation. Every patient on the surgeon's list, who met the inclusion criteria, was sent an opt-in slip (Appendix B) and a participant information sheet (Appendix C). If they wished to partake, they returned the opt-in slip to the researcher in the stamped-addressed envelope provided. The researcher identified when willing volunteers were having their procedure and approached them to explain the study further and acquire informed consent (Appendix D).

If surgical nurses informed the researcher of problems from the patient's notes that would exclude them from the study, after they had opted in, the individual was not

approached to take part but was thanked for expressing interest. If no obvious exclusion criteria existed, e.g. no previous PTSD diagnosis or hearing problems, the patient and researcher moved to the consulting room and the patient was further queried regarding exclusion criteria. Those ineligible were thanked for their time and reasons for their exclusion from data collection explained. At this juncture patients were given the opportunity to re-read the information sheet before being asked to sign the consent form and made aware of ethical issues such as data anonymity and right to withdraw at any time. Subsequently, the pre-colonoscopy interview was conducted.

2.6.3 Programming stimulus presentation and SCR recording.

Within the Psychlab software the computer is set up to record SCR by clicking the "Start Record" button. Using the software's media control window, the six audio files containing the words, in the six different presentation combinations, were loaded into the "stimulus" folder and each file in WAV format was uploaded in slots 0-5 in the media control window. A program was written in PCC that ran when the recording was started, to control what stimulus was played and ensured all participants' SCR measures were taken for exactly 90seconds. Depending on which parameter (1-6) was entered into the parameter field, a different version of the audio word presentation was played. Following the initial instruction, "it is important that you remember these words" and the dummy-word "Brust", the nonsense-words "pote", "moof" and "scrate" were played twice in the combinations outlined in equipment section. The six-word series audio files were given to consecutive participants meaning participant 1 was assigned parameter 1 and heard version 1 of the recording and participant 2 was assigned parameter 2 etc. Participant 7 was the next participant to be assigned parameter 1 again. The parameters that were assigned were cycled round after every

6 participants. With a target sample of 42 people this ensured equal numbers in the different presentation order groups.

2.6.4 Data collection.

The data collection comprised four main stages. Copies of all measures used can be found in Appendix E.

1.) Pre-colonoscopy questionnaires and SCR baseline measures

Consenting patient's right index and middle fingers were cleaned with an alcohol wipe and dried, after first smoothing any hard skin with emery board if required. The recesses in each electrode pad, connected to the SC5 unit, were filled with a pea-sized amount of electrolyte and double-sided, sticky electrode collars were attached to them. These were adhered to the participant's fingers. One pad was placed on the medial phalanx of their right index finger and the other was attached to the medial phalanx of their right middle finger. The fact that the electrodes and SC equipment remained attached while the questionnaire measures were taken allowed the electrodes and electrolyte to stabilise, the unit to be calibrated and its responsiveness established before SCR data were recorded. To expedite data collection, each measure was individually explained and presented to participants. Questions from each measure in the pre-colonoscopy section of the questionnaire pack were read to the patient and their answers duly recorded. The first measure presented was the POMS-BF to gauge participants' current mood. The HADS was then used to establish a baseline of participants' reflection of their depression and anxiety levels during the last week to be compared with any changes of this perception throughout the study. This was followed by the DESII questionnaire to obtain a baseline level of psychological disturbance with which a post

procedural repetition of this measure could be compared. The researcher ensured participant numbers were written on the front of the pack and on all completed measures.

This phase of the study culminated in the participants putting on a pair of closed-back headphones, connected to the headphone jack of the laptop. The SC5 unit was also connected to the laptop to record their SCR. A data file was created for the participant and the software loaded with the PCC code for stimulus presentation. The required parameter number was entered into the field, the participant was then asked to close their eyes and the "Start Record" button clicked. Recording automatically commenced for 90 seconds whilst the given stimulus presentation was heard. Participants were then detached from the equipment and informed they would hear further audio CDs during their colonoscopy. The researcher and a nurse escorted the patient to the colonoscopy suite at their allocated time.

2.) Colonoscopy procedure, intra-colonoscopy word presentations and distress rating

Patients were prepared for the procedure, in a side room, by a nurse who guided them through the paperwork. Then the colonoscopist, a consultant surgeon, briefly outlined the procedure and explained the nature of conscious sedation. Upon consent, patients were readied for examination by changing into a gown and wheeled to the colonoscopy suite on a trolley-bed.

The nurse attached a blood pressure monitor cuff to the patient's upper right arm (patients lay on their left side during the procedure) and a pulse oximeter was attached to the patient's right index finger. To aid respiratory function, whilst under sedation, a nasal oxygen tube was attached to the nose. Before the midazolam was administered, headphones were placed on the participant. Nurses were instructed not to verbally reassure patients during the colonoscopy procedure in order to maximise any effect of the recorded suggestion.

The surgeon administered midazolam (average dosage 2.5mg) and fentanyl (dose 50-75mcg) as required for sedation and pain relief respectively. Dosages were tailored to the individual patient considering age, body mass and anxiety level. The patient was rolled on to their side and, usually within 30 seconds of intravenous midazolam sedation, the sedative took effect, air was introduced into the colon to inflate the bowel and the endoscope was inserted to commence the examination.

The CD player was started as soon as the midazolam bolus had been given. The start of the CD was consistent for all participants with no audio stimulus until one minute into the recording, to allow for sedative effect. Firstly participants heard, "It is important you remember these words", then one of the nonsense words repeated every 10 seconds (according to the randomisation) for five minutes into the endoscopy. Then half the sample heard either the three nursery rhyme titles (control group) or the three positive suggestion statements (experimental group), repeated every 10 seconds for five minutes.

Colonoscopy was timed from midazolam injection and "play" being pushed on the CD player. CDs lasted just over 10minutes then automatically stopped. The researcher recorded signs of behavioural distress during each minute of the intra-colonoscopy presentation, for a maximum of 15 minutes, using the Behavioural Distress Scale. Participants' heart rates at midazolam infusion (Minute 1), Minute 6 and Minute 13 were also recorded.

Routine procedures lasted around 20minutes but the exact length varied between patients. From patient observation and discussions with the surgeon, it was apparent that the periods of most discomfort were during initial colonoscope insertion and whenever it was required to navigate a bend in the colon.

During sedation, patients were able to respond to the surgeon's requests for them to move. Many were observed to display signs of discomfort including groaning, grimacing and shouting. After the colonoscope was retracted, the patient was disconnected from the monitor by the nurse, the headphones removed and the CD player taken from the patient's pillow. The patient was then wheeled to the recovery area where they slept/rested for an hour during which time they completed the third phase of data collection.

3.) Post-colonoscopy questionnaires

In the recovery area, the escorting nurse presented participants with their questionnaire pack and they completed all measures under the section marked "To Be Completed within 60 minutes of Your Colonoscopy". The nurse ensured they completed this section within the hour and before leaving. These measures were the EPI Form A, POMS-BF, HADS and the post-colonoscopy questionnaire, designed by the researcher, to examine levels of implicit and explicit recall for intra-procedural events.

Patients then dressed, were able to have refreshments and, after a further 15minutes wait, were discharged. A typical, outpatient endoscopy appointment lasted 2-2½hours. Participants returned their questionnaire to the nurses' station to be collected by the researcher at the end of every clinic. Responses were locked away, awaiting computerised, statistical analysis.

4.) Follow-up questionnaires and SCR measures

Arrangements made with participants during the consenting process ensured they were either seen at the hospital or visited at a specific time slot at their home within two days of the procedure. During this visit, which lasted around 30 minutes, participants completed the final questionnaires, the repeat-measures of POMS-BF, Post-Colonoscopy Questionnaire,

HADS and DES II. Questionnaires about sleep and the IES-R examined if the colonoscopy had impacted on their sleep patterns or daily life.

Participant had their SCR recorded whilst listening to the same test words they heard during the pre-colonoscopy phase. After all measures were completed, participants were thanked for their contribution and, if they requested, debriefed on the study's premise.

2.6.5 Statistical analysis.

The raw scores from questionnaires and SCR measures were entered into Microsoft Excel 2007 spreadsheets, as a database. One sheet was designed to calculate mean difference between pre and post-SCR responses to each nonsense word that participants heard. This datum set, and other questionnaire scores recorded on the spreadsheets, were entered into SPSS for Windows, Version 16.0. In this program, data were cleaned of all non-responders and other missing data. The analysis comprised repeated measures ANOVA and ANCOVA, Mann-Whitney U tests, t-tests, Kruskal-Wallis Test and Chi-squared Analysis.

3.0 Results

3.1 Recruitment

During seven months' data collection, 111 people were approached to participate in the study. Of these, seven were found to be ineligible due to one or more of the exclusion criteria and of the remaining, 80 declined to partake in the research. Data collection was also impeded by many of the programmed clinics being cancelled due to unavailability of surgeons. Table 5 outlines reasons people were lost to the study.

Table 5: Reasons for participant attrition

Exclusions	
DECLINED/CONSENT NOT GIVEN	**80**
NO SEDATION	**3**
ILLNESS	**1**
INCOMPLETE QUESTIONNAIRES	**1**
HEARING IMPAIRMENT	**1**
ENGLISH NOT FIRST LANGUAGE	**2**

The 25 participants represented 22.52% of the total patient population. Of these 100% completed the initial questionnaires and SCR measures. 100% were observed during colonoscopy and completed the second set of 60 minutes post-colonoscopy questionnaires. One participant did not complete the follow up measures therefore the data analysis is based on results from 24 participants (96% of the sample). Follow-up measures were completed, either one or two days after their colonoscopy.

3.2 General Characteristics of the Sample

Patient demographics were as follows; 58.33% (n=14) participants were male and 41.67% (n=10) were female. Patients' ages ranged from 30 to 75years with an average of 59.33 years (SD=11.48).

Table 6 outlines the dosage of sedative and analgesia participants in the current study received and contrasts them with those used in the Woodruff and Wang (2004) study.

Table 6 Dosage comparisons

Study	Mean Midazolam Dosage	Midazolam Range	Mean Fentanyl Dosage	Fentanyl Range
Current Study	2.5mg (SD=0.51)	2-3mg	53.13µg (SD=8.45)	50-75 µg
Woodruff and Wang (2004)	5.18mg (SD=1.5)	3-10mg	72.92µg (SD=28.85)	50-100

The anaesthetists were asked to minimise the use of midazolam and fentanyl, within clinically acceptable limits, to increase the likelihood of finding implicit memory for the nonsense words played during colonoscopy. Although the present study more rigorously controlled dosage than Woodruff and Wang (2004), the amount of compound used was still at the surgeons' discretion, based on patient variables such as gender, age and weight but, at the researcher's request, was within a much narrower range.

3.3 Un-blinding

Prior to conducting main analysis the researcher had to be un-blinded to the order of audio-stimuli presented pre and intra-colonoscopy. Table7 shows the order of nonsense-words for each parameter presented to participants at baseline SCR measurement.

Table 7. Parameters and word presentation order

Parameter Played at Baseline Recording	Word Presentation Order
Parameter 1	Brust, Scrate, Moof, Pote, Scrate, Moof, Pote
Parameter 2	Brust, Moof, Pote, Scrate, Moof, Pote, Scrate
Parameter 3	Brust, Pote, Moof, Scrate, Pote, Moof, Scrate
Parameter 4	Brust, Pote, Scrate, Moof, Pote, Scrate, Moof
Parameter 5	Brust, Moof, Scrate, Pote, Moof, Scrate, Pote
Parameter 6	Brust, Scrate, Pote, Moof, Scrate, Pote, Moof,

During colonoscopy, patients were randomly allocated an audio CD containing a priming nonsense word with either nursery rhyme titles or positive suggestions. Table 8 outlines the contents of each of the CDs.

Table 8. Contents of CD played during colonoscopy.

C.D. Heard	Number of Participants Hearing CD	Nonsense-word	Stimulus
A	4	Moof	Nursery Rhyme Titles
B	4	Pote	Positive Suggestions
C	4	Scrate	Nursery Rhyme Titles
D	4	Moof	Positive Suggestions
E	4	Pote	Nursery Rhyme Titles
F	4	Scrate	Positive Suggestions

3.4 Main Results

3.4.1 Covariate analyses.

On a correlation matrix (Appendix F) of independent and dependent variables, anticipated significant correlations were found between HADS and POMS, due to possible concurrent validity between the mood measures. Personality traits were measured as a potential covariate and analysis of the matrix showed that Eysenck Personality Inventory Neuroticism scores (EPI N) significantly correlated with the POMS total mood-disturbance (TMD) measures taken at three time-points in the study. EPI N also significantly correlated with IES-R total and HADS depression and anxiety scores across all the time periods. Post DES II scores were noted as potential covariates for POMS at follow-up, IES-R total and HADS anxiety across the three time periods. IES-R totals significantly correlated with POMS scores at all three time points.

3.4.2 Colonoscopy and psychological sequelae –hypothesis one.

To test the hypothesis that colonoscopy causes psychological disturbance during the days following the procedure participants completed the DES II prior to and within two days of their colonoscopy. To allow for parametric analysis scores were converted in to square root scores, for skewness data see appendix F, and compared in a paired t-test. It was expected that if colonoscopy caused psychological disturbance that higher levels of dissociation would be noted in participants after their colonoscopy.

Mean DES II scores were 6.96 (SD= 4.93) before colonoscopy and 6.46 (SD= 5.73) at follow-up (within two days of the procedure). A paired t-test on transformed scores was conducted to evaluate the impact of the colonoscopy on patients' levels of dissociation. There was no statistically significant change in DES II scores from baseline when re-tested at follow-up. t (23)= 1.058, p=0.301 (two-tailed). Therefore the null hypothesis could not be rejected.

Patients self-rated their colonoscopy distress level twice, 60 minutes post-colonoscopy and again at follow-up. Two patients rated their colonoscopy as "Very Painful", four found it "Mildly Painful", 11 said it was "Painful" and seven had no recollection of pain. Five participants changed their pain rating at the follow-up, with four recalling less pain than at their post-colonoscopy assessment. However, despite adequate levels of analgesia, 70.83% reported experiencing pain during the procedure. This was comparable to Woodruff and Wang (2004) who found 67% of their sample recalled pain.

One participant rated their colonoscopy as "Very Distressing", three found it "Stressful", eight said it was "Mildly Stressful", 12 thought it was "O.K." and no participants stated having no recall of the procedure. Four participants reduced their distress rating and two increased their procedural distress rating at follow-up. This indicates, at least anecdotally, that 50% found their colonoscopy stressful.

3.4.3 Positive suggestion and intra-procedural distress- hypothesis two.

In total, 83.33% of colonoscopies were either 15minutes or longer and the participant distress levels were monitored for the first 15minutes of their procedure. However the remaining 16.67%(N=4) were less than 15minutes: one lasted 10 minutes, one 11minutes

and the other two 14minutes. Total length of all procedures was recorded, the longest taking 75 minutes and the shortest 10 minutes. The mean procedure length for the sample was 26.88 minutes (SD=13.84) and the median time was 25 minutes (IQR=10).

To make scores comparable for such widely-ranging procedure lengths, BDS scores were converted into mean BDS score per minute. To allow BDS scores to be combined with, other trauma scores, measured in different units, they were transformed into standardised Z-scores (Z-mean-BDS/min). This method was in line with the approach used by Bohin (1999).

Another trauma measure used during the colonoscopy was the participant's heart rate taken at three intervals. Minute One, was the moment the final injection had been administered, Minute Six, when priming words had ended and suggestion group stimuli had begun, and finally, Minute Thirteen of the observation period. From this, the average heart rate was calculated and a heart rate range score (HRR) derived by subtracting the minimum recorded heart rate from the maximum recorded at any two measurement points. The HRR score was then standardised (Z-HRR) and added to the Z-mean-BDS/min score to give an overall standardised trauma rating called (Z_TRAUMA_2).

Figure 3 shows the distribution of this population. The mean is $2.64X10^{-16}$, i.e. virtually zero. Positive scores indicate those who experienced the greatest amount of trauma and negative scores indicate those who experienced less intra-procedural trauma.

