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The Relational Neurobehavioral Approach: Can a Non-Aversive Program Manage Adults with Brain Injury-Related Aggression Without Seclusion/Restraint?

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Abstract

Purpose—The Relational Neurobehavioral Approach (RNA) is a set of non-aversive intervention methods to manage individuals with brain injury-related aggression. New data on interventions used in the RNA and on how the RNA interventions can be used with patients with acquired brain injury (ABI) who have differing levels of functional impairment are provided in this paper.

Method—The study was conducted over a 6-week period in a secure 65-bed program for individuals with ABI that is housed in two units of a skilled nursing facility (SNF). Implementation of the RNA was compared between two units that housed patients with differing levels of functional impairment ($n = 65$ adults). Since this was a hierarchical clustered dataset, Generalized Estimating Equations regression was used in the analyses.

Results—RNA interventions used to manage the 495 aggressive incidents included: *Aggression ignored, Closer observation, Talking to patient, Reassurance, Physical distraction, Isolation without seclusion, Immediate medication by mouth, Holding patient*. Different interventions were implemented differentially by staff based on level of functional impairment and without use of seclusion or mechanical restraint.

Conclusions—The RNA can be used to non-aversively manage aggression in patients with brain injury and with differing levels of functional impairment. Programs adopting the RNA can potentially manage brain injury-related aggression without seclusion or mechanical restraint.

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DECLARATION OF INTEREST

The authors declare that there is no conflict of interest.

INTRODUCTION

A set of non-aversive intervention methods called the Relational Neurobehavioral Approach (RNA) [1,2] for managing individuals with brain injury-related aggression is described in this paper.

Causes of human aggression have been described in the literature according to various social psychological [3], neurobiological [4–10] and behavioral [11–15] models. Aggression is a frequently reported consequence of brain injury [16–20], and aggression can be divided into verbal or physical subtypes [16]. Based on this vast literature but with emphasis on the frustration-aggression hypothesis [3], aggression is conceptualized in this paper as occurring in the neurobehavioral population in the following stages (Figure 1): 1) Predisposition to aggression; 2) Ongoing stress/arousal (high vs. low); 3) Triggers/instigations to aggression (high vs. low); 4) Cognitive control (high vs. low); and the resultant 5) Verbal and/or Physical aggression.

Although this stage model is not intended to capture all of the issues that lead some patients with brain injury to aggress, RNA interventions are placed in context in this model when managing brain injury-related aggression. In the frustration-aggression hypothesis, aggression is conceptualized as a reaction to the disruption of planned or ongoing activity or the thwarting of an individual's goals [3]. In contrast, instrumental aggression is maintained by environmental contingencies. There is empirical support for dividing aggression into reactive hostile/angry aggression and proactive/instrumental aggression subtypes [13]. This division has potential treatment consequences. Frustration-related aggression that is repeatedly triggered by particular stimuli may become automatic and may be resistant to reductions by consequence manipulation [21]. Recent literature includes approaches that attempt to avoid eliciting frustration-related aggression and avoid the use of extinction procedures, instead teaching alternative behaviors to assist patients to meet their needs [22]. The RNA described in this paper is one of several such non-aversive approaches used to manage aggression, such as errorless rehabilitation [23], low-demand compliance training [24,25], positive behavioral supports [26,27], and verbal mediation approaches based on motivational interviewing [28]. This paper is intended to add to these approaches, to provide clinicians with a way to conceptualize the targeting of non-aversive interventions, and to provide another set of tools to manage the complex problem of brain injury-related aggression.

The RNA is based on learning theory and principles of social psychology and aims to limit demands and minimize the use of interventions that patients may find aversive and that may instigate aggressive responses [1,2,29,30]. A philosophy of non-confrontation, normalization, positive engagement and support, and functional and behavioral skill development are emphasized. The non-aversive program attempts to manage aggression using multiple methods, including increasing the availability of non-contingent reinforcement, attempting to change the state of the patient's arousal (thereby reducing current propensity to aggress), reducing instances of the eliciting stimuli, and enhancing (where possible) the patient's ability to consciously suppress aggressive behaviors [31–33].

Based on a patient's biological, psychological and social predisposition, an individualized program for each patient is developed to manage that patient's pathway to aggression (Figure 1). Staff attempt to inform rehabilitation efforts with an understanding of the patient's goals and recognition of the transactional meanings of interactions. Some key components of the RNA are aimed at reducing ongoing stress/arousal from the environment (e.g., interactions with peers and/or staff) and triggers to the instigation of aggression (Figure 1). These components include [32]: antecedent control; physical environment and proximity management; rewarding activities program; and active medication management. Practical features of the RNA include: avoidance of coercive interactions from staff and staff demands for action from patients (e.g., getting out of bed/shower at certain times); staff offices being located on the treatment units in order to actively engage with patients; staff scheduling rewarding one-on-one interactions with patients (e.g., going on walks, one-on-one meals); cognitive difficulties being identified on all treatment plans; and specific seating assignments in common areas (e.g., dining room) to avoid known interpersonal or environmental instigations to aggression.

