

Interventions to increase engagement with rehabilitation in adults with acquired brain injury: a systematic review.

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Abstract

Rehabilitation in adults with acquired brain injury is often hampered by a lack of client engagement with the rehabilitation process, leading to frustration, withdrawal of services and poorer recovery. Motivation, apathy and awareness are potential mechanisms underlying engagement, but few studies have suggested potential intervention techniques. A systematic review of the literature was carried out to identify and evaluate interventions designed to increase rehabilitation engagement in adults with acquired brain injury.

Database searches used the following terms: rehabilitation, brain injury, and compliance / engagement / adherence in PsychInfo, Medline, Cinahl, Embase, AMED, Web of Knowledge, PsycBite, Cochrane clinical trials, and clinicaltrials.org. Hand searches were conducted of reference lists and relevant journals.

15 studies were included in the review. Intervention techniques fell into two broad categories: behavioural modification techniques and cognitive/meta-cognitive skills. Contingent reward techniques were most effective at increasing adherence and compliance, while interventions enabling clients' active participation in rehabilitation appeared to increase engagement and motivation. The review highlighted methodological and measurement inconsistencies in the field and suggested that interventions should be tailored to clients' abilities and circumstances.

Key words

Acquired brain injury, rehabilitation, engagement, motivation.

Word count: 5, 325

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Background

Acquired brain injury (ABI) affects an estimated 200 per 100,000 of the global population (Hyder et al., 2007). All ABI, even mild injuries, have the potential to cause complex physical, cognitive, communicative, emotional and behavioural problems which have profound and long-lasting consequences for the clients and their families. Recent estimates suggest that over 100 per 100,000 people experience persistent difficulties beyond one year post injury (Whitnall, McMillan, Murray & Teasdale, 2006; Scottish Intercollegiate Guidelines Network (SIGN), 2013). Specialist assessment and rehabilitation, commencing early after injury, can have a positive impact on outcome (Headway, 2013; SIGN, 2013).

Rehabilitation of adults with ABI is often hampered by a lack of client engagement (Medley & Powell, 2010). Client involvement in the planning and evaluation of rehabilitation is a core value of the person-centred approach, which empowers clients to actively participate in their own care and is recommended in brain injury rehabilitation (Lewin, Skea, Entwistle, Zwarenstein & Dick, 2001; Headway, 2013; SIGN, 2013). Involvement of clients in clinical decision-making is recommended in the management of long term conditions (Holliday, Cano, Freeman & Playford, 2007). Goal setting – in which rehabilitation staff and clients work collaboratively to identify, monitor and evaluate personally relevant and meaningful rehabilitation goals – is widely considered to be best practice in facilitating client involvement and engagement with rehabilitation (Siegert, McPherson & Taylor, 2004; Hart & Evans, 2006; Playford, Siegert, Levack & Freeman, 2009; Scobbie, Wyke & Dixon, 2009).

Although considerable research has targeted improving the effectiveness of goal setting, this has largely focussed on its pragmatic aspects such as goal characteristics (Barnes & Ward, 2000; Locke & Latham, 2002; Hart & Evans, 2006; Levack, Dean, McPherson & Siegert, 2006; Wade, 2009; Levack et al., 2012), with little consideration of theory (Siegert & Taylor, 2004). Researchers (e.g. Siegert et al., 2004; Scobbie et al., 2009; Lane-Brown & Tate, 2010) have identified several theories underpinning goal setting in rehabilitation, including the importance of internal factors (such as motivation) in goal-directed behaviour proposed by Goal Setting Theory (Locke & Latham, 1990), the self-efficacy components of Social Cognitive Theory (Bandura, 1986), and the Health Action Process Approach (Schwarzer, 1992). Self-regulation, which is “a systematic process involving conscious efforts to modulate thoughts, emotions and behaviours in order to achieve goals within a changing environment” (Cameron & Leventhal, 2003), is a particularly useful theoretical approach to goal setting, invoking the meta-cognitive skills required for goal-directed activity (Hart & Evans, 2006; McPherson, Kayes & Weatherall, 2009). Carver and Scheier’s (1998) control-process model of self-regulation posits goal-directed behaviour as the output of a negative feedback loop, in which clients reduce the discrepancy between their perception of their current (progress towards goals) and desired situation (the rehabilitation goal).

Evidence for the utility of goal setting in neuro-rehabilitation is mixed (Siegert & Taylor, 2004). Some suggest that goal setting increases rehabilitation effectiveness (Wade, 2009; Leach, Cornwell, Fleming & Haines, 2010). Others suggest that its usefulness is limited by clients’ ability and willingness to set goals (Playford et al., 2000; Levack, Dean, McPherson & Siegert, 2006; Levack, Taylor, et al., 2006). This, they argue, is influenced by two key factors: insight/awareness and metacognitive skills. Adults with ABI frequently lack

awareness of their abilities and/or deficits (Schacter & Prigatano, 1991), which can lead to disengagement from neuro-rehabilitation, which they perceive as unnecessary (Hufford, Williams, Malec & Cravotta, 2012). They may also lack the insight necessary to evaluate their capabilities and set realistic goals (Conneeley, 2004; Levack, Dean, McPherson & Siegert, 2006). Metacognitive skills – of which goal setting is one – reflect the ability of an individual to self-regulate and self-monitor the learning process and are essential for planning, monitoring and evaluating goals and goal-directed behaviour. They are largely synonymous with executive function, which is frequently impaired after brain injury. Playford et al. (2000) and Levack, Taylor et al. (2006) argue for more research into interventions to support client involvement in the goal setting process. Holliday et al. (2007) found that an intervention designed to increase client involvement in goal setting in a neurological rehabilitation setting increased clients' perceived autonomy and perceived relevance of rehabilitation goals.