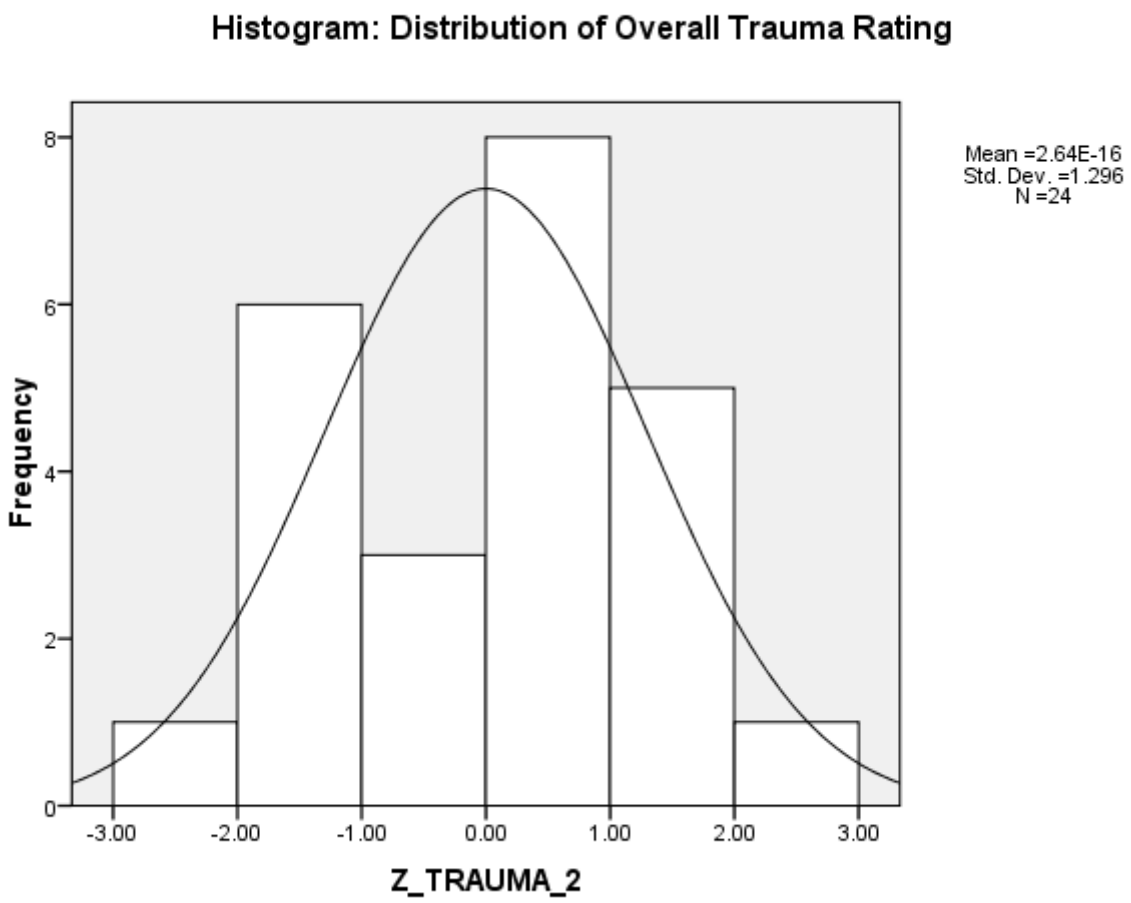

Figure 3: Distribution of trauma scores (Z-Mean-BDS/min + Z-HRR)

To examine the effects of suggestion-group on intra-procedural trauma level, participants were split into those hearing nursery rhymes for the second five minute period of their procedure and those hearing positive suggestion. The means and standard deviations were then compared between the two groups with regard to intra-colonoscopy trauma measures shown in Table 9.

Table 9. Mean and standard deviation intra-colonoscopy trauma measures for nursery rhyme control group and positive suggestion-group

Measure	Suggestion-group	Mean	SD
Z Trauma	*Positive Suggestion*	-0.51	1.11
	Nursery Rhyme	0.51	1.31
Mean BDS/Min	*Positive Suggestion*	0.61	0.44
	Nursery Rhyme	0.91	0.77
Mean Heart Rate	*Positive Suggestion*	72.06	9.63
	Nursery Rhyme	70.38	14.68
Heart Rate Range	*Positive Suggestion*	9.42	5.18
	Nursery Rhyme	13.08	7.89

To establish if there were any significant differences between the two groups, with regard to overall trauma score and its constituent parts, several independent t-tests were conducted and results outlined in Table 10.

Table 10. Independent t-tests comparing mean trauma scores for the two suggestion-groups

Measure	t	df	Sig(2-tailed)	Mean Difference
Z_Trauma	*2.05*	22	0.05	1.02
Mean BDS/Min	1.18	22	0.25	0.30
Mean Heart Rate	-0.33	22	0.74	-1.68
Heart Rate Range	1.35	22	0.19	3.67

Although three of the t-tests failed to demonstrate significant differences between groups, the difference between groups for overall trauma score was statistically significant at the 0.05 level. This would indicate that people who heard positive suggestion had lower trauma scores. To explore this further, suggestion group was cross-tabulated using a median split of overall trauma scores to further sub-divide the sample into those with high and those with low distress. The high-distress group comprised participants with the median and above Z_trauma_2 scores and the low-distress group comprised those below the median score of 0.24. (IQR=2.28). The results are shown in Table 11.

Table 11. Z Trauma score/suggestion-group cross-tabulation

Distress Level	Nursery Rhyme	Positive Suggestion	Total
Low- N	3	9	12
% within median split	25%	75%	100%
% within group	25%	75%	50%
High- N	9	3	12
% within median split	75%	25%	100%
% within group	75%	25%	50%
Total- N	12	12	24
% within median split	50%	50%	100%
% within group	100%	100%	100%

A Chi-square analysis for independence (with Yates Continuity Correction) indicated a significant association between distress level and suggestion-group χ^2 (1,n=24)=4.17, p=0.04).

3.4.4 Positive suggestion and post-procedural psychological disturbance-hypothesis three.

It was hypothesised that mood disturbance measures for the Positive Suggestion-group would be lower than the Nursery Rhyme group. To measure anxiety and depression, participants completed a HADS pre-procedure, within 60 minutes after and at follow-up. Distributions of depression and anxiety scores were examined across the three time periods. With the exception of baseline depression scores, all HADS measures demonstrated a positive skew (see Skewness and Kurtosis values Appendix F). As the data did not meet the assumptions for parametric tests, the decision was taken to transform them. Despite

ANCOVAs being thought to be robust to skewed data (Glass & Stanley,1970) some authors argue it is better to transform data to allow it to meet parametric assumptions, especially in smaller samples (Tabachnick & Fidell, 2007). As the planned analysis of the HADS data was a two-way mixed 3X2 ANCOVA there was no non-parametric equivalent, meaning data had to be altered to meet the assumptions of the statistical test. Given the nature of the distribution, the square root of the HADS scores was applied and resolved the skew. These data were then analysed against the suggestion group.

An ANCOVA was conducted on square root HADS depression scores between suggestion groups controlling for EPI N a potential covariate. The analysis showed no significant interaction between groups and HADS depression scores ($F(2,19)=0.41$, $p=0.67$). There was a significant main effect of Time of HADS completion ($F(2,19)=6.16$, $p=0.01$) and the effect-size was large(partial eta squared=0.39). Both groups showed a reduction in depression scores across time. However, there was no significant main effect of suggestion group ($F(1,20)=2.61$, $p=0.12$) indicating what participants heard during their colonoscopy did not impact on the reduction of post-procedural depression. There was a significant relationship between the EPI N covariate and the dependent variable, accounting for 23.9% of the variance ($F(1,20)=6.27$, $p=0.02$).

Another two-way mixed 3X2 ANCOVA, comparing transformed square root HADS anxiety scores with suggestion group, was conducted controlling for EPI N and post DES II as covariates. This showed no significant interaction ($F(2,18)=0.15$, $p=0.86$). There was a highly significant main effect of time of HADS completion ($F(2,18)=7.70$, $p= 0.004$) and the effect-size was large (partial eta squared=0.46). Both groups showed a reduction in anxiety scores across time, however, there was no significant main effect of suggestion group ($F(1,19)=2.06$, $p=0.17$) indicating what participants heard during their colonoscopy had little

bearing on reduction of post-procedural anxiety levels. There was a significant relationship between the EPI N covariate and the dependent variable, accounting for 52.8.% of the variance (F(1,19)=21.23, p=0.0002). Post DES II covariate did not have a significant relationship with the dependent variable. (F(1,19)=2.63, p=0.12).

Figure 4 outlines how HADS scores reduced across both groups over the three time periods.

HADS Depression Scores *HADS Anxiety Scores*

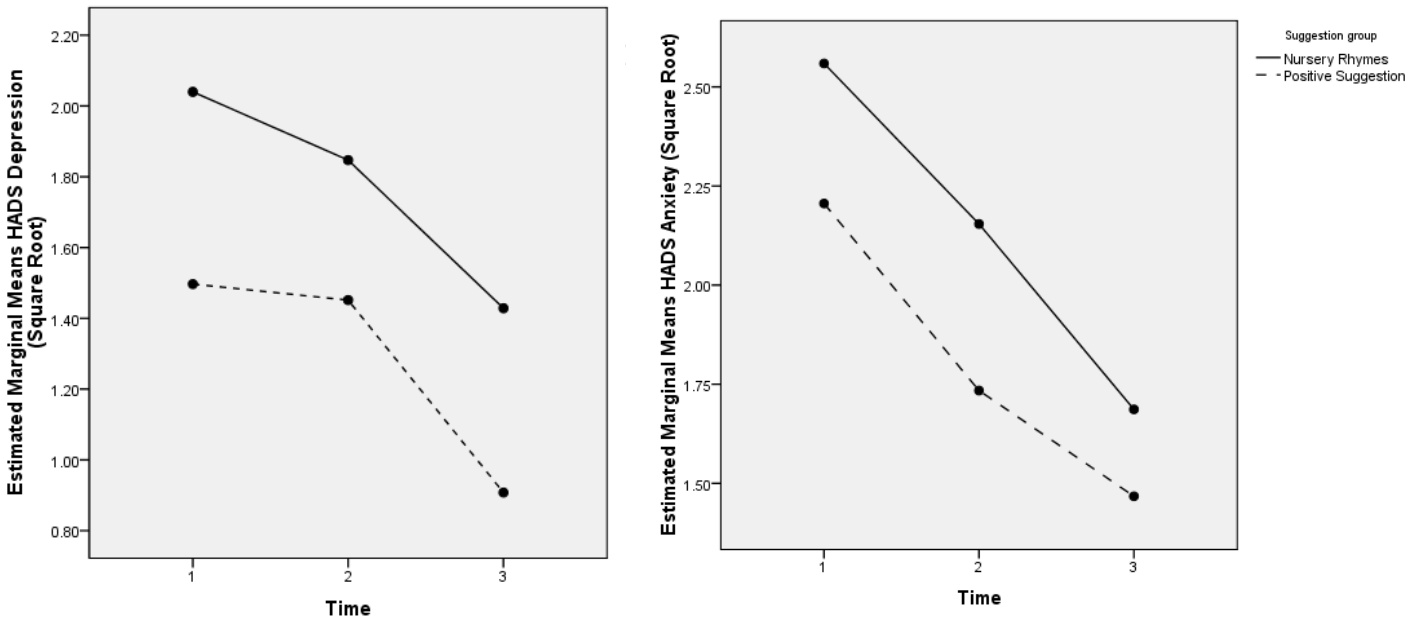

Figure 4: Mean Transformed HADS Anxiety and HADS Depression Scores for Suggestion-groups

Other mood-states were measured by the POMS-BF. POMS scores people on the following factors, Tension/Anxiety, Depression/Dejection, Vigour/Activity, Fatigue/Inertia and Confusion/Bewilderment. Due to the inter-correlations between the factors they can be summed (with Vigour weighting negatively) to give a Total Mood-disturbance Score (TMD).

It is recommended whenever a single estimate of affective state is required that TMD be used (McNair, Lorr, Heuchert & Droppleman, 2003).

Table 12 shows a comparison of normative TMD data for adult and geriatric populations obtained by Nyenhuis *et al*. (1999) with the TMD scores for the three time periods in the sample for the current study.

Table 12:POMS_TMD Normative Data and TMD scores for current study sample

Adult Norms		**Geriatric Norms**		**Study Sample TMD Baseline**		**Study Sample TMD 1-Hour**		**Study Sample TMD Follow-up**	
Mean	***SD***	***Mean***	***SD***	***Mean***	***SD***	***Mean***	***SD***	***Mean***	***SD***
17.7	*33.0*	*5.3*	*25.9*	*9.3*	*13.7*	*5.9*	*12.9*	*1.0*	*16.0*

The difference between means for norms of adult and geriatric samples may be explained by the age-range of the sample in the current study, the reduced baseline being attributable to the mix of adults and older-adults. The mean TMD score decreased for the entire sample across the three time periods. To investigate if this reduction was due to an effect of suggestion group, a two-way mixed 3X2 ANCOVA was conducted using the EPI neuroticism scale, and DES Post as covariates.

POMS_TMD data were checked for normality by looking at skewness statistics and histograms (see Appendix F). Baseline and 60 minutes post-colonoscopy TMD scores were normally distributed, however, follow-up scores were positively skewed. Since TMD scores can be negative, a square root transformation was not possible, neither was a logarithmic conversion as scores can be zero. As ANCOVAs are reasonably statistically robust and there is no alternative non-parametric test to a two-way mixed ANCOVA, the analysis comparing

the TMD scores at the three measurements points for the two suggestion groups was still conducted. Given the positive skew of follow-up TMD scores, caution should be exercised when interpreting the results.

A two-way mixed 3X2 ANCOVA comparing TMD scores with suggestion-groups, and EPI-N and Post DES II acting as the covariates, showed no significant interaction between the suggestion groups and TMD scores ($F(2,18)=0.71$, $p=0.48$). Although both groups showed a reduction of TMD scores with time, there was no significant main effect of time of TMD administration ($F(2,18)=0.70$, $p=0.51$).There was no significant main effect of suggestion group ($F(1,19)=0.66$, $p=0.43$) indicating what participants heard during their colonoscopy did not reduce post-procedural TMD scores. There was a significant relationship between the EPI N covariate and the dependent variable, accounting for 43.7% of the variance ($F(1,19)=14.75$, $p=0.001$). The post DES II was a not significant covariate ($F(1,19)=0.66$, $p=0.43$). Figure 5 outlines TMD reduction across both groups over the three time periods.

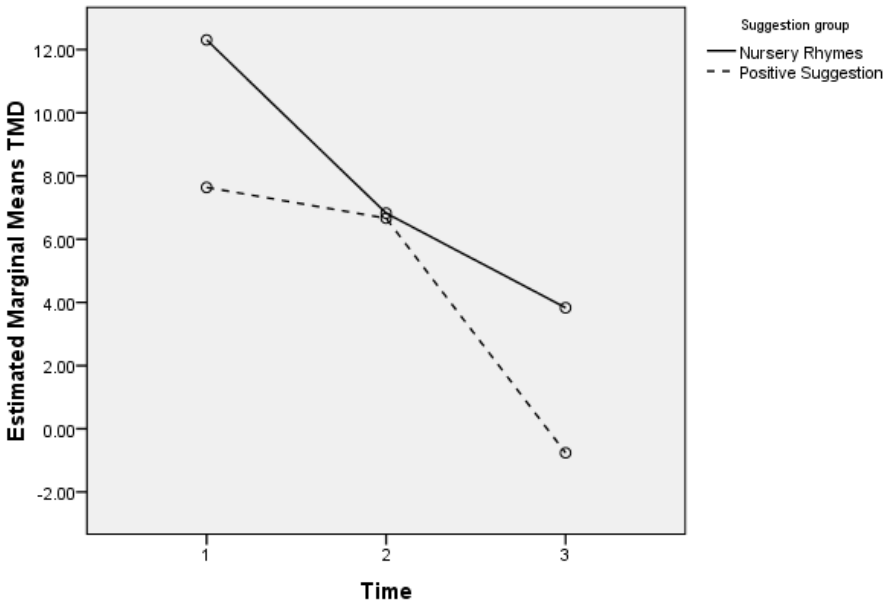

Figure 5 Mean POMS TMD Scores for Suggestion-groups

All participants completed the IES-R at follow-up to measure levels of avoidance, hyperarousal and intrusion. Participants also completed a DES II pre-colonoscopy and at follow-up. DES II scores were tested for normality and all showed a positive skew (Appendix F). Thus the scores were transformed into DES II square root scores to enable parametric analysis. Total IES-R scores and subscales demonstrated a similar trend (Appendix F); however, it was elected to run a non-parametric analysis on these measures.

Table 13 shows the mean IES-R scores for the suggestion groups. Given that scores were shown to be skewed, Mann-Whitney U tests were conducted to examine any differences between total IES-R scores and subscale scores between suggestion-groups.