As ongoing stress/arousal and triggers to instigation are being addressed, a patient's capacity for cognitive control is also considered in the RNA (Figure 1). For those patients who are capable of a high level of cognitive control (e.g., patients who can deliberately attempt to suppress an ongoing response tendency to aggress), a cognitive intervention/restructuring approach is used to manage imminent aggressive behaviors. Whereas for those patients with a low level of cognitive control (e.g., patients who are profoundly impaired), antecedent control and physical environment & proximity management are used to manage imminent aggressive behaviors. Once aggression occurs despite efforts to prevent it, its effects are minimized, and attempts are made to rapidly deescalate the patient. The individualized program is continuously reexamined and adjusted to help prevent or decrease the risk of future aggression.

Previous data regarding the RNA are as follows. In a report of two patients with traumatic brain injury [34], preliminary evidence of the RNA showed eliminating absconding behaviors from a residential facility. In a sample of 40 brain-injured patients [29] over a 20-month period, preliminary evidence of the RNA showed successful management of aggression in six especially aggressive patients who were responsible for 78% of the aggressive incidents in a skilled nursing facility (SNF). In a final publication [2], the type and frequency of antecedents to aggressive incidents were reported.

In this paper, data on the RNA not previously reported are used to attempt to answer the following questions: 1) What were the specific interventions used to manage aggressive incidents in a SNF that adopted the RNA?; 2) Since the SNF was physically divided into 2 units (unit 2 housing more functionally impaired patients than unit 1) and the RNA was used on both units, can the RNA be used to manage aggression in brain-injured patients with different levels of impairment?; and 3) In a SNF that adopted the RNA, can aggression be managed without seclusion/restraint procedures? This paper contributes to the scientific literature on managing brain injury-related aggression by adding new data on specific interventions used by the non-aversive RNA and on how the RNA interventions can be used with patients with acquired brain injury who have differing levels of functional impairment.

METHODS

Study Setting

Data collection procedures and detailed descriptions of the facility and the patients were previously described [2]. Ethical consent for the study was given by the Institutional Review Board at Samuel Merritt University (Oakland, California), and verbal and written informed consent was obtained for all participants. This manuscript describes data collected over a 6-week period of the ongoing RNA intervention at this SNF.

The study was conducted in a secure 65-bed program over a 6-week period for individuals with acquired brain injury that is housed in two units of a SNF in the San Francisco Bay area. The 65-bed program is physically divided into 2 units. The determination of which patient is placed on which unit is by interdisciplinary team consensus and the clinical team's assessment of the patient's likely response to the two units' differing environmental demands. Unit 2 houses more functionally impaired patients than unit 1. All staff rotate through both units to obtain clinical experience with patients of different degrees of cognitive and functional impairment. Having the unit dichotomy allows for a comparison of the implementation of the RNA by staff across patients with differing levels of functional impairment.

All interdisciplinary staff attend an 8-hour training in the RNA, and the concepts are reinforced during weekly staff behavior management meetings. The interdisciplinary staff also meets with the program's primary care physician and psychiatrist weekly for a review of patients exhibiting distress or problematic behavior. The SNF has a rich staffing environment. Typically, per unit, there are 2–3 registered nurses or licensed vocational nurses, 7–8 certified nursing assistants, 1–2 recreational therapists, and 3–4 activities therapists.

All staff in routine patient contact were approached to participate in this study. Out of 75 staff approached, 63 (84%) agreed to participate. One therapist and one registered nurse declined to participate for unknown reasons. The remaining 10 staff who declined to participate were dietary staff who cited limited patient contact, or laundry/housekeeping staff who frequently cited poor English language skills when declining to participate.

Measures

Staff provided demographic data to a research assistant within 7 days of the beginning of the prospective collection of data on aggressive incidents. The Overt Aggression Scale–Modified for Neurorehabilitation–Extended (OAS-MNR-E) [35,36] is a standardized, reliable, and valid incident-based measure that allows for the rating of the antecedents, duration, nature, severity, location, and interventions used to manage aggressive incidents in a neurobehavioral population. Facility staff use the OAS-MNR-E for routine data collection regarding incidents [29]. Over a 6-week period, a research assistant collected reports of aggressive incidents using the OAS-MNR-E from staff informants as soon as possible following an aggressive incident and all within 72 hours of occurrence. When staff members were not scheduled to return to the facility during the 72 hours following an incident,

interviews were conducted by telephone. All incident reports were finalized within 72 hours of the actual incident.

The Adaptive Behavior and Community Competency Scale (ABCCS) was used as a measure of functional impairment [37]. The four scores used to compare patients on both units were: Activities of Daily Living composite (continence, bathing & dressing items); Language composite (understanding others & understandability items); Cognition composite (attention, memory & leisure items); and Mobility. Higher scores indicate greater level of functional ability.

