

# **Call Light Use in a Traumatic Brain Injury Rehabilitation Hospital**

A Senior Honors Thesis

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by

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### Abstract

The purpose of this study was to evaluate the frequency of call light and bed alarm usage by persons with Traumatic Brain Injury (TBI) in the hospital and to determine whether the use of the call light was appropriate, accidental, or initiated by a family or staff member. Observational data was collected on 40 patients (11 TBI patients and 29 patients with other Acquired Brain Injuries (ABI)). Results revealed low rates of bed alarm and call light usage by patients with TBI, as well as moderate to low correlations between call light usage and other indicators of cognitive status. For further study, it will be necessary to find other ways of determining eligibility for interventions to aid in proper call light usage.

People who suffer from traumatic brain injuries (TBI) are at significantly higher risk of experiencing a fall in a hospital setting (Bailey, Amato, & Mouhlas, 2009). Such falls are a result of memory loss, impulsiveness, irritability and affected cognition (Oliver, Britton, Seed, Martin, & Hopper, 2007). Clinicians in the hospital teach people with TBI to use a call light to signal when they want to leave their beds. Unfortunately, the memory loss associated with TBI interferes with their ability to remember to use the call light signal. One solution for this problem is to hire staff to sit near the person's bed on a 24-hour basis in order to prevent the person from falling out of bed; this is very expensive and other solutions are needed (Bailey et al., 2009).

### Traumatic Brain Injury: From Injury to Rehabilitation

A TBI occurs as a result of either an internal or external injury to the head. Resulting wounds can be open or closed (Hux, 2003). The formal definition, as defined by the Individuals with Disabilities Education Act is "an acquired injury to the brain caused by an external physical force, resulting in total or partial functional disability or psychosocial impairment, or both, that adversely affects a [person's] educational performance" (Hux, 2003). A TBI can result from a variety of events ranging from a gunshot wound to anoxia. The two stages of neurological effects that occur during a TBI are the primary mechanisms of injury and the secondary mechanisms of injury (Hux, 2003). The primary stage occurs at the time of injury as a result of acceleration-deceleration forces acting on the head. The second stage occurs as a result of the primary stage and can occur minutes after the initial injury or months later. One of the most dangerous secondary mechanisms of injury is increased intracranial pressure. Seventy-five percent of deaths from TBI result from the sudden rise in pressure that destroys brain tissue and causes the brain stem structure to compress, ending in death (Hux, 2003). As a result of TBI,

patients experience memory loss, impulsiveness, irritability and related cognitive problem behaviors, such as failure to remember to use the call light. TBI patients often experience agitated behavior that is difficult to manage, and that interferes with their ability to remember nursing instructions (Gillis, 1996). Safety coaches may be hired to monitor the patient when family members are not available to insure the patient's safety.

Rehabilitation hospitals also address the needs of persons who have other neurological problems, such as Acquired Brain Injuries (ABI). ABI is an umbrella term that refers to a brain injury that occurs as a result of a traumatic brain injury, tumor, stroke, or other cause (Gillis, 1996). A TBI is the direct result of trauma to the head, while an ABI includes brain injuries secondary to other diagnoses (Gillis, 1996).

The call light is an important method of communication for the patients to help ensure their own care (Tzen & Yin, 2009). Patients use the call light if they need the attention of the nursing staff for bathroom assistance, pain medication, or other needs (Tzen & Yin, 2009). A common call light, such as those used by Dodd Rehabilitation Hospital, are orange buttons with white crosses, located in the top two side rails of the Hill Rom Versa-Care Beds (Musto et al., 2010). There is also a detachable hand held control that can be attached to rails of the bed. When the patient sets off his or her call light, a light outside the patient's room is lit up, and the call is displayed on the computer in the nurse's station, along with a beeping noise (Musto et al., 2010).