Table 13: Mean and Standard Deviations of IES-R scores for Suggestion-groups

Suggestion-group	**N**	**Mean IES-R Total Score**	**Mean IES-R Intrusion Scale**	**Mean IES-R Hyperarousal Scale**	**Mean IES-R Avoidance Scale**
Nursery Rhyme Titles	*12*	*2.00 (SD=2.26)*	*0.60 (SD=1.21)*	*0.04 (SD=0.14)*	*0.05 (SD=0.08)*
Positive Suggestion	*12*	*5.92 (SD=7.17)*	*0.31 (SD= 0.39)*	*0.19 (SD= 0.57)*	*0.27 (SD= 0.36)*

Mann-Whitney U Tests demonstrated no significant differences between suggestion-groups on any of the IES-R Scales when a Bonferroni adjustment was applied to the four Mann-Whitney U tests conducted, giving a stricter alpha level of 0.0125 required for significance.

IES-R Total (U=40.5, z=-1.84, p=0.66, r=0.38).

IES-R Intrusion (U=69.5, z=-1.15, p=0.88, r=0.03).

IES-R Hyperarousal (U=60.5, z=-1.02, p=0.31, r=0.21).

IES-R Avoidance (U=38.5, z=-2.08, p=0.04, r=0.42).

The presence of an outlier in the total IES-R scores in the positive suggestion group may account for the skewed distribution and large deviation. Despite this elevating the overall mean in the positive suggestion group there was no significant difference between the groups. Tests were re-run omitting outliers, (Positive Suggestion N= 8 and Nursery Rhyme Title N=9) however, the result still produced no significant differences between the groups.

A two-way mixed 2X2 ANCOVA comparing pre and post DES II scores with suggestion group with HADS anxiety scores at each time point as covariates was conducted. It showed no significant interaction (F(1,19)=0.07, p=0.79). There was no significant main effect of time of DES II completion (F(1,19)=0.58, p=0.46) and both groups showed a reduction in dissociation at follow-up. There was no significant main effect of suggestion-group (F(1,19)=0.27, p=0.61) indicating stimulus heard during colonoscopy caused no reduction of dissociation. Also the HADS showed no significant relationship with the dependent variable.

3.4.5 Word stimuli heard during colonoscopy- hypothesis four.

To examine the effects of the nonsense word, on intra-procedural trauma level, participants were split into those that heard “Moof”, “Scrate” or “Pote”. The means and standard

deviations were then compared between the two groups with regard to intra-colonoscopy trauma measures shown in Table 14.

Table 14. Mean and standard deviation intra-colonoscopy trauma measures for the three primed nonsense-words.

Measure	**Priming Word**	**Mean**	**SD**
Z_Trauma	*Moof*	-0.52	1.23
	Scrate	0.77	0.71
	Pote	-0.26	1.55
Mean BDS/Min	*Moof*	0.68	0.50
	Scrate	0.93	0.81
	Pote	0.67	0.59
Mean Heart Rate	*Moof*	74.42	13.68
	Scrate	71.15	12.42
	Pote	68.09	11.07
Heart Rate Range	*Moof*	8.63	5.62
	Scrate	14.63	6.50
	Pote	10.50	7.48

To establish if there were any significant differences between the three groups overall trauma scores and component measures, several One-way ANOVAs were conducted. The results showed no significant differences between the means of the groups primed with different nonsense words for any of the aforementioned trauma measures.

Z_Trauma: F(2,21)=2.49, p=0.11

Mean BDS/Min: F(2,21)=0.43, p=0.66

Mean Heart Rate: F(2,21)=0.59, p=0.6

HRR: F(2,21)=1.74, p=0.20

Distress level was compared with word heard intra-procedurally using the median split Z-trauma scores calculated previously. A Chi-square test was conducted to establish if word-group distribution was balanced. Although more people hearing Scrate were in the high-trauma category and more people hearing Moof had low trauma scores, the observed differences were not significant. Interestingly, equal numbers hearing Pote (n=8) were categorised as either high (n=4) or low-trauma (n=4).

Evidence for implicit memory was based on SCR difference scores between follow-up and baseline response to auditory stimuli. Lykken and Venables (1971) stated SCR demonstrates vast differences between individuals. They cite a method of standardisation called the Rose Range Correction developed by Lykken, Rose, Luther and Maley (1966). A standardised score was obtained for this sample by applying the Rose Correction to SCR difference scores recorded for stimuli using the following formula, where xi is an individual data-point and SCR-max and SCR-min refer to the maximum and minimum SCR scores in an individual's SCR dataset.

$$\textbf{Rose Correction} = \frac{\text{SCR xi - SCR min}}{\text{SCR max - SCR min}}$$

It was anticipated that primed words would initiate the greatest difference in SCR response, evidencing implicit emotional learning under conscious sedation. However, Figure 6 shows this was not the case.

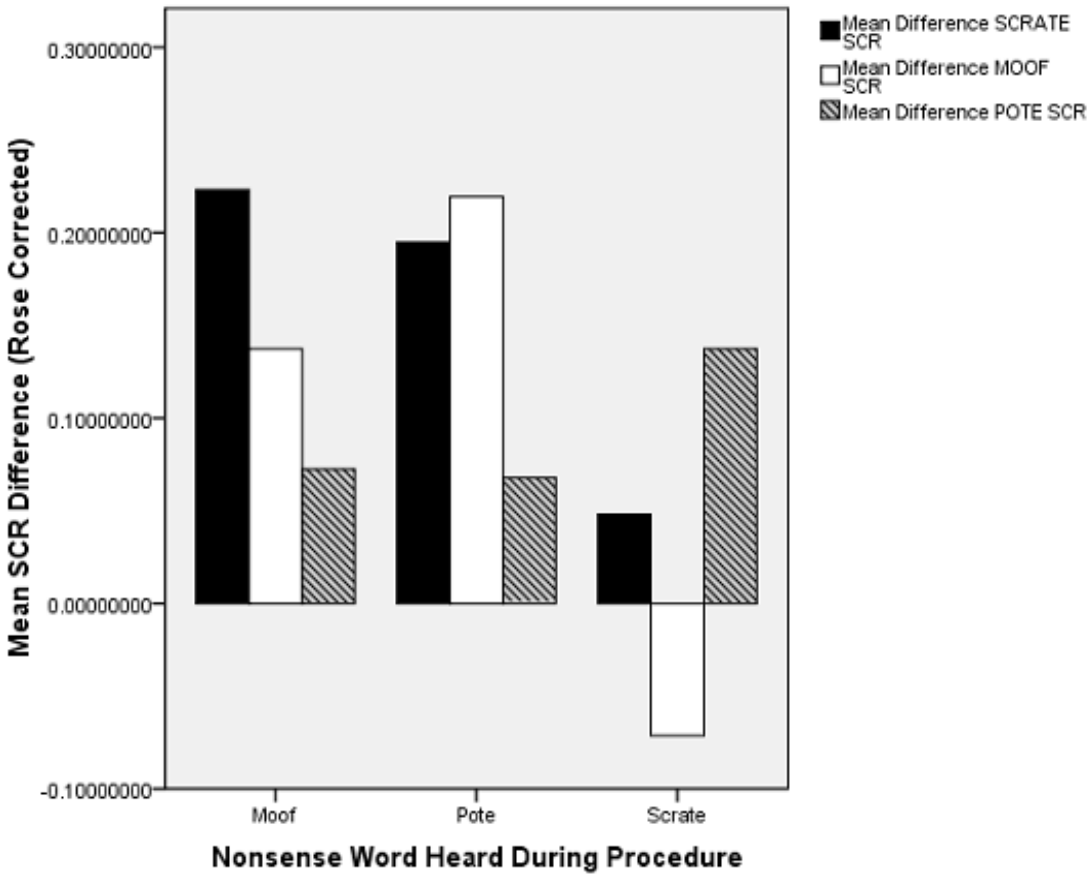

Figure 6. Mean SCR differences (between follow-up and baseline) to word stimuli for each of the priming groups with no explicit recall of intra-procedural nonsense word.

Figure 6 shows the mean SCR differences to words for the 21 participants reporting no explicit recall for nonsense words during their procedure. For participants primed with Moof, it can be seen their largest SCR difference was to Scrate and their primed word was the second in order of mean magnitude SCR difference. For the two emotive word conditions, the exact opposite of the predicted effect was noted as the primed word in each of these groups produced the smallest SCR difference. In the Scrate group the response to Moof was actually a negative difference and it was the non-primed emotive word, Pote, which had the largest SCR difference.

A two-way 3X3 mixed measures ANOVA was conducted, as SCR scores demonstrated a normal distribution. This showed no significant interaction between the three word-priming groups and SCR differences ($F(4,40)=1.85$, $p=0.14$). There was no significant main effect of SCR differences ($F(2,20)=0.22$, $p=0.80$), neither was there a significant main effect of word-priming group ($F(2,21)=0.78$, $p=0.46$).

3.5 Ancillary Findings

3.5.1 Trauma scores for primed word and suggestion group.

Comparisons were then made between mean-trauma scores and suggestion group based on the priming word. Figure 7 shows that the group primed with Pote, and played positive suggestions, had the lowest trauma scores whilst the group primed with Scrate and hearing nursery rhyme titles had the highest intra-procedural trauma score.

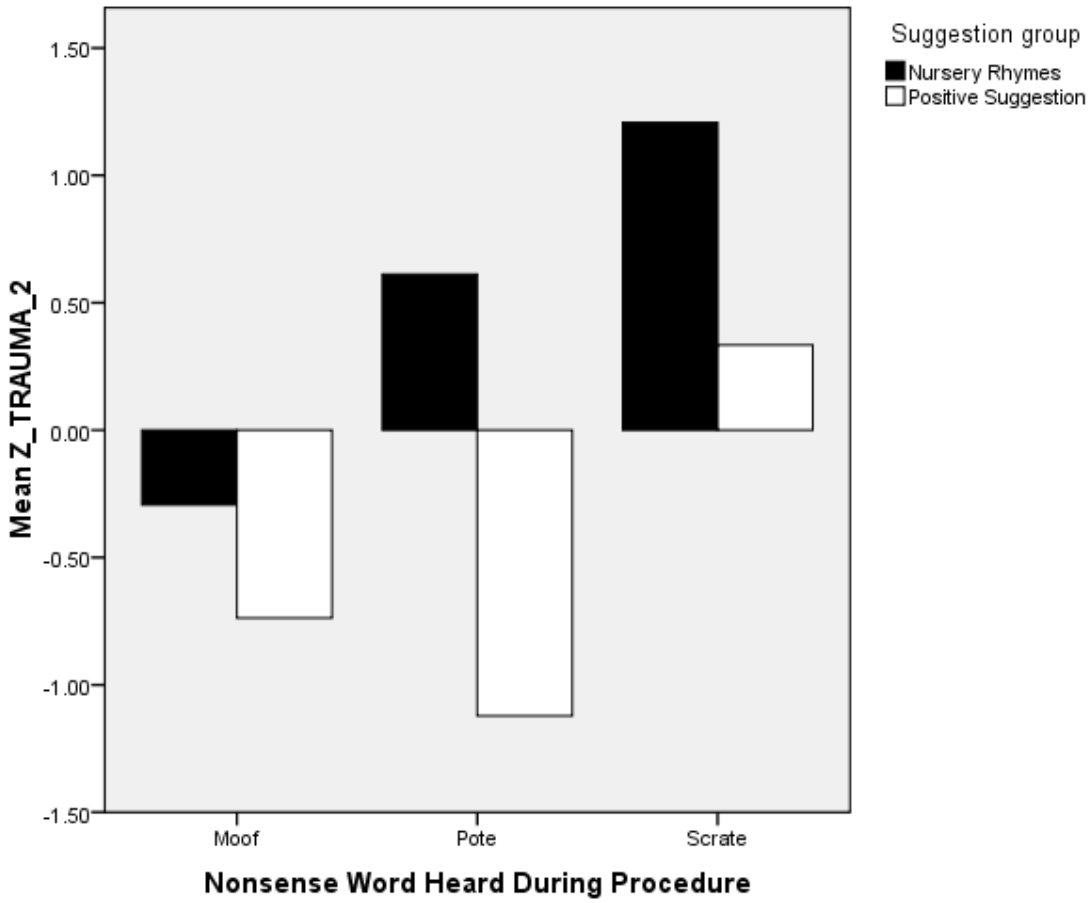

Figure 7: Mean Z Trauma scores for suggestion group and priming word

Across all word groups, people hearing positive suggestion had lower trauma scores than those hearing nursery rhyme titles. This would indicate, as hypothesised, that positive suggestion reduces intra-procedural distress. In the groups hearing Moof and Pote, trauma scores are negative and are only just above zero in the Scrate group. These data also show that those primed with emotive words (Pote and Scrate) had higher (positive) trauma scores in the nursery rhyme condition. As expected the trauma scores for Moof, used as a non-emotive control stimulus, were lower for both conditions. The fact that people who heard Pote had lower trauma scores when followed by positive suggestion goes against the predicted trend. This indicates either that priming did not occur for this group or that the suggestion impacted on people's encoding of the emotive stimulus.

3.5.2 Explicit and implicit memory.

To examine if patients demonstrated explicit memory for intra-colonoscopy events, they completed a questionnaire within 60 minutes of their procedure which was repeated at follow-up. Only people who could recall the exact words heard during sedation (the incidence of learning) were deemed to have explicit recall. Measuring SCR to primed-words, played during their colonoscopy, tested implicit memory formation. Tulving and Schacter (1990) note that "priming" refers to a process whereby prior experience facilitates effects on indirect tests of memory. SCR can be considered as an indirect test of "unintentional retrieval" in line with Jacoby (1991). Therefore the single presentation of nonsense words at baseline generates a primed rather than habitual response following the incidence of learning.

Questionnaire responses showed 15 participants (62.5%) recalled hearing a human voice, three (12.5%) recalled hearing the nonsense words presented during sedation (one "moof" and two "scrate"). Additionally, four participants (16.7%) recalled hearing nursery rhymes and eight (33.3%) recalled hearing positive suggestion (two of these remembered hearing positive suggestion only at the follow-up meeting).

Seven participants estimated the exact length of their procedure. Seven over-estimated the time taken by between five and 30 minutes, whilst 10 participants underestimated the time. Recollections of the procedure from this group varied between five and 45 minutes less than the actual procedure.

Within 60 minutes of the procedure, 100% of the participants recalled having their injection and, at follow-up, only one participant stated no longer recalling the injection. 20 participants stated remembering endoscopic insertion, six reported partial recall, but four had

no memory for this event. At follow-up more participants showed less clear recall for colonoscope insertion as seven had no recall and eight stated only partial recall.

Participants answered five questions about their surgeon. Within 60 minutes of colonoscopy, nine participants recalled all details perfectly, one answered four of the questions correctly, nine recalled three items, two recalled two, one recalled only one but no one had no recall of their surgeon. At the follow-up session the memory scores improved by an average of two items for five participants but deteriorated by one item for two others.

3.5.3 Sleep-patterns.

To examine differences between sleep patterns for those with explicit and those with implicit recall of events, participants completed a sleep questionnaire. On this measure 29.16% reported sleep-disturbance and five participants (20.83%) reported dreams but only three found them disturbing.

Participants were categorised into one of three memory groups. This was established by accurate reporting of auditory stimuli on the post-colonoscopy questionnaire either accurately reporting nonsense word, nursery rhyme titles or exact positive phrases played under sedation (explicit) and by SCR[4] tests demonstrating priming (implicit). Mean sleep disturbance scores were compared across the three memory groups. The mean sleep disturbance scores for the groups are outlined in Table 15.

[4] SCR changes overall showed no evidence for memory priming. Positive SCR changes may reflect random fluctuations or may be contaminated by implicit encoding for other words presented at baseline word presentation.

Table 15: Memory group mean sleep disturbance scores

Memory-group	N	Mean Sleep-disturbance Score	SD
Explicit Memory	*10*	*0.10*	*0.32*
Implicit Memory	*10*	*1.40*	*1.58*
No Memory	*4*	*0.00*	*0.00*

As sleep disturbance showed a positive skew in the distribution across the sample (for skewness and kurtosis values see Appendix F), it was decided to examine any significant differences in the group means using non-parametric analysis. A Kruskal-Wallis Test revealed a statistically significant difference in sleep disturbance across the three memory groups (χ^2 (2,n=24)= 8.43, p=0.02).

Participants demonstrating implicit memory for the procedure had a higher mean score than the other groups. To see if the difference between the implicit and explicit memory groups were significant, a *post hoc* comparison test was carried out. The Mann-Whitney U test conducted, showed there was a significant difference, with a large effect size, between sleep disturbance levels for those with implicit and those with explicit memory

(U=22.5, z= -2.45, p=0.01, r= 0.55).

4.0 Discussion

4.1 Summary

This study aimed to investigate if positive motivational suggestions, heard under conscious sedation during colonoscopy, would reduce the incidence of distress, mood-disturbance and intrusive memories. Furthermore, the study aimed to test implicit emotional learning by examining participants with and without impaired explicit memory for intra-procedural events on a physiological measure of SCR to auditory stimuli.