Statistical Analysis

All analyses were conducted using Stata/SE version 14.1 (College Station, TX), and p -values < 0.05 were considered as significant. Fisher's exact tests were used as appropriate. Since each patient could have more than one incident and incidents by the same patient would be naturally correlated with each other (i.e., incidents are "clustered" by patient), this dataset was a hierarchical clustered dataset [38]. Generalized Estimating Equations (GEE) regression was used to conduct the clustered analyses, since there was one level of clustering (e.g., patient) and since the number of clusters was overall greater than the number of observations per cluster.

GEE linear or logistic regression was used as appropriate, depending on whether the outcome variable was linear or binary (respectively). A Gaussian or binomial family was used as appropriate when specifying the distribution. The identity or logit link function was used as appropriate and an independent correlation structure was used for all clustered analyses. Robust standard errors were used for all clustered analyses, as valid standard errors are obtained with the robust option even when the assumed correlation structure for a particular analysis is wrong.

RESULTS

Demographic and Clinical Features of Patients

Demographic and clinical features of the patients by unit are presented in Table 1. Age, sex, ethnicity, percentage of aggressive incidents, and primary reason sent to the facility were not significantly different between units. Patient diagnoses differed significantly between the units. Regarding the functional scales, patients on unit 1 had a significantly greater composite Activities of Daily Living, Language and Cognition scores (i.e., were less impaired) than patients on unit 2; patient Mobility scores were not significantly different between the units.

Features of Aggressive Incidents

Aggressive incidents were compared between units after accounting for clustering. Of the 137 incidents reported in unit 1, 65% were verbal aggression and 35% were physical aggression, whereas of the 358 incidents reported in unit 2, 38.5% were verbal aggression and 61.5% were physical aggression (odds ratio (OR) = 2.96, $p = 0.02$). Staff were a target in 83.2% of incidents on unit 1 and 64.5% of incidents in unit 2 (OR = 0.37, $p = 0.023$).

Other patients were a target in 18.2% of incidents in unit 1 and 30.2% of incidents in unit 2 (OR = 1.94, $p = 0.13$). Patients targeted themselves (e.g., made derogatory comments directed at themselves or hit their heads) in 2.2% of incidents in unit 1 and 8.4% of incidents in unit 2 (OR = 4.09, $p = 0.051$). Objects/property were a target in 2.2% of incidents on unit 1 and 14.0% of incidents on unit 2 (OR = 7.25, $p = 0.016$). Unseen persons/hallucinations were a target in 1.5% of incidents on unit 1 and 2.0% of incidents on unit 2 (OR = 1.35, $p = 0.82$).

Features of Antecedents for Incidents

The antecedents for all incidents after accounting for clustering are presented in Table 2. The order of the antecedents listed in Table 2 is the same order of the antecedents listed on the OAS-MNR-E. Compared to unit 2, the following four antecedents were reportedly significantly more frequently on unit 1: *Given direct instruction*, *Request explicitly denied*, *Any other verbal interactions*, *Other – Change in routine*. Compared to unit 1, the following three antecedents were reportedly significantly more frequently on unit 2: *Agitated/distressed*, *Other patients' behavior*, *Direct response to other patients' verbal behavior*. For the category “Other”, the staff member filling out the OAS-MNR-E form can hand-write information not listed in the pre-determined antecedent categories. The five most common “Other” descriptions categorized post-hoc are listed in Table 2.

Features of Interventions for Incidents

The interventions for all incidents after accounting for clustering are presented in Table 3. Compared to unit 1, there were significantly more interventions when staff and unseen person/hallucination were targets on unit 2. The specific RNA interventions used to manage aggression included: *Aggression ignored*, *Closer observation*, *Talking to patient*, *Reassurance*, *Physical distraction*, *Isolation without seclusion*, *Immediate medication by mouth*, and *Holding patient*. Compared to unit 1, the following two interventions were reportedly significantly more frequently on unit 2: *Talking to patient*, *Immediate medication by mouth*. Compared to unit 2, *Reassurance* was reportedly significantly more frequently on unit 1. No seclusion or mechanical restraint procedures were ever used.

Interventions on Unit 2 based on Type of Incident – Any Staff vs. Other Patients

Whether the type of intervention differed based on the target of the incident on unit 2 after accounting for clustering is presented in Table 4; a similar analysis on unit 1 was not conducted, since there were too few incidents to perform this analysis. When the analysis was limited to verbal incidents, the intervention of *Talking to patient* was used significantly more frequently when another patient was the target than when staff was the target; the intervention of *Immediate medication by mouth* was used significantly more frequently when staff was the target than when another patient was the target. When the analysis was limited to physical incidents, the interventions of *Aggression ignored* and *Immediate medication by mouth* were used significantly more frequently when staff was the target than when another patient was the target; the intervention of *Physical distraction* was used significantly more frequently when another patient was the target than when staff was the target. No seclusion or mechanical restraint procedures were ever used.