Once the patient is in stable medical condition after the TBI, rehabilitation begins. The general goal of rehabilitation is to combat the various physical, cognitive and psychosocial impairments that may result from TBI (Bourgeois, Lenius, Turkstra, & Camp, 2007; Melton &

Bourgeois, 2005). A supportive team of therapists including physical, occupational, speech and recreational therapists is assigned to help the patient through rehabilitation. Registered nurses (RNs) and Patient Care Assistants (PCAs) also play a vital role in the recovery process. The patient is instructed on use of the call light upon admission. If the patient fails to utilize the call light in an appropriate manner, a safety coach is often hired to prevent falls. However, this method is expensive and impractical.

During rehabilitation, many different methods of cognitive rehabilitation therapy (CRT) are used (Parenté & Herrmann, 1996). Some of the goals of CRT include training the patient to develop different skills, educating him and his family about his condition, and finding ways to improve his lifestyle (Parenté & Herrmann, 1996). A few types of CRT include stimulation therapy, attention-concentration training, strategy training, process training, and stimulus-response conditioning. Spaced Retrieval is a strategy training technique with the purpose of helping patients with TBI to retain information over extended periods of time. So far, the use of Spaced Retrieval has been shown to be effective in teaching persons with memory loss due to chronic TBI to remember many important behaviors, such as keeping appointments, using a planner, and remembering names and information (Bourgeois, Lenius, Turkstra, & Camp, 2007; Melton & Bourgeois, 2005). To date, Spaced Retrieval has not been used in hospital settings where more severe memory problems are addressed in cognitive therapy. For example, TBI patients may need to learn strategies for remembering orientation facts, such as what day it is and where they are. They may also need to re-learn basic skills such as how to feed and dress themselves. There are often concerns for their safety when they cannot remember instructions such as to use their call light when they need assistance. In this setting, however, Spaced Retrieval may be a useful strategy to use for teaching them to remember to use their call light.

Before clinicians examine the efficiency of Spaced Retrieval in teaching skills such as call light use, they need to know the frequency of the problems experienced by TBI survivors. The purpose of this research, therefore, was to collect frequency data on call light usage by persons with TBI in the hospital. It is important to know how often patients use their call light appropriately and how often they fail to use it, as indicated by setting off the bed alarm. The two research questions addressed were:

1. How often do patients with TBI in a rehabilitation hospital utilize call lights appropriately or inappropriately?
2. What is the relationship between the functional status of the patient and his or her call light use?

## Methods

### Participants

Data was collected from the 3<sup>rd</sup> and 4<sup>th</sup> floor of The Ohio State University Medical Center Dodd Hall Rehabilitation Center, where TBI survivors are most likely to be housed during their rehabilitation. Data was collected with a convenience sample of the first 40 participants whose call lights or bed alarms were activated during the observation periods. Patients were identified from a census sheet at the time of observations based on their diagnosis of ABI. All data in this study were de-identified and permission from the OSU Institutional Review Board was received to waive consent from the patients. No direct contact with the patients was made during data collection. As shown in Table 1, the total group consisted of 20 men and 20 women with a mean age (s.d.) of 52.6 (19.63) years old. The diagnoses of the patients were extracted from their

medical records. Eleven of these patients were categorized as TBI patients (6 males and 5 females; mean age (s.d.) of 32.64 (14.0) years. Twenty-nine were categorized as ABI patients. Some common primary diagnoses of these patients included cerebral artery occlusion unspecified with cerebral infarction and subarachnoid hemorrhage. Of these patients, 14 were male and 15 were female, with a mean age (s.d.) of 60.14 (15.6) years old.

**Table 1***Description of TBI and ABI Patients*

	<b>Total Patients</b>	<b>TBI Patients</b>	<b>ABI Patients</b>
N	40	11	29
Mean Age	52.6 (19.63)	32.64 (14.0)	60.14 (15.6)
Race	32 W, 7 B, 1 O	10 W, 1 B	22 W, 6 B, 1 O
Gender	20 M, 20 F	6 M, 5 F	14 M, 15 F