Another common problem following ABI is a lack of motivation. This can lead to disengagement from everyday life and from rehabilitation (Holloway, 2012), resulting in a withdrawal of rehabilitation services, frustration for clients, relatives and rehabilitation staff, and a poorer recovery (Holloway, 2012). Although poorly defined for measurement purposes (Maclean & Pound, 2000, Siegert & Taylor, 2004), client motivation has been found to be a good predictor of rehabilitation outcome. Motivational Interviewing (MI, Miller & Rollnick, 1991, Miller & Rollnick, 2009) is a useful tool for assessing and increasing motivation, and has been shown to be effective in improving treatment outcomes in a wide variety of physical health settings (Rubak, Sandbæk, Lauritzen & Christensen, 2005; Knight, McGowan, Dickens & Bundy, 2006; Lundahl, Kunz, Brownell, Tollefson & Burke, 2010; Chilton, Pires-Yfantouda & Wylie, 2012). Medley and Powell (2010) suggest that MI adds value to neuro-

rehabilitation by enhancing the therapeutic relationship and enabling effective case formulation; by facilitating collaborative and realistic goal-setting and by promoting constructive engagement in rehabilitation interventions. Despite the potential usefulness of this technique amongst adults with ABI, few empirical studies of its effectiveness exist (Knight et al, 2006; Holloway, 2012).

There is currently little clarity within the literature regarding potential techniques to increase rehabilitation engagement in adults with ABI. A recent systematic review of interventions to reduce apathy amongst adults with acquired brain injury identified only one study (Lane-Brown & Tate, 2009). Although a recent literature review described a broad range of interventions to increase awareness in this group, the authors emphasised the need for a more systematic, empirical evidence base and noted that although many interventions were, by necessity, tailored to the individual client, the description of this process was often lacking (Fleming & Onsworth, 2006).

Objectives

A systematic review of the research literature was carried out in order to draw together and evaluate empirical evidence on the broad topic of interventions specifically designed to increase engagement with rehabilitation in adults with ABI.

Methods

Inclusion criteria

Population

Adults (aged 16 years +) with acquired brain injury who are currently undergoing rehabilitation in any setting.

Intervention

Any intervention with the explicit aim of increasing engagement with rehabilitation.

Comparator

Engagement, adherence or compliance with rehabilitation outside of the intervention, either in a control group or participants pre-intervention.

Setting

No restrictions were placed on rehabilitation setting.

Outcome

Any objective measure of engagement, adherence or compliance with rehabilitation.

Study design

No restrictions were placed on study design.

Exclusion criteria

Studies where participants were predominantly children or young adolescents, or where participants had been diagnosed with a neurological disorder only, such as Multiple Sclerosis, were excluded. Any studies where the intervention was targeted at overcoming physical or cognitive barriers to rehabilitation without targeting engagement were excluded. Studies reporting only subjective or self-report outcome measures were also excluded.

Search strategy

Electronic searches

The following search terms, including exact terms and all relevant subject headings, were used: brain injury AND rehabilitation AND “engagement” OR “adherence” OR “compliance”. Searches were conducted, without language restrictions, on 13th May 2013 of the following databases: Ovid PsycINFO (1987-May 2013), Medline (1946-May 2013), Cumulative Index to Nursing and Allied Health Literature (CINAHL Plus, 1937-May 2013), Embase (1980-May 2013), Allied and Complementary Medicine (AMED, 1985-May 2013), Web of Knowledge – Social Science & Science citation indexes (1970-May 2013), Cochrane Central Register of Controlled Trials, Clinicaltrials.org, and Psychological Database for Brain Impairment Treatment Efficacy (PsycBITE). The databases searched and the search terms and subject headings used are included in Appendix A.

In the absence of any similar published reviews, search sensitivity was confirmed using a relevant article previously found using an Internet search.

The search identified an article describing the design of a questionnaire to measure motivation in adults with ABI. Therefore, the Web of Knowledge Citation Index was used to identify additional published articles citing this measure.

Hand searches

The reference lists of articles included in the review, and several relevant review articles, were hand-searched. The contents lists of three journals identified as being of particular relevance – Brain Injury, Neuropsychological Rehabilitation and Disability and

Rehabilitation – between January 2012 and May 2013, and in press articles available online before 13th May 2013, were searched for further relevant articles.

Where results consisted of conference abstracts, Internet searches were conducted to attempt to identify resulting published articles.

Quality assessment

The quality of the studies selected for the review was assessed using a quality assessment checklist developed for this review, including study design, sample size, description of participants and intervention and relevance of the outcome measure (Table 1). As randomised controlled trials are exceptionally difficult in this diverse client group (Turner-Stokes, Nair, Disler & Wade, 2005; Holloway, 2012), it was anticipated that many of the studies would utilise single case experimental designs (SCEDs). Therefore, studies were evaluated in terms of their experimental design, following the recommendations of Perdices and colleagues (Tate et al., 2008; Perdices & Tate, 2009; Evans, Gast, Perdices & Manolov, 2014) . Owing to the lack of clarity over the theoretical processes involved in rehabilitation engagement in this client group, studies were also evaluated for their theoretical explanation for the intervention in terms of engagement. All studies were assessed independently by two reviewers, both experienced researchers with knowledge of neuropsychological theory. Each criteria was rated on a five-point scale. For the descriptive elements, 1 indicated little or no information while 5 indicated sufficient information for the reader to replicate the study. The quality assessment was an iterative process: the two reviewers' ratings were compared and any discrepancies in quality assessment discussed and a consensus reached in all cases.

[INSERT TABLE 1 HERE]

Data extraction and synthesis

Information was extracted from each study and tabulated to enable comparison.

As many of the articles consisted of single case studies, meta-analytic techniques were not appropriate.

Results

Study selection

The results of the search are shown in Figure 1. In summary, 420 abstracts were screened, 58 full text articles were assessed for eligibility, and 15 studies were selected for review. Of the articles excluded at the screening stage, 85 described observational studies with no intervention component, 58 described interventions not targeting engagement, 38 involved children or young adolescents, 71 were commentary or review articles, 32 consisted of a service evaluation or description, 14 described qualitative studies, 20 suggested clinical guidelines, 11 described the development or validation of measures, 16 involved non-brain injured participants, 3 described drug interventions, 3 described incomplete studies and 1 was a book review.

[INSERT FIGURE 1 HERE]

Three of the shortlisted studies consisted of conference abstracts only. Two were subsequently excluded as no full text article was available and the abstract contained insufficient to assess eligibility and one was linked to a published paper and included in the review. 41 additional studies were excluded after further assessment: 9 did not involve interventions, 3 did not involve rehabilitation, 17 studies had no objective measure of adherence, engagement or compliance, 8 described interventions targeting specific functional or behavioural barriers to rehabilitation, and 4 described interventions not specifically targeting engagement. 11 of the excluded studies used innovative new technology to facilitate participation in rehabilitation by overcoming functional or cognitive barriers to client-initiated rehabilitation programmes.

Study characteristics

The characteristics of the 15 articles (14 studies) included in the review are presented in Table 2. Nine articles reported the results of single case studies using a range of experimental and non-experimental designs. Four reported Randomised Controlled Trials. Where effect sizes are given by the study authors these were reported. Cohen's d was calculated where possible. A number of the studies utilised Single Case Experimental Designs (SCED), in which participants acted as their own control. None of the included SCED studies met the criteria for calculating effect size as recommended by Shadish et al. (2014) as all reported fewer than 3 cases.

[INSERT TABLE 2 HERE]

Although the studies varied in the number and type of participants, settings and intervention delivery, there were similarities in the type of techniques used. Eight studies reported

interventions using predominantly behavioural modification techniques (Hegel, 1988, Zencius, Wesolowski & Burke, 1989; Zencius, Wesolowski, Burke & McQuade, 1989; Yuen, 1996; Manchester, Hodgkinson, Pfaff & Nguyan, 1997; Newell, 1997; Sohlberg, Lemoncello & Lee, 2011; Hufford et al., 2012), 5 studies primarily cognitive techniques (Pegg et al., 2005; Lane-Brown & Tate, 2010; McPherson et al., 2009; Skidmore et al., 2011; Hsieh, Ponsford, Wong, Schönberger, Taffe & McKay, 2012; Hsieh, Ponsford, Wong, Schönberger, McKay & Haines, 2012) and 2 studies reported a mixture of the two (Corrigan, Bogner, Lamb-Hart, Heinemann & Moore, 2005; Corrigan & Bogner, 2007).

Behavioural interventions

Based on the principles and practice of behaviour therapy, behavioural interventions often involve an environmental manipulation in order to promote desirable and/or reduce problem behaviour. They are particularly relevant to adults with ABI who, despite experiencing often severe and debilitating cognitive deficits, are generally able to learn new associations and skills that might significantly alter their behaviour (McGlynn, 1990). By targeting behaviour, these interventions circumvent problems arising from a lack of awareness and consequent disengagement from ‘unnecessary’ rehabilitation often seen in this client group and can be an effective way of increasing adherence/compliance with rehabilitation (Wood, 1987; McGlynn, 1990; Hufford et al., 2012). Interventions focus on altering the environment before (antecedents) or after (consequences) the target behaviour.

Antecedent management

Barrier reduction

This technique identifies barriers to rehabilitation and aims to address them using practical solutions. Corrigan and colleagues (Corrigan et al., 2005; Corrigan & Bogner, 2007) found that a barrier reduction condition in their RCTs was as effective as financial incentives in increasing initial attendance and engagement and reducing premature termination of substance abuse treatment in adults with ABI. The most commonly-requested barrier reduction was a reminder call, which they argue is an effective, low-cost intervention. Lane-Brown and Tate (2010) included external compensation as part of an intervention to decrease apathy and increase goal-directed behaviour. This consisted of a daily reminder sent to the client's electronic device, overcoming the barrier of poor memory. They suggest that this assisted in initiating goal-directed behaviour, but not necessarily in sustaining the behaviour over time.

Antecedent control

These interventions manipulate the environmental or social stimuli preceding the behaviour in order to evoke desirable behaviour and make competing behaviours less likely. Zencius, Wesolowski, Burke and McQuade (1989) successfully instigated three simple antecedent control procedures – a simple visual cue, daily provision of a walking cane and a written invitation to rehabilitation – to enhance adherence to rehabilitation therapies and goals. Sohlberg, Lemoncello and Lee (2011) used technology to investigate whether providing clients with control over completion of home rehabilitation exercises increased compliance. Their results suggested the opposite – clients' exercise compliance was virtually zero in the 'pull' condition, in which clients initiated the exercises independently, and considerably higher in the 'push' condition, in which exercises appeared on the screen at a pre-determined time selected by the client in conjunction with rehabilitation staff. They suggest that the

‘push’ condition provided much-needed structure which helped clients overcome memory and planning deficits.

Consequence management

Behavioural contracting

A key barrier to successful rehabilitation is a discrepancy between the expectations of clients and health professionals. Behavioural contracting involves the client and health professionals discussing expectations and agreeing on positive behaviours which both parties are expected to display in order for rehabilitation to succeed. This then forms the basis of a written or verbal contract, which is regularly reviewed throughout the rehabilitation process.

Hufford et al’s (2012) study successfully utilised a written contract to enhance compliance and reduce agitation. They acknowledge, however, that the mechanisms for this change are unclear as no control condition was employed or any formal measure of awareness, therapeutic alliance or neuropsychological function. Newell (1997) describes a case study in which contracting vastly improved a client’s abusive behaviour, feelings of control and rehabilitation costs. Zencius, Wesolowski and Burke (1989) and Zencius, Wesolowski, Burke and McQuade (1989) compared the effectiveness of behavioural contracting with other techniques. In 4 of their studies, contracting alone increased adherence to rehabilitation but this behaviour change was not sustained without additional intervention. In another study, a verbal contract combined with a contingent financial reward was ineffective in increasing use of a walking cane (Zencius, Wesolowski, Burke & McQuade, 1989).

Contingency management

Several studies reported the implementation of a 'token economy' (Ayllon & Azrin, 1968) in an inpatient rehabilitation setting. This motivational system, based on operant learning theory, invokes the technique of contingency reinforcement (Skinner, 1969) by providing clients with rewards for exhibiting mutually-agreed target behaviours. In the study reported by Hegel (1988), a token economy was successfully instigated to supplement goal setting and extinction procedures to enhance rehabilitation compliance and attainment of therapeutic goals. Tokens were distributed for both positive and negative behaviours, with the percentage of potentially earned tokens exchanged for positive rewards. Manchester et al. (1997) utilised a token economy to successfully reduce absconding from an inpatient ward and suggest that the reinforcement and reward of positive behaviours rather than punishment of negative behaviours successfully altered the client's perception of the ward as a non-aversive environment and facilitated rehabilitation.

Zencius, Wesolowski and Burke (1989) found that a contingent reward points system increased rehabilitation attendance in two adolescents; in one client this was enhanced with the addition of a response cost procedure. However, 100% attendance was only reached and sustained for both clients once financial rewards were introduced – in contrast to their Zencius, Wesolowski, Burke and McQuade (1989) study. Corrigan and colleagues (Corrigan et al., 2005; Corrigan & Bogner, 2007) conducted randomised controlled trials in adults with ABI receiving substance abuse treatment and found that financial incentives led to improved initial attendance at and engagement with treatment, which has been shown to be important in developing a therapeutic alliance and enhance subsequent retention (Newman, 1997), and reduced premature termination of treatment.

Graded confrontation

Yuen (1996) describes the use of graded confrontation in response to avoidant behaviour (episodes of blank staring) during rehabilitation therapy. Indirect confrontation, in which staff discussed the psychogenic nature of the episodes in front of the client, led to a reduction in the avoidant behaviour. After the behaviour returned, direct confrontation, in which staff directly discussed the behaviour with the client and role-played the behaviour, was successfully implemented to extinguish the behaviour and increase the client's engagement with rehabilitation.

Cognitive and meta-cognitive interventions

These types of interventions aim to equip clients with the skills required for self-directed rehabilitation. In particular, meta-cognitive interventions enhance the skills required to plan, monitor and evaluate goal-directed behaviour.

Information provision

Providing clients with detailed information about their condition and rehabilitation can enhance their feelings of control and improve rehabilitation outcome. Pegg et al. (2005) found that providing personalised information on their injury and rehabilitation progress increased clients' exerted effort in subsequent physical but not speech therapy, and their improvement in cognitive rehabilitation.

Motivational Interviewing (MI)

Motivational Interviewing invokes metacognitive skills by encouraging clients to consider discrepancies between their current and desired state and enhancing motivation by exploring and resolving ambivalence (Miller & Rollnick, 2002). Hsieh and colleagues (Hsieh, Ponsford, Wong, Schönberger, Taffe & McKay, 2012; Hsieh, Ponsford, Wong, Schönberger,

Mckay & Haines, 2012) developed a programme incorporating MI as a means of preparing and engaging adults with ABI for a Cognitive Behaviour Therapy (CBT) programme for anxiety. Their results suggest that MI increased the effectiveness of CBT treatment. Corrigan et al. (2005) included motivational interviewing as a condition in their RCT, but found that this did not significantly influence engagement with substance abuse treatment in adults with ABI, perhaps due to its delivery within a brief telephone interview or to limitations of MI in this client group. Lane-Brown and Tate (2010) found that a programme incorporating MI and external compensation increased goal-directed behaviour in a 32-year-old male.

Meta-cognitive strategy training, self-regulation and goal setting

The Cognitive Orientation to daily Occupational Performance (CO-OP) approach is characterised as a client-driven meta-cognitive strategy training, enabling clients to identify, set & address goals, self-monitor goal attainment and direct their own learning and rehabilitation. It is designed specifically to equip individuals exhibiting impairment in executive function with the tools to help them engage more actively in the rehabilitation process. Skidmore et al (2011) demonstrated the effectiveness of CO-OP training in improving rehabilitation engagement and functional ability in a client 7 days post stroke.

McPherson et al. (2009; also described in Ylvisaker, McPherson, Kayes & Pellett, 2008) describe an intervention based on self-regulation theory, combining traditional and identity-oriented goal setting. They compared scores on the Goal Attainment Scale (GAS) – a popular technique enabling rehabilitation goals to be measured using a standardised scale while incorporating a client's personal needs, preferences and priorities (Bouwens, van Heugten & Verhey, 2009; Turner-Stokes, 2009) – between three intervention groups: goal management training, identity-oriented goal training, and treatment as usual. They found that, while both

treatment groups exhibited increased GAS scores, this was no better than the control group, suggesting that GAS alone was acting as an intervention.

Quality assessment

The results of the quality review for each of the 15 papers is shown in Table 2. The quality scores were lowest for studies involving behavioural interventions (mean = 21.9), medium for cognitive interventions (mean = 27) and highest for mixed interventions (mean = 29).

[INSERT TABLE 3 HERE]

In terms of theory, all the articles described some theoretical basis for the intervention, however the quality of this description and the direct relevance to rehabilitation engagement in this client group varied.

Discussion

This review identified a number of interventions which may successfully increase engagement, adherence or compliance with rehabilitation in adults with ABI. The intervention techniques fell into two broad categories: behavioural modification, and cognitive/meta-cognitive skills. This mirrors the suggestion of Hart and Evans (2006), who describe two types of goal interventions: those targeting the goal itself – rather like the behavioural interventions described here – and those targeting the (metacognitive) process of goal planning – akin to the (meta)cognitive interventions.

Many of the behavioural interventions described in this review comprised single case experimental designs, which have been shown to have empirical value in providing evidence

of treatment efficacy in individual patients (Horner et al., 2005; Perdices & Tate, 2009), particularly when the design encompasses alternating treatments, allowing comparison of the effects of individual elements (Richards, Taylor, Ramasamy & Richards, 1999). All the studies included here employed interventions tailored to individual clients' abilities and circumstances. All were successful in improving clients' adherence and compliance to rehabilitation. This supports previous research, which suggests that behavioural strategies are most effective where learning paradigms are task-specific, have clearly stated, adaptive goals, are supported by environmental modifications, and are meaningful to the individual (Sohlberg & Mateer, 2001; Ylvisaker et al., 2008; Hufford et al., 2012). However, all of the behavioural interventions characterised engagement in terms of adherence and/or compliance and did not measure the clients' internal motivation or engagement with rehabilitation. In addition, the lack of consensus in the research literature regarding the appropriate calculation of effect sizes for single case designs (Campbell & Herzinger, 2010; Lane & Gast, 2014) made comparison between these and other study designs extremely difficult.

The most successful behavioural technique described in this review appears to be the use of contingent rewards, which increased rehabilitation compliance in several studies (Hegel, 1988; Zencius, Wesolowski & Burke, 1989; Manchester et al., 1997; Corrigan et al., 2005; Corrigan & Bogner, 2007). Corrigan et al. (2005) suggest that the use of a financial incentive may have created cognitive dissonance in clients that was resolved by placing a higher value on the treatment itself. The use of contingent rewards has been shown to be effective in changing behaviour in a wide range of circumstances. Barrier reduction and behavioural contracting techniques were also shown to be effective in this client group (Newell, 1997; Corrigan et al., 2005; Corrigan & Bogner, 2007; Hufford et al., 2012).

Those cognitive interventions demonstrating the greatest success were those which empowered the client to play an active role in their rehabilitation. These ranged from providing clients with tailored information about their condition (Pegg et al., 2005) through to interventions targeting broader meta-cognitive processes, equipping clients with the skills to plan, execute and evaluate their own rehabilitation (Skidmore et al., 2011) or enabling client involvement in a collaborative process of identifying, working towards and evaluating rehabilitation goals (McPherson et al., 2009; Lane-Brown & Tate, 2010).

One surprising finding of the review was the lack of evidence for the effectiveness of motivational interviewing in this client group. Of those studies utilising this technique, MI was either found not to be more effective than goal setting alone (Corrigan et al., 2005) or its effects were not sufficiently measured (Hsieh, Ponsford, Wong, Schönberger, Taffe & Mckay, 2012; Hsieh, Ponsford, Wong, Schönberger, Mckay & Haines, 2012). This appears to contradict the suggestion of others (Medley & Powell, 2010; Holloway, 2012). It is possible that MI is effective in increasing motivation for rehabilitation in this group, but that the design of the studies reviewed here was insufficient for evaluation.

In terms of rehabilitation setting, the majority of behavioural interventions described here took place in inpatient settings and evaluated adherence/compliance with rehabilitation, while the (meta)-cognitive interventions were largely set in outpatient or home settings and evaluated goal attainment or engagement. Generally, inpatient rehabilitation for adults with ABI is targeted at those who are experiencing significant functional or psychological problems and often occurs in the early post-injury stages, when awareness of difficulties is lacking and clients are unable to engage with rehabilitation in a meaningful way (Fleming & Onsworth, 2006). It is likely, therefore, that interventions to increase engagement with

rehabilitation in adults with ABI operate on a continuum, reflecting clients' rehabilitation stage. Clients exhibiting difficulties with executive function or lacking in awareness might respond to basic behaviour management strategies, whereas clients further along the recovery process might be more able to grasp the complex ideas and processes of cognitive/meta-cognitive interventions.

Studies employing cognitive or mixed interventions tended to achieve higher quality scores. This was largely due to higher ratings of study design, sample size and description of participants' demographics and co-morbidities. Sample size differences reflect the dominance of single case studies amongst the behavioural studies, while the latter perhaps reflects increasing methodological rigour amongst peer-reviewed journal articles over the last 10 years, during which the majority of the higher rated studies were published. Given Siegert and Taylor's (2004) claims that the literature has hitherto focussed on the pragmatic rather than the theoretical aspects of rehabilitation techniques such as goal setting, this review aimed to evaluate the studies' theoretical contributions. Although all the studies made some attempt at a theoretical explanation, the quality review suggested that this varied.

The principle limitation of this review was the methodological and measurement inconsistencies within the included studies. Methodological difficulties are inherent to the field; many researchers argue that conducting any kind of rigorous evaluation of an intervention, such as an RCT, is very challenging in adults with ABI (Turner-Stokes et al., 2005; Perdices & Tate, 2009; Lane-Brown & Tate, 2010; Holloway, 2012). The ubiquity of single case studies and the lack of consensus over the statistical analysis of SCEDs (Lane & Gast, 2014; Shadish et al., 2014) make synthesis of findings difficult.

There are a number of potential reasons for these methodological inconsistencies. First, adults with ABI are a very heterogeneous group. The most successful interventions are those that are tailored to the individual and their circumstances, as similar interventions can result in different functional manifestations in different individuals and situations (Perdices & Tate, 2009). Second, rehabilitation interventions are often very complex and target multiple outcomes, which can be difficult to evaluate independently (SIGN, 2013). Third, essential elements of rehabilitation such as goal setting and the therapeutic alliance are in themselves interventions (Schönberger, Humle & Teasdale, 2005; 2006), rendering it impossible and unethical to measure the effectiveness of the individual components of a rehabilitation intervention (SIGN, 2013). Many of the interventions included here employed goal setting as part of the rehabilitation process. This was generally not evaluated in itself, illustrating its ubiquity in neuro-rehabilitation (Siegert et al., 2004; Levack, Taylor, et al., 2006; Playford et al., 2009). Furthermore, several of the interventions used Goal Attainment Scaling (GAS) as an outcome measure. GAS ensures that the principles and goals of cognitive rehabilitation take clients' personal needs and preferences into account, reflecting improvement in functional ability on a standardised scale while incorporating their own priorities (Bouwens et al., 2009; Turner-Stokes, 2009). Hart and Evans (2006) argue that, while useful in a clinical setting, GAS is itself an intervention as it facilitates client involvement in setting rehabilitation goals. This is borne out in the finding by McPherson et al. (2008) that clients in the treatment group attained equivalent or lower GAS scores to the control group. The therapeutic working alliance has been shown to be consistently positively associated with treatment success for a wide range of psychotherapeutic techniques (Bordin, 1979; Martin, Garske & Davis, 2000). Schönberger et al. (2006) demonstrated that the development of the therapeutic working alliance improves rehabilitation outcome in adults with ABI primarily by increasing clients' awareness.

Measurement is an acknowledged issue in this field. The 15 studies included in the review differed considerably in their characterisation and measurement of rehabilitation engagement. The majority of studies characterised engagement in terms of adherence, whether attendance at rehabilitation sessions, or rehabilitation effort. Several studies considered a lack of disruptive behaviour, apathy, or anxiety as indicators of increased engagement. Others utilised progress towards rehabilitation goals outcome as a marker of engagement. It is common in neuropsychological rehabilitation for disability scales to be used as an outcome measure rather than goal attainment; both reflect important aspects of the rehabilitation process but often there is a poor correlation between the two (Liu, McNeil & Greenwood, 2004). Only two studies in this review utilised specific (although different) measures of rehabilitation engagement (Pegg et al., 2005; Skidmore et al., 2011). The database searches revealed a validated measure of rehabilitation engagement (Chervinsky et al., 1998). However, none of the studies included in this review utilised this measure. None of the studies utilised a measure of the clients' internal motivation or engagement. It may be that impaired awareness or cognitive difficulties raise questions regarding the accuracy of such measurements; nevertheless tools such as the Working Alliance Inventory (Horvath & Greenberg, 1986, 1989) provide a structured means of measuring client engagement and have been used in this client group (Schönberger et al., 2006).

A number of studies identified by this review described interventions targeting specific functional barriers to rehabilitation, such as goal recall (Hart, Hawkey & Whyte, 2002; Culley & Evans, 2010) or goal planning (Chang, Chen & Chou, 2012; De Joode, van Heugten, Verhey & van Boxtel, 2013). Although excluded due to the review's focus on

engagement, these studies highlight the potential effectiveness of technological innovations in this client group.

In conclusion, interventions to facilitate engagement with rehabilitation interventions amongst adults with ABI are vital to increase health professionals' ability to serve this population and reduce the costs associated with delayed engagement, premature termination of rehabilitation, or ineffective interventions (Corrigan et al., 2005; Holloway, 2012). This review suggests that interventions can be successful in increasing engagement, but they should ideally be tailored to the individual's abilities and circumstances. Contingency management may be successful in increasing adherence/compliance with rehabilitation, while training in the meta-cognitive skills needed for goal setting, monitoring and evaluation may increase rehabilitation engagement. This review found little evidence for the use of MI in increasing rehabilitation engagement in this client group. Finally, this review highlighted the methodological and measurement inconsistencies inherent to the field and the scarcity of high quality evaluation of interventions. More research is needed to identify the mechanisms by which rehabilitation elements – especially integral elements such as goal-setting and the therapeutic working alliance – increase the effectiveness of rehabilitation interventions in this complex and heterogeneous population.

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A) Study design (1 = Case studies; 2 = Observational studies without control group; 3 = Controlled observation studies (no manipulation of variable); 4 = Quasi-experimental studies (without randomisation) – e.g. pre-test & post test of treated and comparison group (usual treatment); 5 = RCTs)
B) Sample size (1 = 1; 2 = 2-5; 3 = 5-19; 4 = 20-49; 5 = 50+)
C) Description of participants' demographics and co-morbidities
D) Description of participants' function (this might include type, timing and location of injury, and any functional 'deficits' experienced)
E) Description of intervention (detailed, clear, <u>replicable</u>)
F) Outcome: objective measure of engagement/compliance/adherence
G) Theoretical basis for the intervention in terms of engagement with rehabilitation.

Table 1: Quality assessment criteria: Rated 1 (poor) to 5 (good)

Study / Setting / Target	Participants	Functional weaknesses	Study design	Intervention Who / How / Techniques used Length of intervention (d = days)	Comparator	Outcome measure	Results ES = Effect Size (from article). d = Cohen's d
Behavioural interventions							
1. Zencius, Wesolowski & Burke, 1989 / Inpatient / Attendance at therapy sessions	N=2 Male, 16 Female, 16 MVA	Impulse control problems Refusal of therapy	SCED Reversal design ABACAD / ABACDE	Rehabilitation staff, in person Behavioural contracting (5d), baseline (4d/6d), contingency reward points system (20d/13d), baseline (7d), points plus response costs (male, 35d), financial incentive (13d/20d).	Baseline alternating with intervention phases	% of therapy sessions attended.	Baseline: 41 / 45 Contract: 95 / 93 Contingent reward: 88 / 92 Baseline: 51 / 68 + response costs: 94 Financial incentive: 100 / 100 Maintained at 2 month follow-up
2. Zencius, Wesolowski, Burke & McQuade, 1989 / Inpatient / 1. Unauthorised breaks, 2. Use of cane, 3. Therapy attendance	N=2 Male, 24 [1] 6 yrs post MVA Female, 24 [2-3] 2 yrs post MVA	Male: vision, memory & cognition, impulse control. Female: balance & co-ordination, cognition.	SCED Reversal design ABC / ABCDAED	Rehabilitation staff, in person 1. Verbal contract (10d) + written behavioural prompts (6d). 2. Praise (7d), staff prompts (12d), antecedent control (10d), baseline (4d), written contract & contingent rewards (6d). 3. Verbal prompts (baseline, 10d), written invitation (19d), daily schedule (13d), baseline (5d), verbal contract & contingent rewards (4d), daily schedules.	1. Patient behaviour pre-intervention (16d) 2. Patient pre-intervention + treatment phases + baseline 3. Patient pre-intervention + treatment phases + baseline.	1. Mean number (and length) of unauthorised breaks. 2. % of time using cane. 3. % therapy sessions attended.	1. Baseline: 4.1 Contract: 1.4 Prompts: 0.17 2. Baseline 43% Praise 61 / Prompts 72 / Antecedent control 96 / Baseline 7 / Contract 0 / Contingent rewards 100 3. Baseline 42.5 / Written invite 95 / Daily schedule 96 / Baseline 35 / Contract 56 / Daily schedules 100.
3. Manchester et al., 1997 / Inpatient / Absconding	N=1 Male, 17 8 months post MVA	Intellectual function, attention & concentration, aggression & behavioural problems	Single case study AB	Rehabilitation staff, in person Contingent reward / token economy with individualised rewards. Daily reminders of desirability of target behaviour 13 weeks.	Patient pre-intervention.	Number of episodes of absconding.	Baseline: 20 in 11 days (1.81 per day) Intervention: Weeks 1-5 mean 0.66 per day. Week 6 onwards: 0.