DISCUSSION

These data are summarized by answering the 3 questions posed in the Introduction. 1) The specific RNA interventions used to manage aggression included: *Aggression ignored*, *Closer observation*, *Talking to patient*, *Reassurance*, *Physical distraction*, *Isolation without seclusion*, *Immediate medication by mouth*, and *Holding patient*. 2) Various RNA interventions were implemented differentially by staff based on the level of functional impairment. *Talking to patient* and *Immediate medication by mouth* were more frequently used in patients with a higher level of functional impairment, and *Reassurance* was more frequently used in patients with a lower level of functional impairment. 3) Management of aggression occurred without seclusion or mechanical restraint procedures in the RNA.

The RNA is based on a philosophy of non-confrontation, normalization, positive engagement and support. It has been suggested that using overly restrictive interventions might cause aggressive incidents in patients with brain injury [22,39]. The RNA is an alternative approach to managing aggression, where a non-aversive individualized program is implemented based on a patient's biological, psychological and social predisposition.

Consistent with the findings of others [40], the increased frequency of physical assault on staff from patients on unit 2 may result from both the severity of cognitive impairment (including communication skills) and associated disinhibition and from the increased degree of intrusiveness required by staff as a result of the unit 2 patients' more limited self-care skills. The significantly greater frequency of assaults on objects on unit 2 than on unit 1 may also result from the unit 2 patients' more severe cognitive impairments.

The differences in antecedents between units 1 and 2 may be a result of the different patient populations and the differing environments and demands on patients in the two units. On unit 1, staff have clear behavioral requirements for patients, and consistent with the frustration/aggression hypothesis [3], *Given direct instruction*, *Request explicitly denied*, *Any other verbal interactions*, and *Change in routine* are more frequent antecedents to aggression than on unit 2. Patients on unit 2 are more likely to be rated as *Agitated/distressed*, possibly reflecting the differing diagnoses and more severe cognitive impairment on unit 2 than unit 1. Unit 2 is by design a less demanding environment, and staff behaviors reflect a more intense effort to avoid frustrating patients and thereby eliciting aggressive incidents. Peers' behavior is, however, more difficult to anticipate and deflect. Socially inappropriate/intrusive behavior of peers may be more common on unit 2, and was observed to be a more frequent instigation to aggression on unit 2 than on unit 1 (i.e., *Other patients' behavior*, *Direct response to another patient's verbal behavior*) [41].

The increased use of *Reassurance* as an intervention on unit 1 may be a result of the greater extent of demands place on patients regarding their conduct on unit 1. Consistent with the program's non-aversive philosophy, the most frequently used intervention to verbal or physical aggression against staff is to ignore or downplay the aggression. Both verbal and physical aggression is far more likely to be ignored if it is directed against staff than against peers. Staff on unit 2 may be targeted during activities of daily living care or during feeding, and staff may proceed with these essential activities, despite being targeted, using other

interventions such as *Talking to the patient* to manage the behavior. When peers are the target of physical aggression, staff's primary focus is the immediate termination of the incident. *Physical distraction* was used in 70% of physical aggressive incidents directed at peers on unit 2, an intervention with a percentage higher than any other interventions for any type of incident or target.

Regarding the intervention *Holding patient* (Table 3), a patient's limbs were only held momentarily in the context of preventing imminent assault. This can be viewed as a form of physical restraint. Regarding the intervention *Immediate medication by mouth* (Table 3), many patients in the SNF, in addition to their ABI diagnoses, have psychotic or affective disorders and receive routine antipsychotic and mood stabilizing medications. Patients who appear to be responding to internal stimulation leading to dysregulated behavior may be offered p.r.n. (pro re nata – as needed) medications. Such medication use can be viewed as a form of chemical restraint. No form of mechanical restraint, such as soft ties or leather straps, or seclusion were used in the 2 units with the RNA.

This paper has the following strengths. First, having 2 units in the SNF allowed a comparison of how the RNA was implemented differentially across patients with different levels of impairment, which would have not been possible if patients had not been separated by severity of impairment and had been housed together. Second, since the aggressive incidents were not truly independent of each other, clustering of these incidents by patient was accounted for by using GEE regression in the analysis phase. To the authors' knowledge, clustered analysis has not been performed in the key previous literature related to this topic [2,18,42]. Finally, because of the number of incidents, analyses were broken down by verbal versus physical and compared by the types of interventions by target.

This paper has several limitations. First, all incident reporting was based on staff self-report, which may be subject to recall bias. Objective recording of incidents, such as via video cameras, may have ideally captured other aspects of the incidents not remembered by self-report but presents ethical barriers, as many incident occurred during personal care. Self-report is reasonable in this study since all of the formal incident reports were finalized within 72 hours of the actual incident. This short timeframe for report completion may help limit this form of bias. Second, as the majority of the patient sample was male, Caucasian and had a mean age greater than 40, the results may have limited external validity regarding women, persons of other ethnicities and younger age groups. Third, the design of this study did not allow drawing firm conclusions on the efficacy of the RNA. A future study directly comparing the RNA with another intervention is needed to draw such efficacy conclusions. All we can say is that we have sustained treatment for patients in this facility using the RNA when patients have failed multiple previous treatment sites. Finally, observational ratings were used and a standardized neurocognitive test battery was not used to fully assess the cognitive status of patients.

CONCLUSION

The RNA can be used to non-aversively manage aggression in patients with brain injury and with differing levels of functional impairment. Programs that adopt the RNA can potentially

manage brain injury-related aggression without seclusion or mechanical restraint procedures. Future research validation of the RNA should include direct comparison with other interventions used to manage post-TBI aggression, more detailed cognitive measures, and a more diverse demographic sample.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. Giles GM, Manchester D. Two approaches to behavior disorder after traumatic brain injury. *J Head Trauma Rehabil.* 2006; 21:168–78. [PubMed: 16569990]
2. Giles GM, Scott K, Manchester D. Staff-reported antecedents to aggression in a post-acute brain injury treatment programme: what are they and what implications do they have for treatment? *Neuropsychol Rehabil.* 2013; 23:732–54. [PubMed: 23782342]
3. Berkowitz L. Frustration-aggression hypothesis: examination and reformulation. *Psychol Bull.* 1989; 106:59–73. [PubMed: 2667009]
4. Siever LJ. Neurobiology of aggression and violence. *Am J Psychiatry.* 2008; 165:429–42. [PubMed: 18346997]
5. Coccaro EF, Fanning JR, Phan KL, Lee R. Serotonin and impulsive aggression. *CNS Spectr.* 2015; 20:295–302. [PubMed: 25997605]
6. Haller J. The neurobiology of abnormal manifestations of aggression—a review of hypothalamic mechanisms in cats, rodents, and humans. *Brain Res Bull.* 2013; 93:97–109. [PubMed: 23085544]
7. Karli P. The neurobiology of aggressive behaviour. *C R Biol.* 2006; 329:460–4. [PubMed: 16731503]
8. Kavoussi R, Armstead P, Coccaro E. The neurobiology of impulsive aggression. *Psychiatr Clin North Am.* 1997; 20:395–403. [PubMed: 9196921]
9. Miczek KA, de Almeida RM, Kravitz EA, Rissman EF, de Boer SF, Raine A. Neurobiology of escalated aggression and violence. *J Neurosci.* 2007; 27:11803–6. [PubMed: 17978016]
10. Willner P. The neurobiology of aggression: implications for the pharmacotherapy of aggressive challenging behaviour by people with intellectual disabilities. *J Intellect Disabil Res.* 2015; 59:82–92. [PubMed: 24467721]
11. James AI, Young AW. Clinical correlates of verbal aggression, physical aggression and inappropriate sexual behaviour after brain injury. *Brain Inj.* 2013; 27:1162–72. [PubMed: 23909644]
12. Kerr K, Oram J, Tinson H, Shum D. The correlates of aggression in people with acquired brain injury: A preliminary retrospective study. *Brain Injury.* 2011; 25:729–41. [PubMed: 21561292]
13. Poulin F, Boivin M. Reactive and proactive aggression: Evidence of a two-factor model. *Psychological Assessment.* 2000; 12:115–22. [PubMed: 10887757]
14. Bandura, A. *Aggression: A Social Learning Analysis.* Englewood Cliffs, NJ: Prentice-Hall; 1973.
15. Tateno A, Jorge RE, Robinson RG. Clinical correlates of aggressive behavior after traumatic brain injury. *J Neuropsychiatry Clin Neurosci.* 2003; 15:155–60. [PubMed: 12724455]

16. Rao V, Rosenberg P, Bertrand M, Salehinia S, Spiro J, Vaishnavi S, Rastogi P, Noll K, Schretlen DJ, Brandt J, et al. Aggression after traumatic brain injury: prevalence and correlates. *J Neuropsychiatry Clin Neurosci*. 2009; 21:420–9. [PubMed: 19996251]
17. Baguley IJ, Cooper J, Felmingham K. Aggressive behavior following traumatic brain injury: How common is common? *Journal of Head Trauma Rehabilitation*. 2006; 21:45–56. [PubMed: 16456391]
18. Alderman N. Prevalence, characteristics and causes of aggressive behaviour observed within a neurobehavioural rehabilitation service: predictors and implications for management. *Brain Inj*. 2007; 21:891–911. [PubMed: 17729043]
19. Visscher AJ, van Meijel B, Stolker JJ, Wiersma J, Nijman H. Aggressive behaviour of inpatients with acquired brain injury. *J Clin Nurs*. 2011; 20:3414–22. [PubMed: 21752131]
20. Riggio S. Traumatic brain injury and its neurobehavioral sequelae. *Psychiatr Clin North Am*. 2010; 33:807–19. [PubMed: 21093680]
21. Bargh JA, Chartrand TL. The unbearable automaticity of being. *American Psychologist*. 1999; 54:462–79.
22. Ylvisaker M, Turkstra L, Coehlo C, Yorkston K, Kennedy M, Sohlberg MM, Avery J. Behavioural interventions for children and adults with behaviour disorders after TBI: a systematic review of the evidence. *Brain Inj*. 2007; 21:769–805. [PubMed: 17676437]
23. Ducharme JM. “Errorless” rehabilitation: strategies of proactive intervention for individuals with brain injury and their children. *J Head Trauma Rehabil*. 2003; 18:88–104. [PubMed: 12802239]
24. Slifer KJ, Tucker CL, Gerson AC, Sevier RC, Kane AC, Amari A, Clawson BP. Antecedent management and compliance training improve adolescents’ participation in early brain injury rehabilitation. *Brain Inj*. 1997; 11:877–89. [PubMed: 9413622]
25. Slifer KJ, Amari A. Behavior management for children and adolescents with acquired brain injury. *Developmental Disabilities Research Reviews*. 2009; 15:144–51. [PubMed: 19489090]
26. Gardner RM, Bird FL, Maguire H, Carreiro R, Abenaim N. Intensive positive behavior supports for adolescents with acquired brain injury: long-term outcomes in community settings. *J Head Trauma Rehabil*. 2003; 18:52–74. [PubMed: 12802237]
27. Ylvisaker M, Jacobs HE, Feeney T. Positive supports for people who experience behavioral and cognitive disability after brain injury: a review. *J Head Trauma Rehabil*. 2003; 18:7–32. [PubMed: 12802235]
28. Manchester, D., Wood, RL. Applying cognitive therapy in neurobehavioural rehabilitation. In: Wood, RL., McMillan, TM., editors. *Neurobehavioral disability and social handicap following traumatic brain injury*. Hove, England: Psychology Press; 2001. p. 157–74.
29. Giles GM, Wager J, Fong L, Waraich BS. Twenty-month effectiveness of a non-aversive, long-term, low-cost programme for persons with persisting neurobehavioural disability. *Brain Inj*. 2005; 19:753–64. [PubMed: 16175836]
30. Giles, GM., Clark-Wilson, J. *Brain Injury Rehabilitation: A Neurofunctional Approach*. San Diego, California: Singular; 1993.
31. May ME. Aggression as positive reinforcement in people with intellectual disabilities. *Research in Developmental Disabilities*. 2011; 32:2214–24. [PubMed: 21700420]
32. Narevic E, Giles GM, Rajadhyax R, Managuelod E, Monis F, Diamond F. The effects of enhanced program review and staff training on the management of aggression among clients in a long-term neurobehavioral rehabilitation program. *Aging Ment Health*. 2011; 15:103–12. [PubMed: 20924812]
33. Vollmer TR. The concept of automatic reinforcement: Implications for behavioral research in developmental disabilities. *Research in Developmental Disabilities*. 1994; 15:187–207. [PubMed: 7938787]
34. Giles GM, Wilson J, Dailey W. Non-aversive treatment of repetitive absconding behaviour in clients with severe neuropsychiatric disorders. *Neuropsychol Rehabil*. 2009; 19:28–40. [PubMed: 19101841]
35. Giles GM, Mohr JD. Overview and inter-rater reliability of an incident-based rating scale for aggressive behaviour following traumatic brain injury: The Overt Aggression Scale-Modified for Neurorehabilitation-Extended (OAS-MNR-E). *Brain Inj*. 2007; 21:505–11. [PubMed: 17522990]

36. Alderman N, Knight C, Morgan C. Use of a modified version of the Overt Aggression Scale in the measurement and assessment of aggressive behaviours following brain injury. *Brain Inj.* 1997; 11:503–23. [PubMed: 9210987]
37. Giles GM. Assessing adaptive behaviour in the post-acute setting following traumatic brain injury: initial reliability and validity of the Adaptive Behaviour and Community Competency Scale (ABCCS). *Brain Inj.* 2007; 21:521–9. [PubMed: 17522992]
38. Vittinghoff, E., Glidden, DV., Shiboski, SC., McCulloch, CE. *Regression Methods in Biostatistics: Linear, Logistic, Survival and Repeated Measures Models.* Springer; 2012.
39. Huckshorn KA, LeBel J, Jacobs HE. An organizational approach to reducing and preventing restraint and seclusion use with people with acquired brain injury. *NeuroRehabilitation.* 2014; 34:671–80. [PubMed: 24796437]
40. Alderman N, Knight C, Henman C. Aggressive behaviour observed within a neurobehavioural rehabilitation service: utility of the OAS-MNR in clinical audit and applied research. *Brain Inj.* 2002; 16:469–89. [PubMed: 12119083]
41. Snellgrove S, Beck C, Green A, McSweeney JC. Resident-to-resident violence triggers in nursing homes. *Clin Nurs Res.* 2013; 22:461–74. [PubMed: 23447361]
42. Stubbs B, Alderman N. Physical interventions to manage patients with brain injury: an audit on its use and staff and patient injuries from the techniques. *Brain Inj.* 2008; 22:691–6. [PubMed: 18698519]

IMPLICATIONS FOR REHABILITATION

- The Relational Neurobehavioral Approach (RNA) is a set of non-aversive intervention methods to manage individuals with brain injury-related aggression.
- RNA methods can be used to manage aggression in patients with brain injury who have differing levels of functional impairment.
- Successful implementation of the RNA may allow for the management of brain injury-related aggression without seclusion or mechanical restraint.

Figure 1. Conceptual stage model of aggression. Key components of the Relational Neurobehavioral Approach are listed in dashed boxes next to the relevant stage of aggression.

Table 1

Demographic and Clinical Features of Patients by Unit.

		Unit 1 (<i>n</i> = 35)	Unit 2 (<i>n</i> = 30)	Test statistic and significance
		Mean (S.D.), % or Median	Mean (S.D.), % or Median	
Age		47.3 (12.6), range 23–88	48.6 (11.7), range 27–82	$t(63) = -0.44, p = 0.66$
Male		82.9%	73.3%	$\chi^2(1) = 0.87, p = 0.35$
Caucasian		71.4%	66.7%	Fisher's exact $p = 0.76$
African-American		8.6%	6.7%	
Hispanic		14.3%	23.3%	
All other races		5.7%	3.3%	
Aggressive incident during study period		62.9%	73.3%	$\chi^2(1) = 0.81, p = 0.37$
Primary diagnosis	Traumatic brain injury	57.1%	26.7%	Fisher's exact $p = 0.001$
	Huntington's disease	0%	23.3%	
	Dementia, not otherwise specified	2.9%	20.0%	
	Cerebrovascular accident	8.6%	10.0%	
	HIV	8.6%	6.7%	
	Anoxia	0%	6.7%	
	Toxic encephalopathy	5.7%	0%	
	Intellectual disability	0%	3.3%	
	History of polysubstance dependence	2.9%	3.3%	
	History of alcohol use disorder	2.9%	0%	
	Brain tumor	2.9%	0%	
	Dentatorubral pallidoluysian atrophy	2.9%	0%	
	Parkinson's dementia	2.9%	0%	
	Neurosyphilis	2.9%	0%	
Primary reason sent to facility	Physical aggression	80.0%	76.7%	Fisher's exact $p = 0.86$
	Disruptive/unmanageable	17.1%	20.0%	
	Other	2.9%	3.3%	
Functional Scales	Activities of Daily Living composite	12	8.5	$p = 0.001$
	Language composite	7	4	$p < 0.001$
	Cognition composite	4	1.5	$p < 0.001$
	Mobility	6	6	$p = 0.87$

Table 2

Features of Antecedents for Incidents by Unit.

Antecedents		Unit 1 (<i>n</i> = 137) Mean (S.D.) or %	Unit 2 (<i>n</i> = 358) Mean (S.D.) or %	GEE regression significance
Number of antecedents per incident		1.74 (0.84)	1.81 (0.85)	<i>p</i> = 0.44
Number based on target	Any staff	1.78 (0.83) (<i>n</i> = 114)	1.93 (0.89) (<i>n</i> = 231)	<i>p</i> = 0.12
	Other patient	1.56 (0.96) (<i>n</i> = 25)	1.70 (0.81) (<i>n</i> = 108)	<i>p</i> = 0.53
	Self as target	1.67 (0.58) (<i>n</i> = 3)	2.0 (0.87) (<i>n</i> = 30)	<i>p</i> = 0.26
	Object/property	1.67 (0.58) (<i>n</i> = 3)	1.94 (0.79) (<i>n</i> = 50)	<i>p</i> = 0.43
	Unseen person/hallucination	2.0 (0) (<i>n</i> = 2)	2.14 (0.90) (<i>n</i> = 7)	<i>p</i> = 0.65
Noisy environment		2.2%	9.5%	<i>p</i> = 0.076
Seizure within last 24 hours		0%	0%	Not applicable
Agitated/distressed		14.6%	31.6%	<i>p</i> = 0.001
Other patients' behavior		4.4%	13.1%	<i>p</i> = 0.032
Direct response to other patients' verbal behavior		5.1%	13.4%	<i>p</i> = 0.025
Direct response, other patients' physical behavior at another		0.7%	0.3%	<i>p</i> = 0.50
Direct response, other patients' physical behavior at them		1.5%	4.2%	<i>p</i> = 0.16
Given item		0%	1.7%	Not applicable
Structured activity		13.1%	7.0%	<i>p</i> = 0.10
Verbal guidance to assist completion of task		13.9%	10.1%	<i>p</i> = 0.31
Given direct instruction		27.7%	14.0%	<i>p</i> = 0.002
Purposeful behavior ignored		2.2%	0.8%	<i>p</i> = 0.29
Request explicitly denied		24.8%	9.8%	<i>p</i> = 0.005
Given verbal/visual feedback		11.7%	5.9%	<i>p</i> = 0.13
Any other verbal interactions		10.9%	4.7%	<i>p</i> = 0.003
Physical guidance to complete a task		5.8%	11.2%	<i>p</i> = 0.27
During restraint/assisted to another location		0.7%	1.1%	<i>p</i> = 0.75
No obvious antecedent		8.0%	12.0%	<i>p</i> = 0.22
Other [*] – Hallucination/Delusion		3.6%	9.8%	<i>p</i> = 0.23
Other [*] – Change in routine		6.6%	1.1%	<i>p</i> = 0.008
Other [*] – Attention seeking		1.5%	2.2%	<i>p</i> = 0.63
Other [*] – Transition from one activity/place to another activity/place		0%	2.0%	Not applicable
Other [*] – Obstructed by an object/person		1.5%	1.1%	<i>p</i> = 0.73
Other (see below for list of remaining comments)		13.1%	14.8%	<i>p</i> = 0.67