### Procedure

Observations on the TBI unit were made between October 2010 and January 2011. Observations were made during two shifts (6-9 am; 5-8 pm). The data collection times were based on when it was thought the patients would be the most active, have the greatest need to use the call light, and be the most likely to set off the bed alarm by forgetting to use the call light. Data collection sheets (Appendix A) were used to collect data on the following variables: room locations, type of signal (call light or bed exit alarm), time of alarm onset and offset termination, description of the problem related to the incident, the resolution of the incident, and the person who responded (RN, PCA). The researcher sat in the nurse's station in close proximity to the Unit clerk who was responsible for answering the call light calls and directing the appropriate responder to handle the patient's need. Each signal was displayed on a computer monitor,

indicating the type of call and room number. The Unit clerk answered the call by asking what was needed in the room, listening for a response from someone in the room, and then providing a response. As needed, the Unit clerk contacted the appropriate person to handle the need in the room. The researcher completed a data sheet for each signal incident. Call light use was coded as: call light appropriate, call light mistake, or call light other. An appropriate use of the call light included any time the patient required the assistance of the nursing staff for bathroom assistance, pain medication, etc. Call light mistake occurred when the patient accidentally set off the call light and did not require any assistance. Call light other included use of the call light by the patient's family member, a PCA, a RN, or the doctor using the light to contact the Unit clerk. A total of 7 observation sessions were required to attain the desired data on 40 patients.

### Instruments

The materials required for this research were a stopwatch for the researcher to calculate the time between the onset and offset termination of the signal, the computer monitor, and the data sheets to record collected data. Two measures of functional status were used during this study, the *Functional Independence Measure* (Kohler et al., 2010) and the *Agitation Behavior Scale* (Bogner, 2000). Data were recorded by the RNs and then extracted from the patients' medical records.

The FIM is used to measure the functionality of patients in inpatient settings. It has 18 items that can receive a score from 1-7. Of the 18 items, five were addressed in this study: comprehension, memory, problem solving, expression, and social interaction. These were the items thought to affect the patient's ability to utilize the call light most significantly. A score of "1" represents complete dependence and "7" complete independence. Two FIM Measures are

taken during a patient's hospitalization, one upon admittance and one upon discharge. Only the FIM scores upon admission were examined because it was thought this is when the patient would be most prone to inappropriate call light usage.

The ABS scale is used to assess agitation of a patient across 14 behavioral items. The ABS scale form is completed by the RN three times throughout the day. Each item on the scale is given a rating of "1", "2", "3", or "4" depending on the degree to which the behavior is present ("1" absent, "2" present to a slight degree, "3" present to a moderate degree and "4" present to an extreme degree). Two examples of behavioral items include item 1 (short attention span, easy distractibility, inability to concentrate) and item 2 (impulsive, impatient, low tolerance for pain or frustration) (See Appendix 2)). The 14 items are separated into three categories: disinhibition, aggression, and lability. The Total Score is calculated by adding the scores from each of the 14 behavioral items, ranging from 14 to 56.

### Reliability

A graduate nursing student participated in observation and data collection for reliability purposes. Both researchers received instruction by Dr. Bourgeois and Dr. Chipps on how to collect and record data such as locating data on the computer monitor, calculating the length of time of alarm, and recording the data in the proper format. For 20% of the subjects, both observers recorded data independently and then compared data sheets to calculate reliability. Agreement reliability was calculated by dividing the total number of agreements by the sum of agreements and disagreements. This number was multiplied by 100, which resulted in an overall interrater agreement of 100% for a total of 8 of the 40 subjects.

## Data Analysis

The researcher transferred the data for the dependent variables from the data sheets into Excel spreadsheets for descriptive analysis. Means and standard deviations were calculated for the frequency of appropriate call light usage, mistakes in call light usage, and call lights initiated by someone other than the patient. Correlational analyses were conducted between each of the three dependent measures and the FIM scores at admission and the ABS scores.