4. Hegel, 1988 / Inpatient / % attainment of goals, reduce vocalisations	N=1 Male, 18 2 months post MVA	Behavioural disinhibition & apathy, mild dysphonia, attention, concentration, memory, visual perception	SCED Multiple baselines & reversal design ABCB	Rehabilitation staff, in person Goal setting and extinction procedure to target vocalisations (4d, baseline). Contingent phase: tokens in response to goal attainment and failure (6d, 14d) Non-contingent phase: tokens regardless of behaviour (4d).	Patient pre-intervention versus contingent phase versus non-contingent phase versus contingent phase	Number of disruptive vocalisations. % of therapeutic goals met in physical (PT), occupational (OT) and speech (ST) therapy.	Baseline: mean 12.13. Contingent phase: 0. PT: 9 / 76 / 28 / 88 ST: 21 / 88 / 42 / 92 OT: 33 / 78 / 17 / 96
5. Newell, 1997 / Outpatient / Rehab costs & complaining behaviour	N=1 Male, 28 9 yrs post-injury	Poor impulse control & socialisation. Verbal abuse towards therapists.	Single case study	Insurance case manager, in person. Collaborative goal setting and written behaviour contract. No timings given.	Patient pre-intervention.	Verbal abuse incidents. Patient's feelings of control over life and rehabilitation. Rehabilitation progress and costs.	Abuse decreased. Control increased. Moved to less intensive & costly setting and returned to work.
6. Hufford et al., 2012 / Inpatient / Adherence to rehabilitation & agitation	N=1 Male, 37 4-13 days post-injury, fell down stairs	Impulsivity, distractibility, perseveration, unawareness. Memory, thought & attention Visual neglect.	Single case study	Rehabilitation staff, in person. Behavioural contract listing expected positive behaviours, and providing education regarding injury & subsequent effects (3d). Motivation enhanced by letter from employer allowing return to work after completing rehabilitation.	Patient pre-intervention (10d)	Staff-rated daily adherence to contract. Agitated Behaviour Scale (ABS).	100% adherence ABS scores declined from 40 to 14 (below threshold).
7. Yuen, 1996 / Inpatient / Avoidance behaviour	N=1 Male, 55 1 year post cerebro-vascular accident	Abusive behaviour. Aphasia, impulsivity, perseveration, attention, apraxia	SCED Single case study ABAC	Rehabilitation staff, in person Graded confrontation: indirect (staff discussed behaviour in patient's presence) then direct (staff role-playing behaviour, & explaining need for rehabilitation) confrontation. 4 weeks.	Patient pre-intervention and between phases.	Number of episodes of blank staring. Staff-observed participation in therapy and rehabilitation goals.	Indirect: 0 episodes for 2 weeks, then increased. Direct: 0 episodes. Rehabilitation participation and progress improved rapidly.

8. Sohlberg et al., 2011 / Home / Exercise compliance	N=2 Female, 61 15 months post aneurysm Female, 40 2 yrs post toxic medication reaction	Memory and attention Executive attention and working memory	SCED ABABAB ABABAA	Student clinicians, in person + self-directed, at home Televised Assistance Program (TAP) system to administer attention-based home rehabilitation. Alternating conditions: exercises at pre-determined time ('push') versus participant initiated ('pull'). 6 weekly sessions.	Compliance between pre-intervention and two conditions, and between participants	% of exercises completed. Goal Attainment Scale category.	Subject 1: 'Push' condition mean 55.75% 'Pull' condition: 0. Subject 2: 'Push' condition mean 63.5% 'Pull' condition: 28.3% 1: pre-intervention -1, post +1 2: pre-intervention 0 post +2
9. Corrigan & Bogner, 2007 / Outpatient / Session attendance over 1 month	N=74 62% male, 57% Caucasian Age 42.5 yrs Mean 7.5 yrs post-injury	Functional abilities. No further details given.	RCT	Research assistants, single telephone interview. Attention control: verified record. Financial incentive: \$20 reward for perfect attendance. Barrier reduction: specific barriers to attendance discussed & overcome.	Attention control (N=24) versus barrier reduction (N=26) versus financial incentive (N=24).	Number of appointments missed. % perfect attendance. Therapeutic alliance (Helping Alliance Questionnaire II). % premature termination of treatment. % goals met	1.04 / 0.73 (ES = -0.46) / 0.29 (ES = -1.69) 42% / 62% / 75% 50% / 35% / 33% 17% / 23% / 33%
Cognitive interventions							
10. McPherson et al., 2009 (& Ylvisaker et al., 2008) / Inpatient / Goal attainment	N=34 27 Male Median age 29 / 28 / 40	No detail. Inclusion criteria: moderate to severe trauma with disabling consequences	Pilot RCT Block randomisation	Key workers, weekly x6. Goal Management Training: protocol used to identify steps involved in one goal. Identity-oriented goal training: six-step process using identity mapping to identify goals & action strategies.	TAU (N=12) versus Goal Management Training (N=10) versus Identity-oriented goal training (N=5)	Goal Attainment Scale score: Baseline / Post-intervention / 3 month follow-up	TAU: 28.34 / 57.69 (d=3.14) / 51.63 (d=2.63) Goal Management: 26.38 / 47.56 (d=2.09) / 43.97 (d=1.48) Identity-oriented: 26.15 / 50.76 (d=2.51) / 48.48 (d=2.67)
11. Skidmore et al., 2011 / Inpatient / Engagement	N = 1 31 Male 7 days post-stroke	Mild impairment attention &	Single case study	Trained therapist, in person 1 daily 45-minute session; 10 sessions over 2 weeks.	Patient improvement from admission	Pittsburgh Rehabilitation & Participation Scale (1-6).	Baseline: 3.2 Post-intervention: 4.9

and functional ability		executive function Severe impairment to visuospatial abilities.		Cognitive Orientation to daily Occupational Performance approach: client-driven meta-cognitive strategy training. Aimed to identify, set & address goals, self-monitor & direct learning & rehabilitation.		Assistance with ADLs: Functional Independence Measure and Performance Assessment of Self-Care Skills.	Baseline: 68 Post-intervention: 97 Baseline: 1.1 Post-intervention: 2.9
12. Hsieh et al., 2012* Outpatient / CBT effectiveness	N=27 21 Male 37% < 1yr, 26% 1-2 yrs, 37% 3yrs+ post injury	Cognition. Mood – depression and anxiety	RCT	Clinical (neuro)psychologist, in person. MI+CBT: 3 weekly sessions MI + 9 sessions CBT. Non-directive counselling (NDC) + CBT: 3 sessions NDC + 9 sessions CBT. Treatment As Usual (TAU).	TAU (N=8) versus NDC+CBT (N=10) versus MI+CBT (N=9)	HADS Anxiety pre- to post-treatment.	NDC+CBT: ES = .24 MI+CBT: ES = .50 TAU = non-significant
13. Pegg et al., 2005 / Inpatient / Rehabilitation effort	N=28 89% Male	None	Randomised 2x2 factorial design	Psychologists, in person. 3 x 60 min session at beginning, middle & end of inpatient stay. Personalised information: review patient's injury & rehabilitation progress. Control = generalised information provision: videotapes of general information on brain injury rehabilitation.	High vs low desire for information, and personalised vs generalised information condition (2x2)	Rehabilitation Intensity of Therapy scale – therapists' rating. Functional Independence Measure.	Speech Therapy: mean change 0.32 Physical Therapy: mean change 0.58 (d=1.30) Personalised group showed greater cognitive improvement.
Mixed interventions							
14. Lane-Brown & Tate, 2010 / Home / 3 goals: organisational, fitness & social.	N=1 Male, 32 3 yrs post MVA	Planning & organisation, processing speed, memory, difficulty sustaining activity, apathy.	SCED Multiple baseline, experimental design AABCA	Psychologist, in person. Goal setting: 3 target behaviours identified. 2 goals (organising bedroom & increasing fitness) targeted after mastery of previous goal. Motivational interviewing: to assist in initiating and sustaining goal-directed activity. External compensation: daily reminder alert to PDA 28 x 1 hour weekly sessions	Patient pre-intervention, post-treatment & 4 week follow-up	Number of minutes dedicated to 2 target behaviours and progress towards goals (tidiness rating scale and time to run 200m). Self, relative and clinician ratings on Apathy Evaluation Scale and Apathy	Goal 1: ES = 1.44 Goal 2: ES = 1.29 AES Reliable change index: Self 2.6 / Relative 7.1 / Clinician 2.7 AFSBS:

				7.5 months total.		subscale of Frontal Systems Behaviour Scale	Self 4.3 / Relative NS / Clinician 2.1
15. Corrigan et al., 2005 / Outpatient / Target: attendance, treatment compliance initial treatment engagement	N=195 138 male 57 female Age 36.6 yrs Mean 8 yrs post injury	Cognition. No further details given.	RCT	Program staff, single telephone interview. Attention control: verified record. Motivational interview: elicited expectations, reinforced goals, expressed hope of favourable outcome. Barrier reduction: barriers to attendance discussed & overcome. Financial incentive: \$20 reward for completing initial assessment.	Attention control vs motivational interview vs barrier reduction vs financial incentive	% of subjects signing agreement in 30 days. Average time to sign agreement (days). % of participants who missed any appointment. % who prematurely terminated treatment within 3 months and 6 months.	45% / 45% / 74% / 83% 34.8 / 44.0 / 32.1 / 22.8 64% / 57% / 42% / 40% 15% / 9% / 6% / 4% 47% / 34% / 16% / 21%

Table 2: Characteristics of included studies

Notes: SCED = Single Case Experimental Design. * Hsieh, Ponsford, Wong, Schönberger, Taffe & Mckay (2012) and Hsieh, Ponsford, Wong, Schönberger, Mckay & Haines (2012).

Study	Type	Criteria							Total
		A	B	C	D	E	F	G	
1. Zencius et al 1989a	Beh	3	2	1	2	4	5	4	21
2. Zencius et al 1989b	Beh	2	2	4	2	4	5	4	23
3. Manchester et al, 1997	Beh	1	1	1	5	5	3	3	19
4. Hegel, 1988	Beh	3	1	1	4	5	4	3	21
5. Newell, 1997	Beh	1	1	1	2	4	2	3	14
6. Hufford et al, 2012	Beh	1	1	5	5	5	4	5	26
7. Yuen, 1996	Beh	1	1	4	5	5	5	5	26
8. Sohlberg et al, 2011	Beh	4	2	1	4	5	5	4	25
9. Corrigan & Bogner, 2007	Mixed	5	5	5	2	5	4	4	30
10. McPherson et al, 2009 (& Ylvisaker et al 2008)	Cog	5	4	3	1	5	4	4	26
11. Skidmore et al, 2011	Cog	1	1	5	5	5	5	5	27
12. Hsieh et al, 2012a & Hsieh et al, 2012b	Cog	5	4	4	5	5	1	3	27
13. Pegg et al, 2005	Cog	5	4	3	2	4	5	5	28
14. Lane-Brown & Tate, 2010	Mixed	3	1	5	5	3	5	4	26
15. Corrigan et al, 2005	Mixed	5	5	5	3	5	5	3	31

Table 3: Quality assessment results

Note: A. Study design. B. Sample size. C. Description of participants' demographics and co-morbidities. D. Description of participants' function. E. Description of intervention. F. Outcome. G. Theoretical basis for the intervention.

Beh = Behavioural; Cog = Cognitive

Figure 1: Flow diagram of articles selected for systematic review