Consenting patients, undergoing colonoscopy, completed questionnaires measuring mood, personality, dissociation, sleep-patterns, post-procedure recall and impact of colonoscopy. Also participants' SCR to nonsense words, one of which they were primed with during their colonoscopy, was recorded. They also heard either positive suggestions or nursery rhyme titles. SCR to nonsense-words were recorded again at a follow-up visit, one to two days later.

The main findings of the research were that people hearing positive suggestion demonstrated reduced distress during colonoscopy and there was a significant association between distress level and suggestion group. Controlling for potential personality covariates, there was found to be no significant effect of what participants heard under sedation reducing their total mood-disturbance scores across time. Neither depression nor anxiety was affected by what participants heard during sedation, however, measures of both decreased after colonoscopy.

Both suggestion groups showed reduced levels of dissociation at follow-up but there was no significant effect of stimulus. Neither group showed any significant difference in

levels of intrusive memories of colonoscopy post-procedure. However, participants demonstrating implicit memory for events showed significantly higher sleep disturbance levels post-colonoscopy than those with explicit memory of the auditory stimuli.

As most had no explicit recall for a nonsense word being played during their sedation, if participants showed the largest SCR to that word at follow-up, this was taken as an indication of implicit memory formation. Differences between follow-up and baseline SCR to nonsense words were examined to see the physiological effects of priming with emotive words. Contrary to the hypothesis, participants who had no explicit memory for intra-procedural nonsense words showed the lowest difference in SCR to the word with which they were primed if it was an emotive nonsense word related to their colonoscopy.

4.2 Contribution to Research Area

4.2.1 Interpretation of findings.

Comparing participants' distress levels with suggestion group showed people hearing positive suggestion scored lower on intra-colonoscopy measures of trauma. This supported the hypothesis and offered credence to Brewin, Dalgleish and Joseph's (1996) Dual Representation Theory Model whereby the processing of positive suggestion and encoding information under conscious sedation is done by bypassing midazolam impaired cortical routes and processed by the situationally accessible memory system. As the stress hormone cortisol is also thought to impair the formation of verbally accessible memory, the stress of the procedure may have impacted on the participants' ability to reason and question positive suggestions using cortical systems (Elzinga & Bremner, 2002). Therefore, they may have

accepted these suggestions uncritically and literally, intimating that positive suggestion could increase patient co-operation.

As suggestions appear to be able to be taken in implicitly, either as a result of the sedation or stressfulness of the situation, it is important for clinicians to be mindful of the tone of conversations directed towards the patient who may be more susceptible to suggestion.

Positive suggestion did not appear to have a significant effect on the lowering of participants' mood disturbance scores (HADS depression, HADS anxiety and POMS-BF TMD) meaning the null hypothesis could not be rejected. Both groups showed that after their colonoscopy was completed, their anxiety, depression and TMD had decreased. This may be attributed to heightened pre-procedural tension due to concern for the colonoscopy investigation findings and, for first-time patients, what it entailed. Anecdotally, patients reported their relief that the procedure was over was the major factor in improving their mood**.**

It was noted there was a statistically significant level difference in sleep disturbance levels for participants with different memory types. People with implicit memory for events showed the highest amount of sleep disturbance. This finding suggests the implicit emotional encoding of events impacted on sleep. Patients with no memory for intra-procedural events had the least sleep disturbance. This is likely to be because midazolam sedation had not only impacted on explicit encoding of events but it was sufficient to prevent any memory formation, thus not impacting on sleep during the nights immediately post-colonoscopy.

Osterman and van der Kolk (1998) observed that inescapable stress is particularly conducive to the development of PTSD symptoms. With this in mind, it could be reasoned

that it would be the implicit encoding of the stress that may lead to disturbed sleep and other sequelae related to PTSD as defined by DSM-IV (American Psychiatric Association, 2000). This was found to be the case in this study; however, the measures were taken too soon after the procedure to get a picture of the event's true impact on sleep. Measures for intrusion and avoidance of intra-procedural memory revealed no difference between groups. This reasoning may also account for why the two suggestion groups showed no significant differences in levels of post-colonoscopy dissociation. However, this conjecture may not be founded because the null hypothesis for intrusion of memories may still hold true and cannot be rejected.

Testing the SCR difference to nonsense words heard during colonoscopy revealed a contradictory result to that which was hypothesised. The un-primed emotive words produced the largest SCR difference in participants with no explicit memory. Additionally, participants primed with the neutral word demonstrated the largest SCR to Scrate. Although the null hypothesis cannot be rejected, this phenomenon could perhaps be explained by habituation and this corroborates Woodruff and Wang's (2004) finding that SCR for primed-words did not conform to predicted trends. They speculated this was either due to negative priming or reduced SCR to a word with which participants had become more familiar (i.e. habituated).

Except for the few participants who specifically mentioned the nonsense words, the majority had no recollection of hearing them and were surprised during debrief to discover they had. Moreover, many said they had "no blanks" but evidently did. This should probably have been recorded more formally but was only discovered during an informal chat, which could qualitatively indicate potential implicit memory effects.

When comparing intra-colonoscopy audio stimuli in relation to trauma it was discovered that people hearing the nursery rhyme control had higher levels of trauma across

each of the word-priming groups. The positive suggestion group showed negative trauma scores in two of the word groups but those hearing Scrate had a low, yet, positive trauma score. Woodruff and Wang (2004) found that Scrate influenced all word groups which potentially strengthened the association for all words with the colonoscopy. This larger priming effect of Scrate may offer a reason for negating the positive suggestion's effectiveness in reducing intra-colonoscopy distress, due to an interaction between emotional priming and implicit acceptance of suggestions.

4.2.2 Comparability with other studies.

This study was designed to address methodological shortcomings of the elements of the previous studies it sought to replicate. For instance, Woodruff (2003) noted a difficulty in measuring SCR to primed words within 60 minutes of the procedure. The half-life of the sedatives and analgesics used, meant that the drugs were still in participants' bloodstreams and appeared to have a limiting effect on the ability to accurately measure implicit memory. Therefore, to eliminate sedative effects on SCR, it was not measured so soon after colonoscopy.

Not only was the current study's aim to build on the evidence-base for implicit memory formation under sedation but also to explore the psychological impact of what is said to a person under the influence of midazolam. Other studies have investigated memory under different dosages of midazolam, like Huron, Giersch and Danion (2002) who concluded "the impairment of episodic memory by benzodiazepines is dose dependent". However, this study controlled for midazolam dosage, employing a range of only 2-3 mg, in accordance with patients' physiological requirements.

Tian *et al*. (2010) demonstrated that "midazolam sedation did not abolish implicit memory". They proposed: "deeper levels [of sedation] should be maintained to eliminate adverse memories". On this assertion, the current study aimed to improve the pleasantness of the implicit memories formed at lower levels of sedation, by introducing the use of positive suggestion. This study clearly demonstrated further support for Tian's findings, however, as Veselis *et al*. (2009) concluded, midazolam dosage requirements for memory impairment in any individual is not predictable: individual differences will exist in level of memory impairment. This notion was supported by the current study as it hypothesised, and found that some of the sample had impaired explicit recall for events whilst others did not.

Woodruff and Wang's (2004) research into implicit emotional learning during sedation suggested only a small group would be affected, possibly those already displaying clinical depression or anxiety. Furthermore, they questioned if neurotic/introverts would show greater evidence for implicit emotional memory. This study was able to go some way to assessing this by using the EPI and found no correlation with SCR scores; but neuroticism was a significant covariate impacting on peoples' mood level.

4.3 Theoretical and Practical Value of Research

4.3.1 Strengths of the study.

The current study has a robust methodology as the design means that, in principal, it is very structured, allowing for easy replication or revision. Although building on previous studies, it is still innovative, exploring additional, previously unstudied, factors. Ultimately, despite a smaller than desired sample, it has provided a good pilot study framework to enable this research to develop into a future, larger scale, project.

The new element, positive suggestion, allowed for more hypotheses to be tested, which therefore meant more measures were taken. This in turn led to a greater amount of data being gathered per participant. For example, the volume of self-reported data given at each stage allowed multiple mood facets to be compared and changes from baseline levels of SCR to be established.

4.3.2 Theoretical limitations.

The impact of positive suggestion may have been less marked in the sample examined, due to a floor effect in which initial anxiety levels for the majority of participants (91.6%) were within the normal-mild range, suggesting the most anxious patients may have opted out. Also, people with a history of mental health difficulties were excluded from the study, meaning the full spectrum of anxiety levels were not examined: implicit suggestion may have had a more significant impact on those with more clinically significant levels of anxiety.

This study assumed that an endoscopic examination under conscious sedation would be distressing. However, colonoscopy may not be as anxiety-provoking as general surgery or even other procedures carried out under conscious sedation. For some people, distress may only be evident during subsequent colonoscopies as psychological disturbance may not manifest quickly. It is this unpredictability that makes it advisable for all patients to be considered at risk of psychological sequelae and err on the side of caution when using conscious sedation.

In contrast, as colonoscopy can be a repeat procedure for many patients, due to it being employed as a monitoring strategy, there could be a habituation effect. This would

probably reduce the evidence for patients displaying anxiety however, this study did not discriminate between first colonoscopies and patients for whom it was routine.

As patients do not expect to have intra-operative experiences, they may infer that they have no memory for the procedure because they were "asleep". They may therefore, reject having memory for events as their explicit encoding was impaired. These people may have implicit recall that was not measured beyond an SCR to a word that may not have been successfully primed; other implicit stimuli from the procedure may have been encoded but not explored.

It could be conjectured that the use of nonsense words might not be the best strategy, since patients may categorise them as nonsense and ignore them. Anecdotally, some participants stated the focus of their attention was on the perceived "threatening" stimuli of the colonoscope and did not consciously attend to words played.

4.3.3 Methodological limitations.

The nature of recruitment, by requesting potential participants to opt-in by letter, was a limiting factor in accessing colonoscopy patients. Furthermore, the fact that people who opted in and stated their interest to partake had to attend the clinic 30minutes early for the procedure, often entailing a lot of waiting. Also the follow-up requirement led to participant attrition, affirming an initial reluctance to participate in the study.

The large quantity of data gathered across the study, with three of the four data collection stages requiring significant input and concentration from participants, could have led to them becoming fatigued or losing the motivation to respond in a considered manner.

The smaller than desired sample meant that statistics employed were underpowered, so the fact that some of the findings were significant, indicates that a larger sample would hopefully amplify these trends revealing discoveries to be highly significant. On the other hand, as fewer participants were analysed, some hypotheses could not be supported even though effects and differences may have been approaching the desired alpha level.

4.3.4 Confounding variables.

A major confounding variable presented in the study was the possible impact of emotive nonsense-words on positive suggestion and vice versa. As a potential interaction between words and suggestion-group may exist it is important for future studies to run emotional learning experiments separately from suggestion investigations.

Patients were approaching colonoscopies with differing anxiety levels, and experiences of colonoscopy. The varied reasons for people undergoing the procedure, e.g. bowel cancer screening or routine polyp removal, could account for inconsistent post-procedural mood scores, potential traumatic associations and fear of diagnosis.

Although the rigorous design of the study's methodology should have resulted in all participants being treated identically, practicalities for the follow-up study meant that 11 participants were tested in their homes, to prevent an even higher attrition rate. The ideal scenario for follow-up measures to be made at the hospital was too great a commitment for some people, particularly some of the more elderly participants or those needing to make long journeys. Naturally, this gave rise to the home tests being conducted in more relaxed conditions than the hospital ones and, in nearly 50% of cases, a very different environment from where baseline measures were recorded.

Despite being aware of the experiment, it was noted that the colonoscopy staff automatically gave patients tactile reassurance at times when they were displaying distress. However, this would be common to both groups and the researcher felt it was preferable to ignoring patient needs.

4.3.5 Future research.

Future research into positive suggestion during conscious sedation could be carried out on different age groups, comparing effects between children, adults and older adults. It would also be interesting to discover if positive suggestion would improve the experience of patients who have unpleasant memories of previous experiences involving noxious procedures. Theoretically it would be interesting to further explore the age effects. Children may show larger implicit memory effects due to weaker explicit memory as a consequence of the time course of neurological development in brain structures related to encoding of explicit memory (Richmond & Nelson 2007). Also pre-verbal children may not form Verbally Accessible Memory in line with Brewin, Dalgleish and Joseph's (1996) model and may be more prone to the effects of Situationally Accessible Memory. Furthermore due to cognitive decline associated with ageing, older adults may also demonstrate a similar response related to cortical impairments and therefore possible poorer explicit memory.

A methodological improvement on any replication of the present study would be to use a split-half sample whereby half the participants would hear suggestion/nursery rhyme title prior to the nonsense priming word and vice versa for the other half.

It would also be pertinent to investigate other procedures such as gastroscopy, dental surgery or any potentially distressing invasive examination. Whereas general anaesthesia has been considered in past studies, such as Stapleton and Andrade (2000), it is now thought that the anaesthetic agents preclude memory formation; however, memories may be retained but

not necessarily retrieved. Howard (1987) discussed intra-operative awareness without recall and suggested that it only takes a single presentation to induce implicit emotional learning. With modern anaesthetic regimes it may be more prudent to examine underlying cognitive mechanisms related to conditioning, regarding fear and trauma, in more surgically noxious procedures that employ sedation.

4.4 Clinical Implications

Evidence of implicit emotional memory under conscious sedation and the longer-term impact of memory formation for potential negative experiences warrant further exploration due to potential for psychological distress. Although this study indicated no significant impact on markers for PTSD following colonoscopy, it is worth noting that people with memory for the procedure showed more sleep disturbance than those with no memory and those with implicit memory reported the most sleep disturbance. It may be important for clinicians to note that invasive exploratory procedures may impact on the patient's sleep and information around sleep hygiene should be made available to patients, as well as information on longer-term psychological follow-ups or referrals, in relation to any intra-operative sequelae.

Consideration needs to be given to the psychological profile of patients undergoing noxious procedures, regarding their greater vulnerability to psychological distress in a sedated state, and using positive, affirming statements to engender a contained environment in which to experience invasive medical examination. People undergoing colonoscopy for the first time may have higher anxiety levels, and therefore the implementation of implicit positive statements may be beneficial and this area of study may need further work.

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6.0 Appendices

Appendix A: Ethics letters

Appendix B: Opt-in Slip

Appendix C: Participant Information Sheet

&

GP Letter

Appendix D: Informed Consent Sheet

Appendix E: Questionnaires & Measures

Appendix F: Correlations Skewness And Kurtosis Data

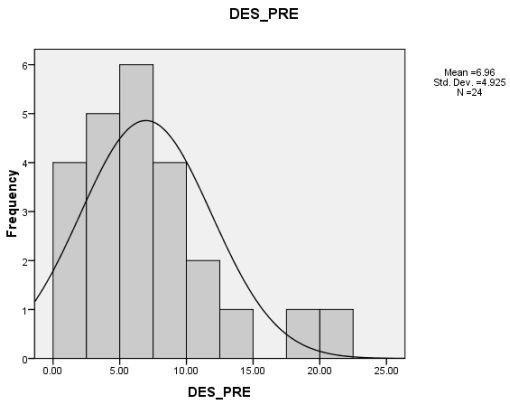
(including Histograms)