## Results

To address the question of how often patients with TBI in a rehabilitation hospital utilize call lights appropriately or inappropriately, the call light usage data were analyzed. As shown in Table 2, the total group of patients had 76 instances of call light use. Of these uses, 46 were used appropriately, 14 by mistake, and 16 were initiated by another person. The TBI patients used their call lights 30 times (16 appropriate, 8 mistake and 6 other). ABI patients used their call lights 46 times (30 appropriate, 6 mistake and 10 other). Data on call light utilization shows TBI patients most often used their call lights appropriately.

To understand the relationship between patients' functional status and call light usage, the FIM and ABS scores were analyzed. A FIM score of a "2" represents maximal assistance, a "3" represents moderate assistance and a "4" represents minimal assistance. The total group of patients had mean (s.d.) of FIM scores ranging from their lowest, 3(1.71) for Problem Solving, to 4.05(1.65) for Comprehension. TBI patients alone had a lower range of FIM scores from a mean of 2.09(1.22) for Problem Solving to 3.09(1.76) Comprehension. The ABI scores were higher than both the total group and the TBI group, ranging from a mean of 3.34(1.91) for Problem

Solving to 4.41(1.50) for Comprehension. TBI patients had lower overall FIM scores than the total group and the ABI group. All TBI patients required moderate or maximal assistance in the five areas of functionality addressed in this study.

**Table 2**

*Total Use of Call Lights by Patients and Mean (s.d.) of FIM and ABS Scores*

	<b>Total Patients</b>	<b>TBI Patients</b>	<b>ABI Patients</b>
Call Light Appropriate	46	16	30
Call Light Mistake	14	8	6
Call Light Other	16	6	10
FIM Mean (SD)			
FIM Comp	4.05(1.65)	3.09(1.76)	4.41(1.50)
FIM Memory	3.20(1.60)	2.10(1.04)	3.62(1.53)
FIM P.S.	3.00(1.71)	2.09(1.22)	3.34(1.91)
FIM Expression	3.68(1.67)	2.82(1.60)	4.00(1.60)
FIM Social	3.70(1.60)	2.56(1.30)	4.14(1.56)
ABS			
N	7	6	1
Mean	21.9	23.2	14.5

Correlations between FIM scores and ABS total and call light appropriate and call light mistake are shown in Table 3. Correlations between FIM scores and call light appropriate for the TBI patients ranged from  $r = .060$  for Problem Solving to  $r = .477$  for Memory. The range of correlations between AFIM scores and call light mistake for the TBI patients was  $r = -.134$  for Social to  $r = .274$  for Expressive. For the ABI group, correlations between FIM scores and call light appropriate ranged from  $r = .068$  for Problem Solving to  $r = .267$  for Expressive. The range

of correlations between FIM scores and call light mistakes was  $r = -.324$  for Expressive to  $r = -.0034$  for Problem Solving.

Correlations across all measures were statistically weak to moderate. This is based on a statistical scale of a correlation between  $r = 0$  and  $r = .20$  representing a weak correlation, a correlation between  $r = .20$  and  $r = .40$  considered a low correlation and a correlation between  $r = .40$  and  $r = .70$  considered a moderate correlation. The strongest correlation was  $r = .477$  and occurred between call light appropriate and FIM Memory for TBI patients. This correlation is displayed graphically in Figure 1.