* Post-hoc categorization of "Other"; Total pre-hoc % for Unit 1 = 26.3%; Total pre-hoc % for Unit 2 = 31%. The remaining antecedents were: Communication failure, Crowded environment, Something taken away, Unstructured time, Social overture, Staff behavior, Non reward, Medical procedure, Thwarted AWOL, Pain, Incontinent, Observed stealing, Recently awoken, Confused, Boredom, Name calling, Food refusal, Asked to leave, Med change, Self-Perceived cognitive failure, Fall, Female CNA, Told to wait, Short staffed, Ignored, Menstrual, Misperception, Refused care, Wanted snack, Lost Item, Static Shock, Sick.

Table 3

Features of Interventions for Incidents by Unit.

Interventions	Unit 1 Mean (S.D.) or % <i>n</i> = 137	Unit 2 Mean (S.D.) or % <i>n</i> = 358	GEE regression significance
Number of interventions per incident	1.80 (0.88)	1.87 (0.81)	$p = 0.60$
Any staff	1.73 (0.80) (<i>n</i> = 114)	1.96 (0.87) (<i>n</i> = 231)	$p = 0.032$
Other patient	1.96 (1.17) (<i>n</i> = 25)	1.78 (0.62) (<i>n</i> = 108)	$p = 0.57$
Self as target	3.0 (2.0) (<i>n</i> = 3)	2.1 (0.88) (<i>n</i> = 30)	$p = 0.37$
Object/property	1.67 (0.58) (<i>n</i> = 3)	1.92 (1.05) (<i>n</i> = 50)	$p = 0.38$
Unseen person/hallucination	2.0 (1.41) (<i>n</i> = 2)	2.43 (0.53) (<i>n</i> = 7)	$p = 0.043$
Aggression ignored	61.3%	58.9%	$p = 0.78$
Patient briefly ignored	0%	0%	Not applicable
Closer observation	5.1%	7.0%	$p = 0.56$
Talking to patient	32.1%	52.5%	$p = 0.002$
Reassurance	53.3%	21.5%	$p < 0.001$
Physical distraction	21.2%	29.6%	$p = 0.16$
Isolation without seclusion	0.7%	0%	Not applicable
Immediate medication by mouth	5.1%	17.0%	$p = 0.045$
Restraints	0%	0%	Not applicable
Holding patient	0.7%	0%	Not applicable
Seclusion	0%	0%	Not applicable
Immediate medication by injection	0%	0%	Not applicable

Table 4

Interventions on Unit 2 based on Type of Incident – Any Staff vs. Other Patients.

<i>Interventions for Only Verbally Aggressive Incidents</i>	<i>Target – Any Staff n = 76</i>	<i>Target – Other Patients n = 57</i>	GEE regression significance
Aggression ignored	63.2%	42.1%	OR = 0.42, $p = 0.059$
Patient briefly ignored	0%	0%	Not applicable
Closer observation	7.9%	1.8%	OR = 0.21, $p = 0.11$
Talking to patient	43.4%	61.4%	OR = 2.07, $p = 0.014$
Reassurance	18.4%	21.1%	OR = 1.18, $p = 0.69$
Physical distraction	19.7%	38.6%	OR = 2.56, $p = 0.062$
Isolation without seclusion	0%	0%	Not applicable
Immediate medication by mouth	31.6%	7.0%	OR = 0.16, $p = 0.031$
Restraints	0%	0%	Not applicable
Holding patient	0%	0%	Not applicable
Seclusion	0%	0%	Not applicable
Immediate medication by injection	0%	0%	Not applicable
<i>Interventions for Only Physically Aggressive Incidents</i>	<i>Target – Any Staff n = 141</i>	<i>Target – Other Patients n = 37</i>	GEE regression significance
Aggression ignored	67.4%	35.1%	OR = 0.26, $p < 0.001$
Patient briefly ignored	0%	0%	Not applicable
Closer observation	7.8%	0%	Not applicable
Talking to patient	57.5%	54.1%	OR = 0.87, $p = 0.78$
Reassurance	27.0%	13.5%	OR = 0.42, $p = 0.17$
Physical distraction	25.5%	70.3%	OR = 6.89, $p < 0.001$
Isolation without seclusion	0%	0%	Not applicable
Immediate medication by mouth	16.3%	2.7%	OR = 0.14, $p = 0.043$
Restraints	0%	0%	Not applicable
Holding patient	0%	0%	Not applicable
Seclusion	0%	0%	Not applicable
Immediate medication by injection	0%	0%	Not applicable