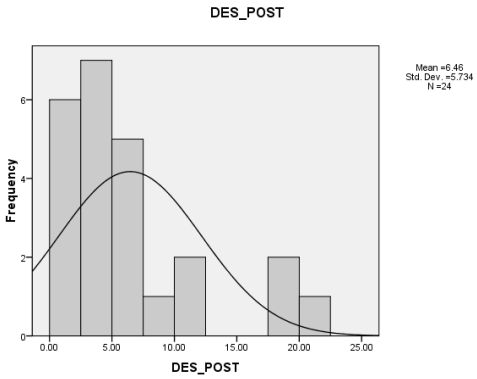
Correlations

		Age	EPI_N	EPI_E	EPI_L	DES_PRE	DES_POST	POMS_Base	POMS_1	POMS_2	IESR_TOT	HADS_D_T1	HADS_D_T2	HADS_D_T3	HADS_A_T1	HADS_A_T2	HADS_A_T3	ZMean BDS/min + ZHRR
Age	Pearson Correlation	1.000	-.472*	.130	.311	-.196	-.294	-.344	-.335	-.039	-.305	-.073	-.154	-.078	-.354	-.224	-.342	.004
	Sig. (2-tailed)		.023	.555	.149	.358	.163	.100	.109	.858	.147	.733	.471	.718	.089	.293	.102	.986
	N	24	23	23	23	24	24	24	24	24	24	24	24	24	24	24	24	24
EPI_N	Pearson Correlation	-.472*	1.000	-.130	.097	.199	.398	.724**	.712**	.487*	.567**	.456*	.594**	.521*	.809**	.812**	.673**	-.240
	Sig. (2-tailed)	.023		.553	.661	.363	.060	.000	.000	.018	.005	.029	.003	.011	.000	.000	.000	.270
	N	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
EPI_E	Pearson Correlation	.130	-.130	1.000	.108	.066	-.102	-.061	-.314	-.212	-.182	.130	-.033	-.023	-.070	-.156	-.152	-.335
	Sig. (2-tailed)	.555	.553		.625	.765	.643	.782	.145	.332	.407	.554	.883	.917	.751	.479	.490	.119
	N	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
EPI_L	Pearson Correlation	.311	.097	.108	1.000	-.099	-.250	-.072	-.086	-.121	-.130	-.080	.037	-.015	-.095	.003	-.034	-.338
	Sig. (2-tailed)	.149	.661	.625		.654	.250	.746	.696	.581	.553	.717	.868	.945	.666	.990	.876	.114
	N	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
DES_PRE	Pearson Correlation	-.196	.199	.066	-.099	1.000	.745**	-.072	.049	.083	-.041	.055	.031	.132	.180	.154	.095	.025
	Sig. (2-tailed)	.358	.363	.765	.654		.000	.736	.821	.698	.850	.798	.884	.537	.401	.473	.658	.909
	N	24	23	23	23	24	24	24	24	24	24	24	24	24	24	24	24	24
DES_POST	Pearson Correlation	-.294	.398	-.102	-.250	.745**	1.000	.176	.384	.458*	.435*	.281	.315	.378	.412*	.452*	.526**	-.018
	Sig. (2-tailed)	.163	.060	.643	.250	.000		.411	.064	.024	.034	.183	.133	.068	.045	.027	.008	.934
	N	24	23	23	23	24	24	24	24	24	24	24	24	24	24	24	24	24
POMS_Base	Pearson Correlation	-.344	.724**	-.061	-.072	-.072	.176	1.000	.767**	.599**	.469*	.544**	.492*	.483*	.747**	.724**	.632**	-.136
	Sig. (2-tailed)	.100	.000	.782	.746	.736	.411		.000	.002	.021	.006	.015	.017	.000	.000	.001	.525
	N	24	23	23	23	24	24	24	24	24	24	24	24	24	24	24	24	24
POMS_1	Pearson Correlation	-.335	.712**	-.314	-.086	.049	.384	.767**	1.000	.648**	.586**	.555**	.666**	.594**	.729**	.721**	.777**	-.117
	Sig. (2-tailed)	.109	.000	.145	.696	.821	.064	.000		.001	.003	.005	.000	.002	.000	.000	.000	.586
	N	24	23	23	23	24	24	24	24	24	24	24	24	24	24	24	24	24
POMS_2	Pearson Correlation	-.039	.487*	-.212	-.121	.083	.458*	.599**	.648**	1.000	.651**	.500*	.528**	.671**	.629**	.705**	.714**	-.029
	Sig. (2-tailed)	.858	.018	.332	.581	.698	.024	.002	.001		.001	.013	.008	.000	.001	.000	.000	.893
	N	24	23	23	23	24	24	24	24	24	24	24	24	24	24	24	24	24
IESR_TOT	Pearson Correlation	-.305	.567**	-.182	-.130	-.041	.435*	.469*	.586**	.651**	1.000	.494*	.601**	.524**	.474*	.679**	.637**	-.293
	Sig. (2-tailed)	.147	.005	.407	.553	.850	.034	.021	.003	.001		.014	.002	.008	.019	.000	.001	.164
	N	24	23	23	23	24	24	24	24	24	24	24	24	24	24	24	24	24
HADS_D_T1	Pearson Correlation	-.073	.456*	.130	-.080	.055	.281	.544**	.555**	.500*	.494*	1.000	.930**	.865**	.504*	.575**	.508*	-.263
	Sig. (2-tailed)	.733	.029	.554	.717	.798	.183	.006	.005	.013	.014		.000	.000	.012	.003	.011	.214
	N	24	23	23	23	24	24	24	24	24	24	24	24	24	24	24	24	24
HADS_D_T2	Pearson Correlation	-.154	.594**	-.033	.037	.031	.315	.492*	.666**	.528**	.601**	.930**	1.000	.881**	.535**	.637**	.612**	-.283
	Sig. (2-tailed)	.471	.003	.883	.868	.884	.133	.015	.000	.008	.002	.000		.000	.007	.001	.001	.180
	N	24	23	23	23	24	24	24	24	24	24	24	24	24	24	24	24	24
HADS_D_T3	Pearson Correlation	-.078	.521*	-.023	-.015	.132	.378	.483*	.594**	.671**	.524**	.865**	.881**	1.000	.498*	.573**	.563**	-.260
	Sig. (2-tailed)	.718	.011	.917	.945	.537	.068	.017	.002	.000	.009	.000	.000		.013	.003	.004	.220
	N	24	23	23	23	24	24	24	24	24	24	24	24	24	24	24	24	24
HADS_A_T1	Pearson Correlation	-.354	.809**	-.070	-.095	.180	.412*	.747**	.729**	.629**	.474*	.504*	.535**	.498*	1.000	.864**	.812**	.034
	Sig. (2-tailed)	.089	.000	.751	.666	.401	.045	.000	.000	.001	.019	.012	.007	.013		.000	.000	.874
	N	24	23	23	23	24	24	24	24	24	24	24	24	24	24	24	24	24
HADS_A_T2	Pearson Correlation	-.224	.812**	-.156	.003	.154	.452*	.724**	.721**	.705**	.679**	.575**	.637**	.573**	.864**	1.000	.799**	-.136
	Sig. (2-tailed)	.293	.000	.479	.990	.473	.027	.000	.000	.000	.000	.003	.001	.003	.000		.000	.527
	N	24	23	23	23	24	24	24	24	24	24	24	24	24	24	24	24	24
HADS_A_T3	Pearson Correlation	-.342	.673**	-.152	-.034	.095	.526**	.632**	.777**	.714**	.637**	.508*	.612**	.563**	.812**	.799**	1.000	-.044
	Sig. (2-tailed)	.102	.000	.490	.876	.658	.008	.001	.000	.000	.001	.011	.001	.004	.000	.000		.838
	N	24	23	23	23	24	24	24	24	24	24	24	24	24	24	24	24	24
ZMean BDS/min + ZHRR	Pearson Correlation	.004	-.240	-.335	-.338	.025	-.018	-.136	-.117	-.029	-.293	-.263	-.283	-.260	.034	-.136	-.044	1.000
	Sig. (2-tailed)	.986	.270	.119	.114	.909	.934	.525	.586	.893	.164	.214	.180	.220	.874	.527	.838	
	N	24	23	23	23	24	24	24	24	24	24	24	24	24	24	24	24	24

Statistics

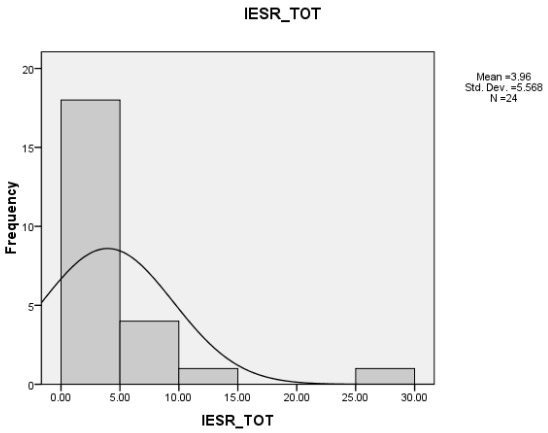
		DES_PRE	DES_POST
N	Valid	24	24
	Missing	48	48
	Mean	6.9607	6.4584
	Std. Deviation	4.92526	5.73448
	Skewness	1.213	1.457
	Std. Error of Skewness	.472	.472
	Kurtosis	1.347	1.179
	Std. Error of Kurtosis	.918	.918

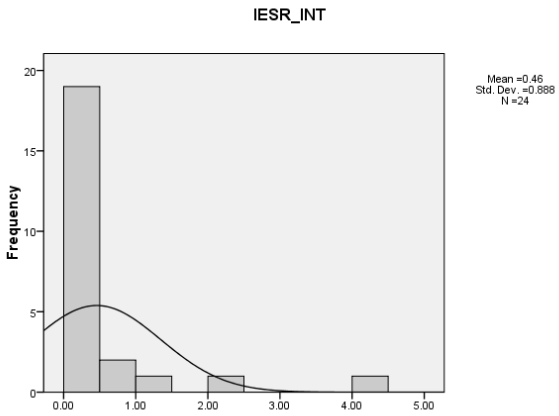


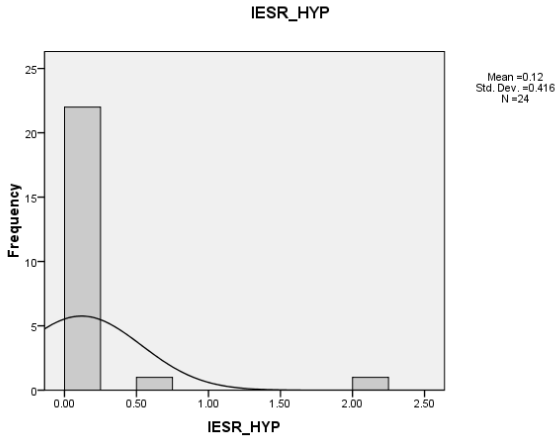


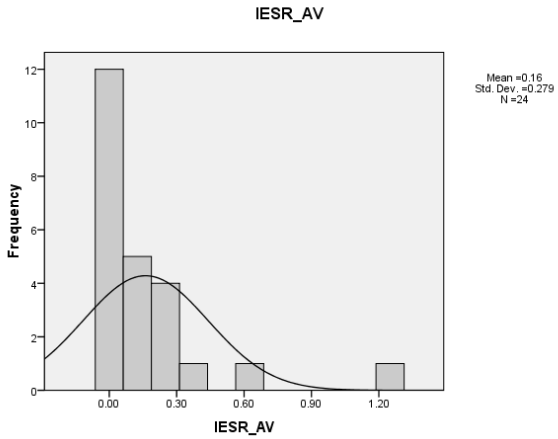
Statistics

		IESR_TOT	IESR_INT	IESR_HYP	IESR_AV
N	Valid	24	24	24	24
	Missing	48	48	48	48
	Mean	3.9583	.4583	.1181	.1615
	Std. Deviation	5.56760	.88823	.41552	.27946
	Skewness	2.979	3.210	4.422	2.937
	Std. Error of Skewness	.472	.472	.472	.472
	Kurtosis	10.711	11.413	20.371	10.088
	Std. Error of Kurtosis	.918	.918	.918	.918







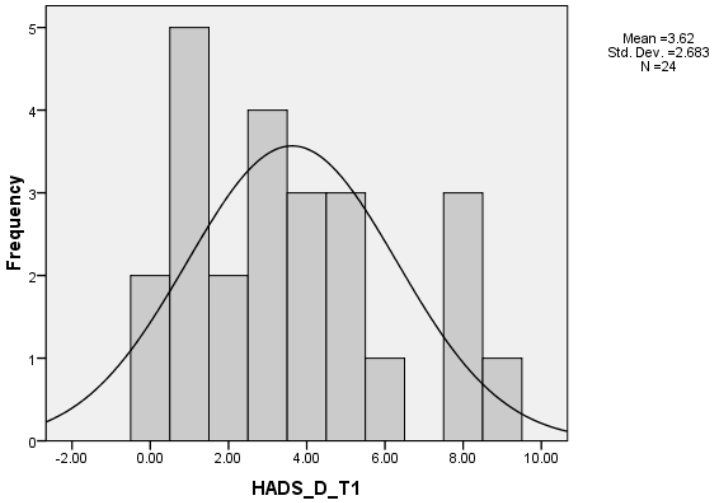


		HADS_D1	HADS_D2	HADS_D3
N	Valid	24	24	24
	Missing	0	0	0
	Mean	3.6250	3.2500	2.1667
	Std. Deviation	2.6835	2.9672	2.7452
	Skewness	0.571	1.096	1.530
	Std. Error of Skewness	0.472	0.472	0.472
	Kurtosis	-0.633	0.510	1.528
	Std. Error of Kurtosis	0.918	0.918	0.918

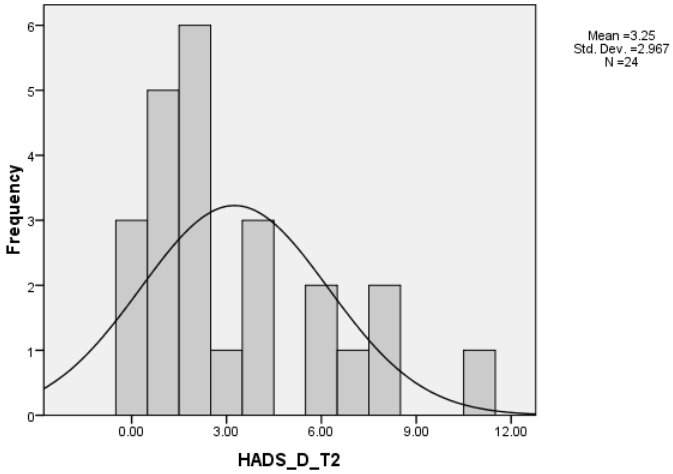
Statistics

		HADS_A1	HADS_A2	HADS_A3
N	Valid	24	24	24
	Missing	0	0	0
	Mean	5.9167	4.5417	3.5417
	Std. Deviation	3.5743	3.9998	3.8219
	Skewness	1.258	1.280	1.145
	Std. Error of Skewness	0.472	0.472	0.472
	Kurtosis	1.618	1.539	0.788
	Std. Error of Kurtosis	0.918	0.918	0.918

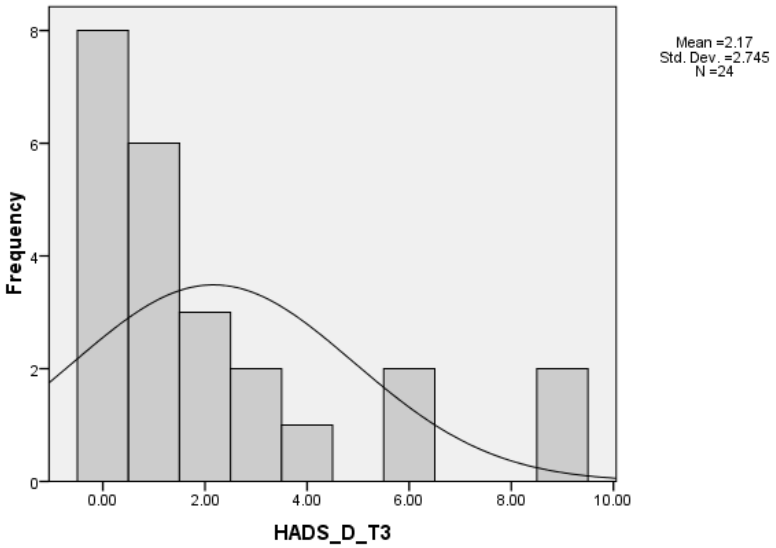
HADS_D_T1

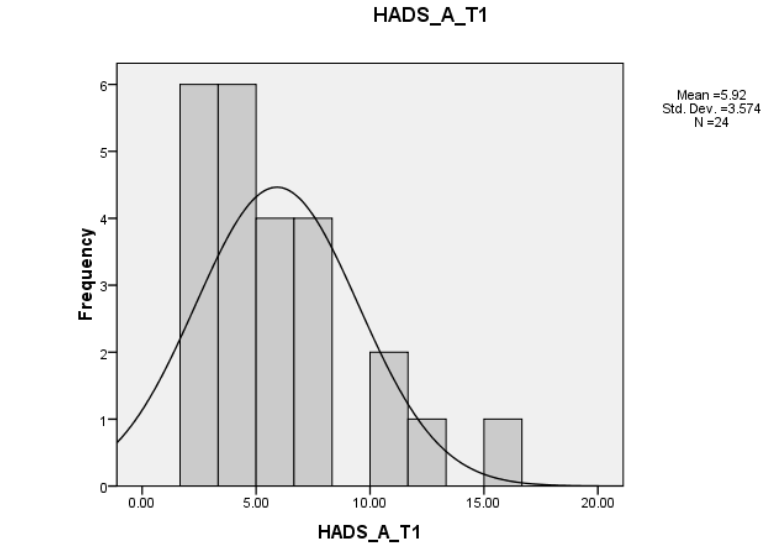


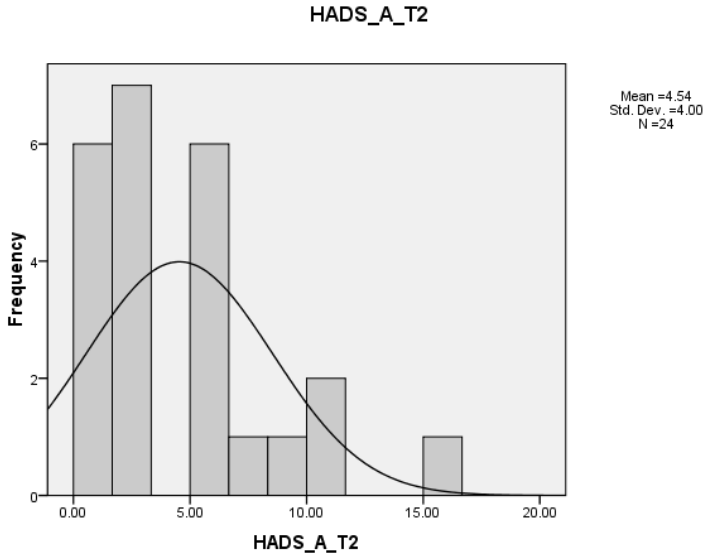
HADS_D_T2

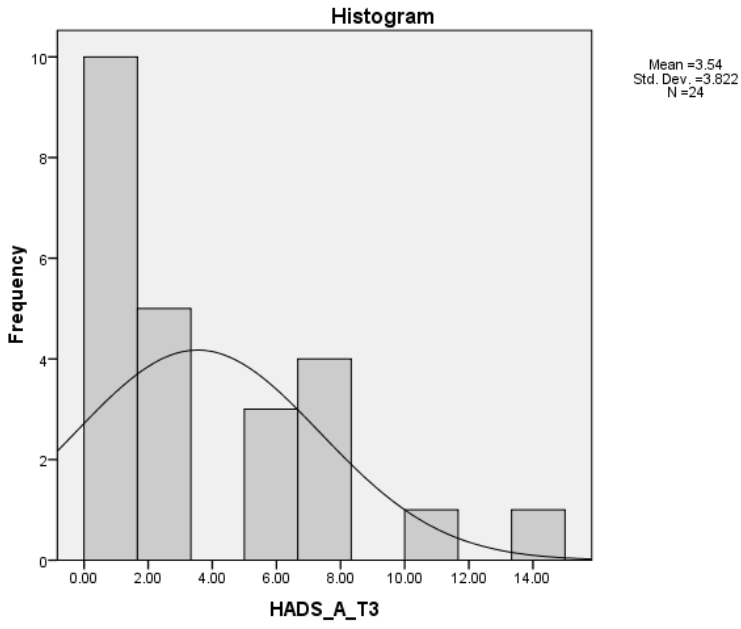


Histogram




HADS_A_T1
Mean =5.92
Std. Dev. =3.574
N =24
Frequency
HADS_A_T1

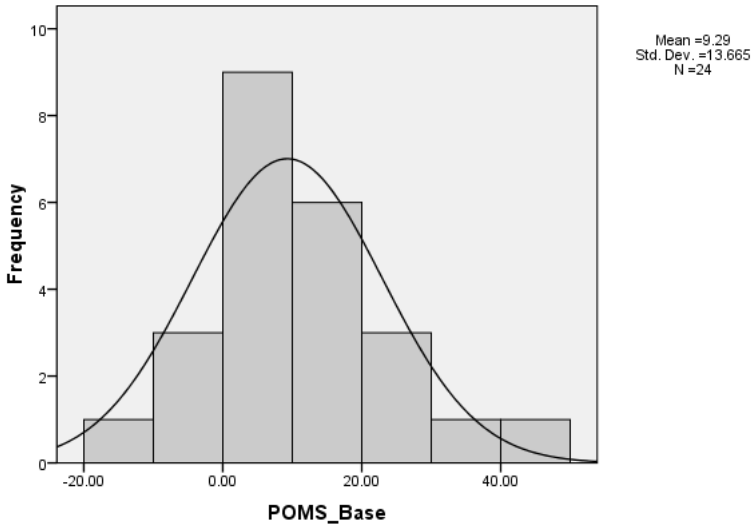

HADS_A_T2
Mean =4.54
Std. Dev. =4.00
N =24
Frequency
HADS_A_T2


Histogram
Mean =3.54
Std. Dev. =3.822
N =24
Frequency
HADS_A_T3

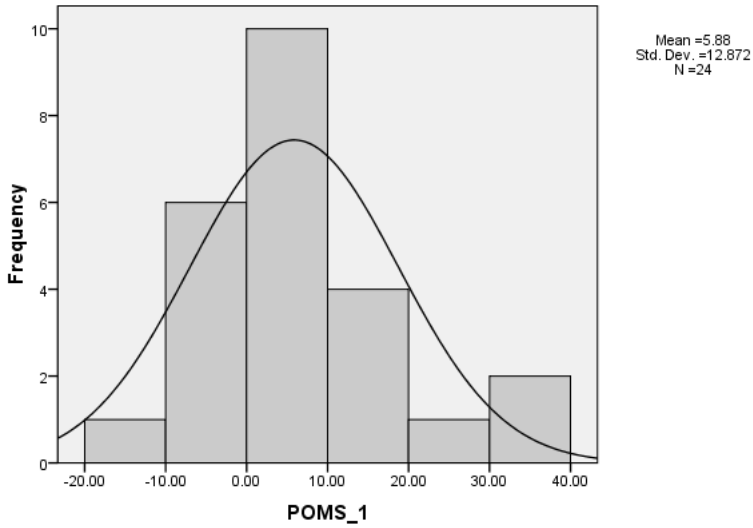
Statistics

		POMS_Base	POMS_T1	POMS_T2
N	Valid	24	24	24
	Missing	0	0	0
	Mean	9.2917	5.8750	1.0000
	Std. Deviation	13.6652	12.8716	16.0244
	Skewness	0.856	0.821	1.998
	Std. Error of Skewness	0.472	0.472	0.472
	Kurtosis	0.220	0.249	4.221
	Std. Error of Kurtosis	0.918	0.918	0.918

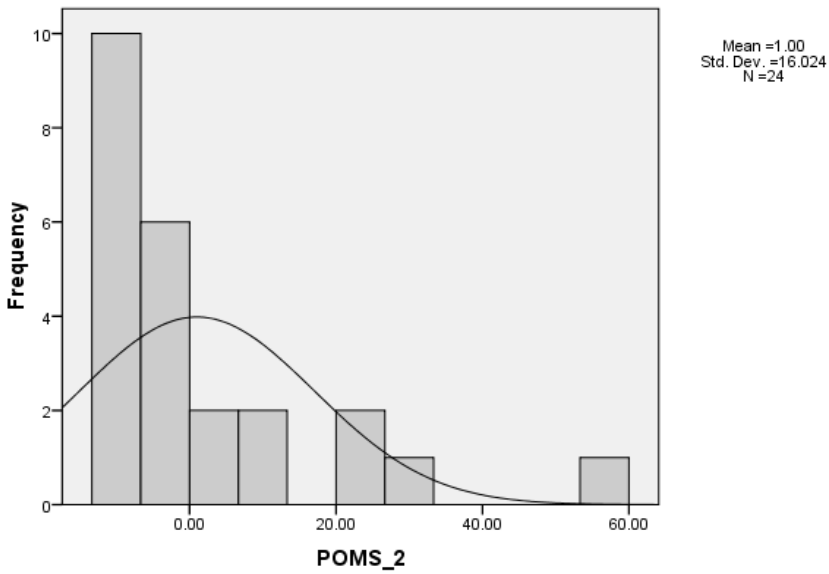
POMS_Base



POMS_1



Histogram



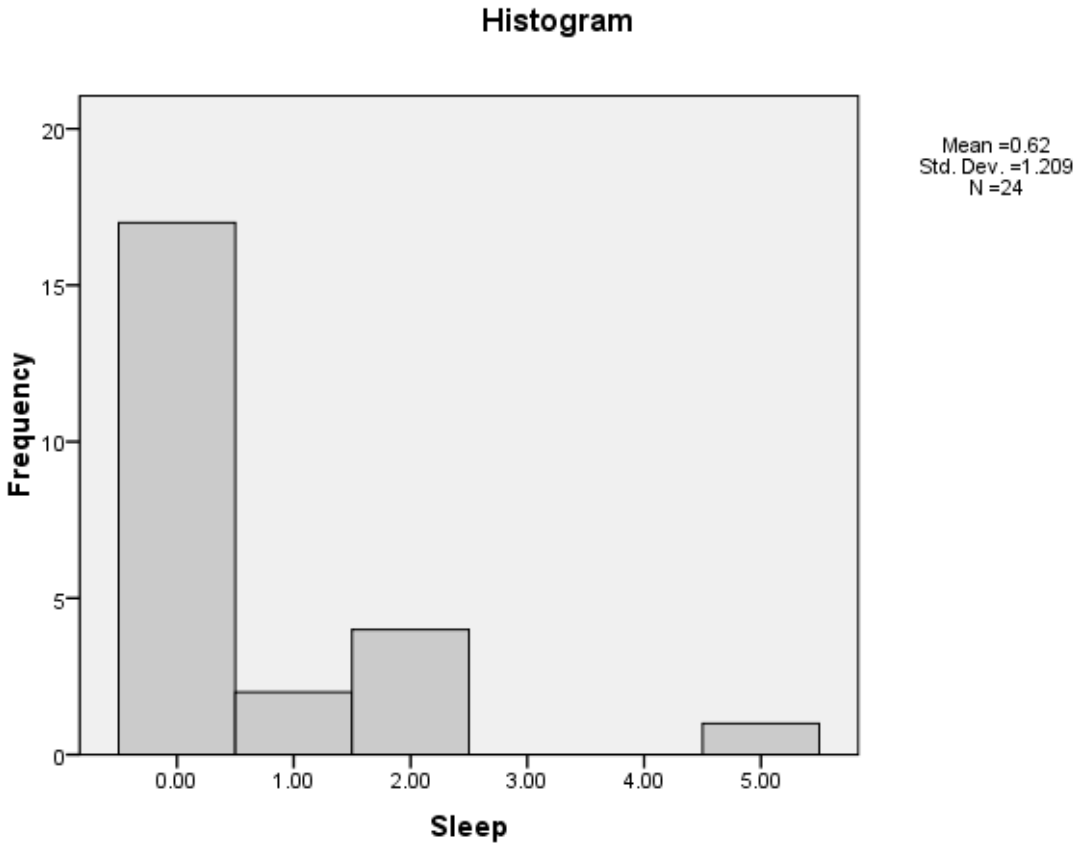
Descriptives

			Statistic	Std. Error
Sleep	Mean		.6250	.24681
	95% Confidence Interval for Mean	Lower Bound	.1144	
		Upper Bound	1.1356	
	5% Trimmed Mean		.4444	
	Median		.0000	
	Variance		1.462	
	Std. Deviation		1.20911	
	Minimum		.00	
	Maximum		5.00	
	Range		5.00	
	Interquartile Range		1.00	
	Skewness		2.417	.472
	Kurtosis		6.691	.918

Tests of Normality

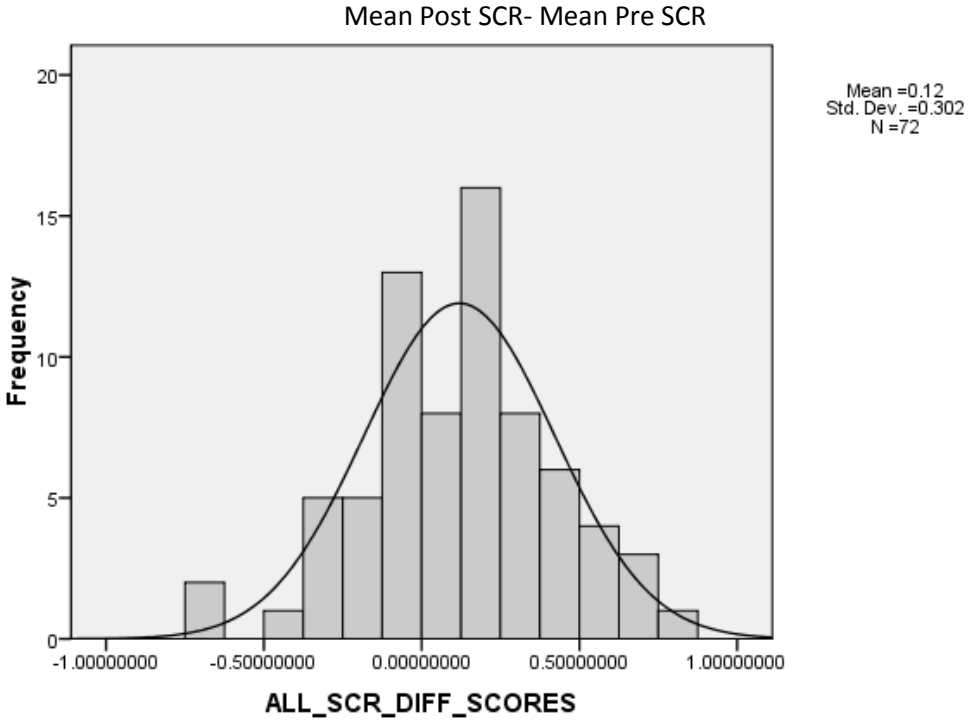
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Sleep	.406	24	.000	.586	24	.000

a. Lilliefors Significance Correction



Appendix G: Additional SPSS Output Data

Histogram: distribution of the difference between the mean SCRs for all words (Rose Correction applied)



Statistics

ALL_SCR_DIFF_SCORES

N	Valid	72
	Missing	0
	Mean	.1194348133
	Std. Deviation	.30164069012
	Skewness	-.171
	Std. Error of Skewness	.283
	Kurtosis	.195
	Std. Error of Kurtosis	.559

Paired t-test DESII pre and post scores

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	DES_PRE_SQRT - DES_POST_SQRT	.15121	.70034	.14296	-.14452	.44693	1.058	23	.301

Mann Whitney U Test for differences in IES-R scores between suggestion groups. Re-run of initial test with outliers removed

Mann-Whitney Test

Ranks

	Suggestion_grp	N	Mean Rank	Sum of Ranks
IESR_R_Tot_No_OUT	Nursery Rhymes	9	7.06	63.50
	Positive Suggestion	8	11.19	89.50
	Total	17		
IESR_INT_No_OUT	Nursery Rhymes	9	7.28	65.50
	Positive Suggestion	8	10.94	87.50
	Total	17		
IESR_R_HYP_No_OUT	Nursery Rhymes	9	9.00	81.00
	Positive Suggestion	8	9.00	72.00
	Total	17		
IESR_AV_No_OUT	Nursery Rhymes	9	7.33	66.00
	Positive Suggestion	8	10.88	87.00
	Total	17		

Test Statistics[b]

	IESR_R_Tot_No_OUT	IESR_INT_No_OUT	IESR_R_HYP_No_OUT	IESR_AV_No_OUT
Mann-Whitney U	18.500	20.500	36.000	21.000
Wilcoxon W	63.500	65.500	72.000	66.000
Z	-1.721	-1.560	.000	-1.587
Asymp. Sig. (2-tailed)	.085	.119	1.000	.113
Exact Sig. [2*(1-tailed Sig.)]	.093[a]	.139[a]	1.000[a]	.167[a]

a. Not corrected for ties.

b. Grouping Variable: Suggestion_grp

Kruskal-Wallis Test Memory Group and Sleep Disturbance

Kruskal-Wallis Test

Ranks

	Memory Type	N	Mean Rank
Sleep	EXPLICIT	10	9.95
	IMPLICIT	10	16.45
	NO MEMORY	4	9.00
	Total	24	

Test Statistics[a,b]

	Sleep
Chi-Square	8.433
df	2
Asymp. Sig.	.015

a. Kruskal Wallis Test

b. Grouping Variable: Memory Type

Median Test

Frequencies

		Memory Type		
		EXPLICIT	IMPLICIT	NO MEMORY
Sleep	> Median	1	6	0
	<= Median	9	4	4

Test Statistics[b]

	Sleep
N	24
Median	.0000
Chi-Square	8.027[a]
df	2
Asymp. Sig.	.018

a. 4 cells (66.7%) have expected frequencies less than 5. The minimum expected cell frequency is 1.2.

b. Grouping Variable: Memory Type

ANOVA: SCR Differences and Priming-Word

Tests of Between-Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1.027	1	1.027	5.599	.028
Word_Prime	.293	2	.146	.798	.463
Error	3.852	21	.183		

Multivariate Tests[c]

Effect		Value	F	Hypothesis df	Error df	Sig.
SCR	Pillai's Trace	.022	.222[a]	2.000	20.000	.802
	Wilks' Lambda	.978	.222[a]	2.000	20.000	.802
	Hotelling's Trace	.022	.222[a]	2.000	20.000	.802
	Roy's Largest Root	.022	.222[a]	2.000	20.000	.802
SCR * Word_Prime	Pillai's Trace	.288	1.767	4.000	42.000	.154
	Wilks' Lambda	.712	1.849[a]	4.000	40.000	.138
	Hotelling's Trace	.404	1.917	4.000	38.000	.128
	Roy's Largest Root	.403	4.227[b]	2.000	21.000	.029

CHI-Square Nonsense Word and Trauma Level

Nonsense Word Heard During Procedure * Trauma_level Crosstabulation

Count				
		Trauma_level		
		High Trauma	Low Trauma	Total
Nonsense Word Heard During Procedure	Moof	2	6	8
	Pote	4	4	8
	Scrate	6	2	8
	Total	12	12	24

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.000[a]	2	.135
Likelihood Ratio	4.186	2	.123
Linear-by-Linear Association	3.833	1	.050
N of Valid Cases	24		

a. 6 cells (100.0%) have expected count less than 5. The minimum expected count is 4.00.

One Way ANOVAS Words & Trauma Measures

ANOVA

Heart_Rt_Change

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	150.750	2	75.375	1.740	.200
Within Groups	909.750	21	43.321		
Total	1060.500	23			

Post Hoc Tests

Multiple Comparisons

Dependent Variable:Heart_Rt_Change

	(I) Nonsense Word Hea...	(J) Nonsense Word Hea...	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	Moof	Pote	-1.87500	3.29095	.838	-10.1701	6.4201
		Scrate	-6.00000	3.29095	.186	-14.2951	2.2951
	Pote	Moof	1.87500	3.29095	.838	-6.4201	10.1701
		Scrate	-4.12500	3.29095	.436	-12.4201	4.1701
	Scrate	Moof	6.00000	3.29095	.186	-2.2951	14.2951
		Pote	4.12500	3.29095	.436	-4.1701	12.4201
Bonferroni	Moof	Pote	-1.87500	3.29095	1.000	-10.4359	6.6859
		Scrate	-6.00000	3.29095	.248	-14.5609	2.5609
	Pote	Moof	1.87500	3.29095	1.000	-6.6859	10.4359
		Scrate	-4.12500	3.29095	.671	-12.6859	4.4359
	Scrate	Moof	6.00000	3.29095	.248	-2.5609	14.5609
		Pote	4.12500	3.29095	.671	-4.4359	12.6859

ANOVA

Mean_BDS_per_Min

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.356	2	.178	.427	.658
Within Groups	8.746	21	.416		
Total	9.102	23			

Post Hoc Tests

Multiple Comparisons

Dependent Variable:Mean_BDS_per_Min

	(I) Nonsense Word Hea...	(J) Nonsense Word Hea...	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	Moof	Pote	...	...	.999	-.8035779620	.8230597885
		Scrate	-2.5335317E-1	...	.716	-1.0666720E0	.5599657003
	Pote	Moof	-9.7409132E-3	...	.999	-.8230597885	.8035779620
		Scrate	-2.6309408E-1	...	.698	-1.0764129E0	.5502247871
	Scrate	Moof	...	...	.716	-.5599657003	1.06667205E0
		Pote	...	...	.698	-.5502247871	1.07641296E0
Bonferroni	Moof	Pote	...	...	1.000	-.8296433167	.8491251432
		Scrate	-2.5335317E-1	...	1.000	-1.0927374E0	.5860310551
	Pote	Moof	-9.7409132E-3	...	1.000	-.8491251432	.8296433167
		Scrate	-2.6309408E-1	...	1.000	-1.1024783E0	.5762901419
	Scrate	Moof	...	...	1.000	-.5860310551	1.09273740E0
		Pote	...	...	1.000	-.5762901419	1.10247831E0

ANOVA

ZMean BDS/min + ZHRR

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.399	2	3.700	2.485	.107
Within Groups	31.259	21	1.489		
Total	38.658	23			

Post Hoc Tests

Multiple Comparisons

Dependent Variable:ZMean BDS/min + ZHRR

	(I) Nonsense Word Hea...	(J) Nonsense Word Hea...	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	Moof	Pote	-.26064	.61002	.905	-1.7982	1.2770
		Scrate	-1.28635	.61002	.112	-2.8240	.2513
	Pote	Moof	.26064	.61002	.905	-1.2770	1.7982
		Scrate	-1.02571	.61002	.236	-2.5633	.5119
	Scrate	Moof	1.28635	.61002	.112	-.2513	2.8240
		Pote	1.02571	.61002	.236	-.5119	2.5633
Bonferroni	Moof	Pote	-.26064	.61002	1.000	-1.8475	1.3262
		Scrate	-1.28635	.61002	.141	-2.8732	.3005
	Pote	Moof	.26064	.61002	1.000	-1.3262	1.8475
		Scrate	-1.02571	.61002	.322	-2.6126	.5612
	Scrate	Moof	1.28635	.61002	.141	-.3005	2.8732
		Pote	1.02571	.61002	.322	-.5612	2.6126

ANOVA

Mean_Heart_R

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	160.462	2	80.231	.519	.603
Within Groups	3246.796	21	154.609		
Total	3407.259	23			

Post Hoc Tests

Multiple Comparisons

Dependent Variable:Mean_Heart_R

	(I) Nonsense Word Hea...	(J) Nonsense Word Hea...	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	Moof	Pote	6.33250	6.21710	.574	-9.3381	22.0031
		Scrate	3.27250	6.21710	.859	-12.3981	18.9431
	Pote	Moof	-6.33250	6.21710	.574	-22.0031	9.3381
		Scrate	-3.06000	6.21710	.876	-18.7306	12.6106
	Scrate	Moof	-3.27250	6.21710	.859	-18.9431	12.3981
		Pote	3.06000	6.21710	.876	-12.6106	18.7306
Bonferroni	Moof	Pote	6.33250	6.21710	.960	-9.8404	22.5054
		Scrate	3.27250	6.21710	1.000	-12.9004	19.4454
	Pote	Moof	-6.33250	6.21710	.960	-22.5054	9.8404
		Scrate	-3.06000	6.21710	1.000	-19.2329	13.1129
	Scrate	Moof	-3.27250	6.21710	1.000	-19.4454	12.9004
		Pote	3.06000	6.21710	1.000	-13.1129	19.2329

ANCOVA: POMS and Suggestion Group

(Covariates= EPI N & DES II Post)

Tests of Between-Subjects Effects

Measure:MEASURE_1
Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Intercept	1833.315	1	1833.315	7.509	.013	.283	7.509	.739
EPI_N	3601.473	1	3601.473	14.751	.001	.437	14.751	.954
DES_POST	207.910	1	207.910	.852	.368	.043	.852	.142
Suggestion_grp	161.736	1	161.736	.662	.426	.034	.662	.121
Error	4638.883	19	244.152					

a. Computed using alpha = .05

Multivariate Tests[c]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
POMS_TMD	Pillai's Trace	.073	.704[a]	2.000	18.000	.508	.073	1.408	.150
	Wilks' Lambda	.927	.704[a]	2.000	18.000	.508	.073	1.408	.150
	Hotelling's Trace	.078	.704[a]	2.000	18.000	.508	.073	1.408	.150
	Roy's Largest Root	.078	.704[a]	2.000	18.000	.508	.073	1.408	.150
POMS_TMD * EPI_N	Pillai's Trace	.127	1.314[a]	2.000	18.000	.293	.127	2.628	.247
	Wilks' Lambda	.873	1.314[a]	2.000	18.000	.293	.127	2.628	.247
	Hotelling's Trace	.146	1.314[a]	2.000	18.000	.293	.127	2.628	.247
	Roy's Largest Root	.146	1.314[a]	2.000	18.000	.293	.127	2.628	.247
POMS_TMD * DES_POST	Pillai's Trace	.226	2.627[a]	2.000	18.000	.100	.226	5.253	.455
	Wilks' Lambda	.774	2.627[a]	2.000	18.000	.100	.226	5.253	.455
	Hotelling's Trace	.292	2.627[a]	2.000	18.000	.100	.226	5.253	.455
	Roy's Largest Root	.292	2.627[a]	2.000	18.000	.100	.226	5.253	.455
POMS_TMD * Suggestion_grp	Pillai's Trace	.078	.761[a]	2.000	18.000	.482	.078	1.523	.159
	Wilks' Lambda	.922	.761[a]	2.000	18.000	.482	.078	1.523	.159
	Hotelling's Trace	.085	.761[a]	2.000	18.000	.482	.078	1.523	.159
	Roy's Largest Root	.085	.761[a]	2.000	18.000	.482	.078	1.523	.159

a. Exact statistic

b. Computed using alpha = .05

c. Design: Intercept + EPI_N + DES_POST + Suggestion_grp
Within Subjects Design: POMS_TMD

ANCOVA: HADS Anxiety (Square root) at Three Time Points Between Suggestion Groups

(Covariates= EPI N & DES II Post)

Tests of Between-Subjects Effects

Measure:MEASURE_1
Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Intercept	5.778	1	5.778	6.621	.019	.258	6.621	.685
EPI_N	18.526	1	18.526	21.230	.000	.528	21.230	.992
DES_POST	2.294	1	2.294	2.628	.121	.122	2.628	.337
Suggestion_grp	1.794	1	1.794	2.056	.168	.098	2.056	.275
Error	16.581	19	.873					

a. Computed using alpha = .05

Multivariate Tests[c]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
HADS_A	Pillai's Trace	.461	7.704[a]	2.000	18.000	.004	.461	15.408	.907
	Wilks' Lambda	.539	7.704[a]	2.000	18.000	.004	.461	15.408	.907
	Hotelling's Trace	.856	7.704[a]	2.000	18.000	.004	.461	15.408	.907
	Roy's Largest Root	.856	7.704[a]	2.000	18.000	.004	.461	15.408	.907
HADS_A * EPI_N	Pillai's Trace	.096	.952[a]	2.000	18.000	.404	.096	1.905	.189
	Wilks' Lambda	.904	.952[a]	2.000	18.000	.404	.096	1.905	.189
	Hotelling's Trace	.106	.952[a]	2.000	18.000	.404	.096	1.905	.189
	Roy's Largest Root	.106	.952[a]	2.000	18.000	.404	.096	1.905	.189
HADS_A * DES_POST	Pillai's Trace	.047	.444[a]	2.000	18.000	.648	.047	.889	.111
	Wilks' Lambda	.953	.444[a]	2.000	18.000	.648	.047	.889	.111
	Hotelling's Trace	.049	.444[a]	2.000	18.000	.648	.047	.889	.111
	Roy's Largest Root	.049	.444[a]	2.000	18.000	.648	.047	.889	.111
HADS_A * Suggestion_grp	Pillai's Trace	.017	.151[a]	2.000	18.000	.861	.017	.303	.070
	Wilks' Lambda	.983	.151[a]	2.000	18.000	.861	.017	.303	.070
	Hotelling's Trace	.017	.151[a]	2.000	18.000	.861	.017	.303	.070
	Roy's Largest Root	.017	.151[a]	2.000	18.000	.861	.017	.303	.070

a. Exact statistic

b. Computed using alpha = .05

c. Design: Intercept + EPI_N + DES_POST + Suggestion_grp
Within Subjects Design: HADS_A

ANCOVA: HADS Depression (Square root) at Three Time Points Between Suggestion Groups

(Covariate= EPI N)

Tests of Between-Subjects Effects

Measure:MEASURE_1
Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Intercept	9.324	1	9.324	5.966	.024	.230	5.966	.642
EPI_N	9.801	1	9.801	6.271	.021	.239	6.271	.664
Suggestion_grp	4.073	1	4.073	2.607	.122	.115	2.607	.336
Error	31.256	20	1.563					

a. Computed using alpha = .05

Multivariate Tests[c]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
HADS_D	Pillai's Trace	.393	6.159[a]	2.000	19.000	.009	.393	12.319	.834
	Wilks' Lambda	.607	6.159[a]	2.000	19.000	.009	.393	12.319	.834
	Hotelling's Trace	.648	6.159[a]	2.000	19.000	.009	.393	12.319	.834
	Roy's Largest Root	.648	6.159[a]	2.000	19.000	.009	.393	12.319	.834
HADS_D * EPI_N	Pillai's Trace	.212	2.559[a]	2.000	19.000	.104	.212	5.118	.449
	Wilks' Lambda	.788	2.559[a]	2.000	19.000	.104	.212	5.118	.449
	Hotelling's Trace	.269	2.559[a]	2.000	19.000	.104	.212	5.118	.449
	Roy's Largest Root	.269	2.559[a]	2.000	19.000	.104	.212	5.118	.449
HADS_D * Suggestion_grp	Pillai's Trace	.041	.410[a]	2.000	19.000	.669	.041	.821	.107
	Wilks' Lambda	.959	.410[a]	2.000	19.000	.669	.041	.821	.107
	Hotelling's Trace	.043	.410[a]	2.000	19.000	.669	.041	.821	.107
	Roy's Largest Root	.043	.410[a]	2.000	19.000	.669	.041	.821	.107

a. Exact statistic

b. Computed using alpha = .05

c. Design: Intercept + EPI_N + Suggestion_grp
Within Subjects Design: HADS_D

ANCOVA: DES II Pre and DES II Post (Square root) Between Suggestion Groups

(Covariates= EPI N & HADS Anxiety times 1, 2 & 3)

Tests of Between-Subjects Effects

Measure:MEASURE_1
Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Intercept	36.776	1	36.776	22.207	.000	.539	22.207	.994
HADS_A_T1	.266	1	.266	.161	.693	.008	.161	.067
HADS_A_T2	.053	1	.053	.032	.861	.002	.032	.053
HADS_A_T3	.139	1	.139	.084	.775	.004	.084	.059
Suggestion_grp	.442	1	.442	.267	.611	.014	.267	.078
Error	31.465	19	1.656					

a. Computed using alpha = .05

Multivariate Tests[c]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
DES_II	Pillai's Trace	.030	.580[a]	1.000	19.000	.455	.030	.580	.112
	Wilks' Lambda	.970	.580[a]	1.000	19.000	.455	.030	.580	.112
	Hotelling's Trace	.031	.580[a]	1.000	19.000	.455	.030	.580	.112
	Roy's Largest Root	.031	.580[a]	1.000	19.000	.455	.030	.580	.112
DES_II * HADS_A_T1	Pillai's Trace	.145	3.226[a]	1.000	19.000	.088	.145	3.226	.400
	Wilks' Lambda	.855	3.226[a]	1.000	19.000	.088	.145	3.226	.400
	Hotelling's Trace	.170	3.226[a]	1.000	19.000	.088	.145	3.226	.400
	Roy's Largest Root	.170	3.226[a]	1.000	19.000	.088	.145	3.226	.400
DES_II * HADS_A_T2	Pillai's Trace	.002	.045[a]	1.000	19.000	.834	.002	.045	.055
	Wilks' Lambda	.998	.045[a]	1.000	19.000	.834	.002	.045	.055
	Hotelling's Trace	.002	.045[a]	1.000	19.000	.834	.002	.045	.055
	Roy's Largest Root	.002	.045[a]	1.000	19.000	.834	.002	.045	.055
DES_II * HADS_A_T3	Pillai's Trace	.428	14.218[a]	1.000	19.000	.001	.428	14.218	.947
	Wilks' Lambda	.572	14.218[a]	1.000	19.000	.001	.428	14.218	.947
	Hotelling's Trace	.748	14.218[a]	1.000	19.000	.001	.428	14.218	.947
	Roy's Largest Root	.748	14.218[a]	1.000	19.000	.001	.428	14.218	.947
DES_II * Suggestion_grp	Pillai's Trace	.004	.072[a]	1.000	19.000	.791	.004	.072	.058
	Wilks' Lambda	.996	.072[a]	1.000	19.000	.791	.004	.072	.058
	Hotelling's Trace	.004	.072[a]	1.000	19.000	.791	.004	.072	.058
	Roy's Largest Root	.004	.072[a]	1.000	19.000	.791	.004	.072	.058

a. Exact statistic

b. Computed using alpha = .05

c. Design: Intercept + HADS_A_T1 + HADS_A_T2 + HADS_A_T3 + Suggestion_grp
Within Subjects Design: DES_II

Appendix H: Chronology of Research Report

Date	Event
15th June 2009	Thesis Proposal Meeting: discussion of feasibility with university staff independent of the research
1st September 2009	Met with surgeon to discuss proposal and feasibility
16th November 2009	Costing approval
22nd January 2010	Independent review of proposal
	Proposal submitted for formal university peer review
29th January 2010	Ethics submission
22nd February 2010	Request for R&D approval submitted
18th March 2010	Ethics Committee meeting
23rd April 2010	Consent assessment training
1st June 2010	Thesis presentation to cohort outlining research progress
11th June 2010	Ethical approval confirmed
23rd July 2010	Good Clinical Practice course attended as stipulated by R&D
17th September 2010	R&D approval-granted letter of access to see NHS patients in hospital
13th October 2010	Started data collection
2nd December 2010	Started to recruit data collection assistants
16th December 2010	Clinical Studies Officer recruited to assist with data collection
7th January 2011	Extension to thesis deadline agreed
14th March 2011	Psychology Undergraduate recruited to assist with data collection
29th April 2011	Data analysis began

Appendix I: Epistemological Position

This research is approached from the positivist position in order to reject null hypotheses and support the theoretical hypotheses. Acknowledging that measurements can be imperfect, statistics were employed to test the probability of results being obtained by chance. Furthermore, the researcher feels that the constructs being tested are empirically measureable.

Critical Appraisal

Reflective Account of the Research Process

Critical Appraisal

Research as a Learning Experience – An Ambitious Expedition

Throughout the entire process of undertaking this research, a diary was kept, allowing me to reflect on the challenges presented, from inception to completion, and to appraise how I managed each stage.

Since completing the research, I have come to view the whole procedure in terms of an emotional journey, akin to crossing a mountain range, with long periods of struggling to a certain point only to discover another almost insurmountable problem over the horizon. However, now having achieved my ultimate goal, I feel the difficulties and set backs were a huge part of the learning experience, helping me to develop fortitude and coping skills transferable to all areas of my life.

Development of the Hypothesis –Planning the Journey

During a university research fair in December 2008, I was introduced to the concept of awareness under anaesthesia and began to research around the topic for a review of critical literature review, to be completed three months later. This led to me developing my own ideas for research, particularly regarding conscious sedation and the possibility of implicit learning leading to unpleasant memories of potentially distressing procedures. I then considered ways of both detecting evidence for this phenomenon and methods of alleviating any patient post-operative distress, either immediate or during any future procedures. This was an exciting stage of the process with almost limitless avenues to be explored and one where I had to rein in my enthusiasm in order to balance possibility with practicality.

Further research into relevant literature and contemporary studies led me to consider positive suggestion as an adjunct to conscious sedation, to improve the experience for patients undergoing noxious procedures. Determining which type of procedure to investigate was partially dictated by the need for it to be common enough to enable data collection from a large population and also one that could have a consistent sedative protocol. Although I considered gastroscopy to be the more uncomfortable and potentially distressing endoscopic procedure, for practical reasons, colonoscopy was the preferred option due to the need for the patients to wear headphones during their examination.

Having examined two previous studies, Bohin (1999) and Woodruff and Wang (2004), I decided to replicate parts of these, to research implicit memory under conscious sedation whilst adding my own investigation into the benefits of positive suggestion. This involved quite a long period of planning to develop a detailed methodology to fulfil both theoretical and practical criteria, a process which taught me the importance of meticulous preparation.

A draft proposal was developed during April 2009 and presented to the University to evaluate its merits as a suitable doctoral project and, having been assessed as worthy, the proposal was finalised by 31st May 2009. A feasibility study, into the practicalities of implementing the research at a local hospital, was then carried out. Surgeons were contacted and clinics observed during September 2009. This enabled me to further hone my methodology to minimise disruption to hospital procedures and I was both surprised and delighted by the enthusiastic response to my proposed research from the hospital staff. The detailed proposal was then peer reviewed by Dr. Noelle Robertson, from the University of Leicester Doctorate in Clinical Psychology Programme, in January 2010.

Gaining Permission for Research – A Real Uphill Struggle

I was now fired with enthusiasm and keen to get started but first I had to be taught a lesson in patience, something I must confess I considered to be the most difficult aspect of the whole process.

I found the ethics submission procedure to be tedious, with new sections being thrown up by the online form every time I answered a question. In fact many of the queries seemed either confusing or irrelevant and generated requests for more paperwork to be sourced and included in the application pack. However, by 29th January 2010 I had finalised the documentation and applied for permission to proceed with my study and, with great relief at having finished the online application, and a little trepidation at what lay before me, I telephoned for an appointment with the Leicestershire, Northamptonshire and Rutland Ethics Committee 2 (LNR2). I was surprised when they contacted me, requesting that the title be altered on a couple of attachments to precisely match my project title. This led to me wondering how rigorously they would examine my proposal and I immediately began envisaging several resubmissions. However, I subsequently attended my ethics interview on 18th March 2010 and, despite intensive questioning from a panel of around 20 people, the procedure was far less daunting than I had anticipated. Subsequently, I received a letter detailing just two amendments, two suggestions and a request for a copy of the University's peer review. I was relieved that they were satisfied with the design and protocol of the study, averting any need for major procedural modifications.

I received my first communication from them less than two weeks later and I was happy to accommodate their requested additions to the G.P. letter, designed to preclude any possibility of confusion over patient identity by adding their date of birth and date of their colonoscopy. I found it a little more frustrating that they also stipulated a rewrite of the

Patient Information Sheet, following the guidance on information sheets from the National Research Ethics Service website. I was concerned that this resulted in expanding a concise synopsis of all pertinent study information into a four page, verbose document and one I feared might deter any potential participants.

Having acquiesced to these requests, I was amazed to receive yet another letter asking for minor alterations to the wording of the Patient Information Sheet and how explicit they had been on some of the statements, for example they said where I had written "participation is not compulsory" it should be changed to "participation is voluntary". I confess to considering this to be petty pedantry but took a deep breath and complied. Ultimately, the proposal was passed by Leicestershire, Northamptonshire and Rutland Ethics Committee 2, on 11th June 2010.

Around the same time as going through the regional ethics procedure, I submitted the requested paperwork to the University Hospitals of Leicester Directorate of Research and Development (R&D), which I discovered was a far more exacting and, ultimately, frustrating experience. The original documentation was posted on 22nd February 2010 and a reply on the 26th requested 16 amendments. In addition, I had to be assessed on my ability to consent participants into the study and acquire the relevant Consent Assessment Certificate, which entailed organising a mutually acceptable date for training and examination. Even after this, R&D still requested further alterations to the documentation, which were duly submitted on 21st May 2010.

Next, during June, they requested to see all of the actual questionnaires, which were to be used in the research, all of which had been accepted by LNR2. This meant having to purchase the questionnaires before the study had been formally accepted but, nonetheless, the finalised questionnaire pack was collated and submitted to them.

I was hopeful that the next communication would be an affirmation that the study could commence, as I had planned on doing my data collection during the summer break from university, but hopes were dashed as I was informed that I needed to go through formal training and pass an examination on Good Clinical Practice (GCP). I achieved this on 23rd July 2010.

I was still just about on course for summer holiday data collection but this plan was further delayed by R&D. They stated they needed confirmation from LNR2 that they had passed all of the questionnaires to be employed. This was fairly readily provided but another, more contentious obstacle was placed in the way of my research when R&D demanded to see the GCP/Consent certificates of both my Research Supervisor and, perhaps even more bizarrely, their own surgeons who were carrying out the endoscopy procedures. From my point of view this was almost insurmountable as, understandably these eminent researchers and surgeons refused to undergo this "training" as it was already inherent in their daily work. At this point my Research Supervisor intervened and R&D finally saw sense and passed the study in principle, although they were still to intervene on a couple of further occasions.

Firstly, they insisted that the SCR equipment, CD player and laptop to be used in the research were tested by the Medical Physics Department and, although I could understand that health and safety is paramount, this was yet another hurdle delaying commencement of data collection. My concerns were confirmed when on 6th September they declared that as the SCR machine was not C.E. marked it would need further testing. It was also noted that the brand new laptop would have to be connected indirectly to the patient via the SCR equipment and, despite the laptop voltage being stepped down to twelve volts through a transformer and the SCR unit containing a component that isolates and protects patients from electrical surges, they insisted that the laptop plug be modified and plugged into a medical grade

isolation unit for use on hospital premises. Eventually, all of the equipment received clearance and subsequently, R&D finally gave me clearance to conduct research with their patients on 17th September 2010 and I could, with great relief, commence data collection.

Communication – Establishing Base Camp

Throughout the turmoil of getting approval for what I had considered as a fairly non-contentious experiment, I spent a considerable amount of time keeping all of the concerned parties informed by e-mail or face-to-face meetings, including academic, administrative and medical staff. For example, in August 2010, I met with the consultant surgeon to discuss starting dates and, a week later, with the clinic's administration department to discuss the logistics of sending opt-in letters to potential participants. I also arranged a September meeting at the Hospital, prior to study commencement, to explain the research and discuss the procedure with all of the relevant staff.

I have always considered good communications to be paramount in maintaining a good working relationship within a team and it proved to be so during this drawn out period, when seemingly nothing happened, to keep the hospital staff enthused about the project.

Data Collection –Scaling the Highest Peak

By the 13th October 2010, I was, at last, in a position to begin data collection but my frustrations did not end there. Unfortunately, the endoscopy clinics were only held twice a week and, as my university lecture day coincided with one of them, I could only attend one clinic per week. However, as I was told that clinics treated up to five patients per session, I still believed there would be plenty of opportunity to achieve the required sample for my statistical analysis. Once again, my optimistic view was shattered by reality. I discovered

most clinics saw four patients or less, several clinics were cancelled due to lack of surgeons, three potential clinics clashed with the University's beginning of term teaching block and, most worryingly, there was a huge reluctance from patients to participate. In fact it was not until 21st October 2010 that I at last managed to test any participants.

Consequently, I realised that, to be anywhere near completing data collection and handing in a finalised thesis by the deadline date, I would need some assistance. My research supervisor was able to put me in touch with five potential assistants, whom I was able to e-mail and meet to discuss the project. Despite all of them showing real interest in participation, the spectre of R&D once again reared its ugly head and, by the time administrative details had been worked out to their satisfaction, one volunteer had already started another project, one had started another job and a third decided he couldn't commit the time. This was a valuable lesson in organisation and I derived a quiet satisfaction from my ability to take over the role of mentor as I guided the two remaining volunteers through the procedure and arranged for the correct documentation to allow them to begin data collection on my behalf.

One volunteer, a Clinical Studies Officer, had already undergone Consent Training, possessed a GCP certificate and, because he was already a substantive NHS employee, he was allowed access to NHS patients without further checks. The other research assistant was a psychology and neuroscience undergraduate who needed to undergo the formal research training and submit her enhanced Criminal Records Bureau check gained through her voluntary employment. This led to yet more discussions with R&D to establish if she would need a research passport to access NHS patients, as she was not a substantive NHS employee. However, it was argued, as she was supervised on the project by an NHS employee she could be allowed access as an "Intercalated B.Sc. student".

This aspect of the study, whilst being the bane of my existence for a long period of time, introduced me to a language unique to the NHS and one in which I began to communicate. I am pleased to recall that despite frustration, sometimes bordering on desperation, I managed to draw on my professionalism to remain calm throughout my dealings with R&D, and accomplished the formation of a team, which bonded from the beginning, enabling data collection to be carried out on two separate days. I also feel the inclusion of a female researcher helped the recruitment of more females to the study which had initially been skewed towards male participants.

After one final piece of administration, the compilation of a Research File to be stored at the hospital, data collection began in earnest. However, patients were still reluctant to participate in the research and by the end of the year, frustratingly; we had only recruited three participants. By the end of January 2011, two years after first beginning to develop the hypothesis for the study, the research was underway but at a far slower pace than I would ever have anticipated, leading to fears of missing deadlines and being unable to reach statistical significance with only eight completed sets of data.

Eventually, and with thanks to my research team, 24 complete sets of data were collected and, although I was disappointed not to have achieved the 42 sets I had envisaged, I realised that this was one of the realities of research.

Analysing Results - Planting the Flag

Finally, with a wealth of data to analyse I had to be selective and choose which of the 50 variables should be scrutinised to accurately test the hypothesis. I realised I had covered so many bases I could be analysing statistics for months and appreciated the necessity of judicious discrimination. This became easier as I focussed on the detail of the hypotheses, breaking them down phrase-by-phrase, and establishing which measures examined each facet most fully.

Some measures needed to be quantified before analysis could begin but the scoring of the questionnaires had been rigorously carried out after each patient had been followed up, something which I had long been aware would have been an immensely tedious exercise if left until the end of the research. Unfortunately, I had to choose a cut-off point to cease data collection so that I could become un-blinded to the contents of the stimuli played to the participants. Having already acquired an extension to the thesis submission deadline, I chose 28th April 2011. This was particularly frustrating for me as I have always taken pride in completing assignments on time and it also meant I had the added disappointment of not achieving the target sample size.

However, as soon as I began to correlate participants with word stimuli and suggestion-groups, scientific curiosity began to overcome any pique at not being amongst the first to complete a thesis. The multivariate statistical analysis proved to be a valuable practical exercise in data examination, which had to be used to cater for both the sample size and the vast diversity of data and it was fascinating to see how a test would often reveal something unexpected whilst others confirmed an intuition. As various themes began to emerge, the hypotheses transformed into deductions and, on a personal level, I began to appreciate the value of research and gain confidence in dealing with statistics.

The Next Challenge – A Less Slippery Slope

This research has been a significant learning experience for me and has signposted some of the pitfalls to avoid in the future. Primarily, I feel that refining the procedure to focus on one particular question would lead to a more successful outcome rather than investigating such a broad spectrum of issues around the topic of conscious sedation.

I would certainly avoid the issue of the two main elements, positive suggestion and emotive word recall, coming into conflict with each other by concentrating on just one of them. For the same reason I would avoid using questionnaires that measure such similar constructs that they result in a plethora of covariates. Additionally, separating the two elements and using fewer questionnaires would involve less commitment time from participants. This might help to ensure more volunteers would be willing to take part in a study.

Finally, I would (in a perfect world) allow myself more time to complete the study. The perfect twenty-twenty vision of hindsight has enabled me to see just how long it takes to gain permission, resources and volunteers to carry out meaningful research. I would also have liked the luxury of more time to follow-up patients after a greater time interval to see if they had developed any psychological sequelae a few weeks after their procedure.

However, I would still like to investigate the merits of positive suggestion during conscious sedation to see if it is beneficial for different age groups and ethnicities and therefore worth recommending as standard protocol in procedures utilising conscious sedation.

Reflective Summary - Recalling the Highs and Lows

The importance of ethically sound research can never be underestimated, although going through the IRAS process for the first time with a study as ambitious as this was far from straightforward. The meeting with the local ethics committee was slightly daunting but ultimately a very positive experience. Incorporating the committee's requests to allow the study to proceed was not too challenging and the procedure was approved with relative ease.

Unfortunately, the local R&D approval proved to be a much more complicated affair. Scrutiny and subsequent questioning on the minutiae meant approval to access patients on the desired research site took over seven months and significantly delayed the anticipated start date of data collection, thus impacting on the possibility of collecting the required sample size within the deadline for study submission, which I personally found immensely frustrating. In any future research I would allow more time for the approval process but hopefully there would not be such strict time constraints and research length could be dictated by the acquisition of sufficient participants to achieve statistical significance.

I have found this research to be very demanding on many levels; however, if I had not been given the opportunity to undertake such a challenge, I would not have developed my understanding of NHS research governance or gained experience of managing a team of volunteer researchers. Additionally, developing a good working relationship with staff at the endoscopy clinics and the two research assistants, made data collection far more enjoyable and helped to ameliorate some very tedious days of sitting around the hospital, research equipment set up and ready, when, disappointingly, all potential participants refused to take part in the study. I was also gratified by the enthusiasm that hospital staff demonstrated towards the research and their eagerness to participate. In the same vein, it was pleasing to witness the interest shown by the participants during their post research debrief and I felt it

helped me to develop the skill of explaining a complex piece of research in terms which could be understood by patients from a variety of backgrounds and ethnicities; an essential competence for clinical work.

Having completed this project, I have discovered that it can take a very long time to turn a proposed study into active research by gaining the required approval. I have also learned that actually carrying out research is far removed from text book simplicity and that where a clinical population is used there are infinite pitfalls and obstacles to achieving a statistically significant sample in a fixed period of time.

Overall the study was an enlightening experience, not only teaching me the finer details of research but also about my ability to cope with the stress of looming deadlines against circumstances beyond my control. Furthermore, as usual, I found the thesis word limit a challenge but realize the importance of brevity and concise reporting. Finally, my overwhelming impression of this piece of research is that it was worthwhile, both as a learning exercise and as a foundation for others to build upon. There are several strands of this study which could be taken up in their own right and I would be delighted to see other researchers following on to discover more about positive suggestion and implicit emotional memory under conscious sedation. My only regret is that I did not have sufficient time to fully immerse myself in the investigation as I had to balance a clinical placement and a course of study with what probably transpired to be an over-ambitious piece of research which, in hindsight, was probably more suited to a full time researcher.

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