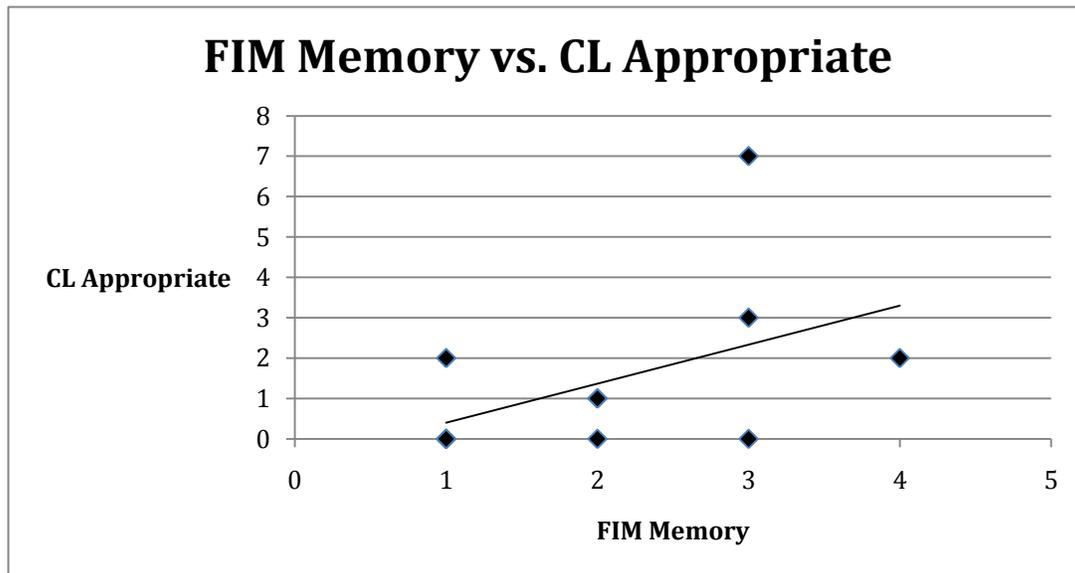
The correlation between ABS Total and call light appropriate for TBI patients was  $r = -.056$ , a low correlation. For ABS Total and call light mistake, it was  $r = -.380$ , a low correlation. A correlation was not calculated for the ABI group because there was only ABS data available for one of the patients.

**Table 3**

*Correlations between Measures of Functionality and Call Light Usage*

	Correlations			
	TBI		ABI	
	CL Appropriate	CL Mistake	CL Appropriate	CL Mistake
FIM Comp	0.17604	0.164417	0.169125	-0.087
FIM Memory	0.477403	0.033211	0.196906	-0.26104
FIM Problem Solving	0.059847	0.132572	0.068429	-0.0034
FIM Expression	0.204036	0.274413	0.266838	-0.32415
FIM Social	0.229328	-0.1341	0.193774	-0.16273
ABS Total	-0.056	-0.37865		

Figure 1



### Discussion

This study sought to find the frequency of call light and bed alarm use by TBI patients, and to examine any relationships between call light use and measures of functional status. It was found that TBI patients used their call lights appropriately more often than by mistake. TBI patients also had lower overall FIM scores than the total group and the ABI group. The data on FIM scores suggests that TBI patients required moderate or maximal assistance in the areas of comprehension, memory, problem solving, expression, and social interaction. TBI patients had a range of correlations between FIM scores and call light appropriate from  $r = .060$  for Problem Solving to  $r = .477$  for Memory. The strongest correlation for TBI patients occurred between call light appropriate and FIM Memory. It was a correlation of  $r = .477$ . This is considered to be a moderate correlation, and indicates the higher the patient's FIM Memory score (the more independent the patient was in this area) the more frequently he used the call light appropriately.

The more frequent use of call light mistakes in conjunction with lower overall FIM scores by TBI patients than ABI patients may indicate that TBI patients have a greater need for effective call light training than other patient populations.

These TBI patients' moderate correlation between their FIM Memory score and call light appropriate is interesting because it suggests that the patients had enough functionality to remember to use their call light in an appropriate manner. It also may suggest that patients' FIM Memory scores are important to their ability to utilize their call lights. Perhaps this may be a way to distinguish between patients who require more call light assistance and those who do not.

Overall, results of this study were unexpected. It was anticipated that the number of call light mistakes by patients with TBI would exceed the number of call light appropriates; however this was not the case. Weak correlations may be the result of the small patient population observed in this study. The sample of 40 patients was mostly ABI patients (N=29) who were older (mean age 60.14 years); there were only 11 TBI patients whose mean age was 32.64 years. It would be important to study more TBI patients in future studies to discover whether different results are obtained with a larger population. In addition, differences in etiology and severity of the brain injury could also account for the results. The ABI patients had diagnoses of stroke, cerebral artery occlusion, subarachnoid hemorrhage, with hemiplegia or weakness preventing them from using their call light and requiring the assistance of other people in the room.

It was also unexpected that there were so few instances of agitation in both groups. Of the 29 ABI patients, only 1 ABS form was completed by nursing staff during the observation period. There were 6 ABS forms completed for the 11 TBI patients during this same period, indicating increased agitation in this group, but not to the extent anticipated by the researchers.

Perhaps the ABI population exhibited less agitation due to more severe physical impairment or as a result of the higher mean age of the population (60.14 years).

The unexpected results may also be due to the constant monitoring of patients by family members, RNs and PCAs, represented by the high frequency of call light other. Dodd Hall Rehabilitation Center does an excellent job of monitoring patients, making it difficult to get an accurate idea of the true bed alarm and call light usage in hospitals by patients with TBI.

Limitations of the study included the small sample size and the high frequency of call light other. Future studies should observe a larger sample of TBI patients. One idea may be to ask clinicians to identify which patients are having problems learning to use the call light appropriately or to find patients who are more impaired (based on lower scores on the FIM) or have more behavioral problems (based on higher ABS score). Also, the high frequency of call light other, due to the constant monitoring of patients by family members, RNs and PCAs, made it difficult to determine how often patients use their call lights independently. If independent call light use is desired, there needs to be an opportunity for the person to be alone to use the call light.

In conclusion, this study found that persons with TBI in a rehabilitation hospital who were at risk of falling out of bed were likely to have many people in their room with them throughout the day to assist with communication with nursing staff via the call light system. In order to gain a better idea of how TBI patients use their call lights independently, and to determine eligibility for interventions to teach proper call light usage, future studies are needed of times when the person with TBI is alone in his room.

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Appendices

**Appendix A**

*Researcher Data Sheet*

Data Sheet: Bed Alarm and Call Light Utilization Date: \_\_\_\_\_ Observer: \_\_\_\_\_

Location	Type	Time On	Problem	Resolution	Responder	Time off
	BA CL	00:00:00				00:00:00
	BA CL					
	BA CL					
	BA CL					
	BA CL					
	BA CL					
	BA CL					

Location Codes: Room codes

Type: Circle BA (bed alarm), CL (call light)

Problem: Describe problem [pt asks to use bathroom; pt yelling; no pt response; other examples?]

Resolution: Describe resolution [nurse goes to pt; nurse talks to pt on intercom]

Responder: nurse, unit clerk, others?

Time Off: time incident resolved

**Appendix B**

*Agitated Behavior Scale recording sheet*

**AGITATED BEHAVIOR SCALE**

At the end of the observation period indicate whether the behavior described in each item was present and, if so, to what degree: slight, moderate or extreme.

**1 = absent:** the behavior is not present.

**2 = present to a slight degree:** the behavior is present but does not prevent the conduct of other, contextually appropriate behavior. (The individual may redirect spontaneously, or the continuation of the agitated behavior does not disrupt appropriate behavior.)

**3 = present to a moderate degree:** the individual needs to be redirected from an agitated to an appropriate behavior, but benefits from such cueing.

**4 = present to an extreme degree:** the individual is not able to engage in appropriate behavior due to the interference of the agitated behavior, even when external cueing or redirection is provided

Date: _____	2300-0700	0700-1500	1500-2300
1. Short attention span, easy distractibility, inability to concentrate.			
2. Impulsive, impatient, low tolerance for pain or frustration.			
3. Uncooperative, resistant to care, demanding.			
4. Violent and/or threatening violence toward people or property.			
5. Explosive and/or unpredictable anger.			
6. Rocking, rubbing, moaning or other self-stimulating behavior.			
7. Pulling at tubes, restraints, etc.			
8. Wandering from treatment areas.			
9. Restlessness, pacing, excessive movement.			
10. Repetitive behaviors, motor and/or verbal.			
11. Rapid, loud or excessive talking.			
12. Sudden changes of mood.			
13. Easily initiated or excessive crying and/or laughter.			
14. Self-abusiveness, physical and/or verbal.			
<b>Total</b>			

Subject ID:

Admission Day: