

Substance Use Disorders Following Traumatic Brain Injury

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Summary

This project was consistent with Priority 3-B (Rehabilitation), specifically addressing early identification and intervention for alcohol/drug addiction. Traumatic brain injury (TBI) is the fastest growing cause of disability among young adults in the United States. More than half of adolescents and adults treated in rehabilitation for TBI have prior histories of substance use disorders, and between 10% and 20% with no history will develop substance use problems in the first 2 years after injury. The acute period of treatment following injury is an opportunity for substance use intervention that should not be squandered. However, patients with TBI have newly acquired cognitive deficits that impact learning and memory. Thus, educational interventions that are going to take advantage of opportunities during acute rehabilitation will need to be specially tailored to the cognitive abilities typical for patients at this early phase of recovery from TBI.

In this project we developed, tested and produced a 12-minute videotape specifically designed to educate patients with TBI and their family members about the effects of substance use after brain injury. To determine whether use of the videotape is effective with this population, we examined information retained, attitudes about alcohol use, and actual use 1 month after hospital discharge among patients who received standard hospital practices and those receiving an educational intervention, with and without use of the videotape. We found that knowledge about TBI and substance abuse is associated with positive attitudes and beliefs, which in turn are associated with abstaining from substance use 30 days after leaving rehabilitation. Among those who received an educational intervention (booklet only, or booklet plus videotape) and retained more information about TBI and substance use (recalled ≥ 3 facts), 100% abstained from use. Patients who were more impaired or confused when the educational intervention occurred, learned more when the videotape was presented in addition to the booklet. Though these results were based on a relatively small sample and can only be considered preliminary, the findings from this study supported the effectiveness of educational interventions in general and the videotape specifically for patients with TBI in acute rehabilitation. As committed to in the original grant application, this educational material has been made available to all rehabilitation facilities in Ohio reporting to the Ohio Trauma Registry.

Background and Need

There has long been awareness of the relationship between intoxication and TBI (Jernigan, 1991; Dikmen, Machamer, Donovan, Winn & Temkin, 1995; Corrigan, 1995), but only more recently has attention been given to the mediating effects of substance use disorders on rehabilitation outcomes, including following TBI (Corrigan, 1995; Dikmen et al., 1995; Kreutzer, Witol, Sander, et al., 1996; Corrigan, Bogner & Lamb-Hart, 1999). Clinicians and researchers have concluded that cognitive and emotional impairments caused by brain injury present unique problems when addressing co-existing substance use disorders (Langley, 1991; Center for Substance Abuse Treatment, 1998; Corrigan et al., 1999). Young adult males are among the highest risk groups for TBI, with most injuries occurring as the result of moving vehicle crashes (Thurman et al., 1999), and alcohol is a major contributor to the occurrence of these injuries. Equally troubling is the proportion of adolescents and adults hospitalized for TBI who have pre-injury substance use disorders. Among patients receiving acute medical rehabilitation, as many as two-thirds have evidence of premorbid substance use disorders (Corrigan, 1995). A prospective study at Ohio State found 58% of a consecutive sample of 350 patients admitted to the Brain Injury Unit had prior histories of substance use disorders using DSM-III-R criteria. A prospective study conducted on the brain injury rehabilitation unit at the University of Washington found 61% had a prior history (Bombardier, Rimmel, & Zintel, 2003).

There is accumulating evidence that persons with TBI and substance use disorders have significantly worse outcomes than persons with TBI alone. Among patients with the most severe brain injuries, alcohol or other drug consumption declines in the immediate post-injury period; however, many patients return to pre-injury levels of use by two years post-injury (Corrigan, Rust & Lamb-Hart, 1995; Kreutzer, Witol & Marwitz, 1996; Corrigan, Smith-Knapp & Granger, 1998). Between 10% and 20% of persons who abstained or were light drinkers pre-injury, become high volume users after (Kreutzer, Witol, Sander, et al., 1996; Corrigan, et al., 1995). Persons with TBI and substance abuse problems are less likely to be working (Kreutzer, Witol, Sander, et al., 1996; Bogner, Corrigan, Spafford & Lamb-Hart, 1997; Corrigan, Bogner, Mysiw, Clinchot & Fugate, 1997), and have lower life satisfaction (Bogner et al., 1997). A measure of problem substance use derived from variables in the TBI Model Systems National Dataset (Corrigan, Bogner, Lamb-Hart & Sivak-Sears, 2003) indicated that a premorbid history of problem use was significantly ($p < .01$) more frequent in males (53% vs. 33%), those with a high school education or less (51% vs. 42%), those unemployed at injury (68% vs. 44%), those with a history of prior TBI (59% vs. 47%), those

with an arrest record pre- and post-injury (72% vs. 32% and 67% vs. 45%, respectively), and those intoxicated due to alcohol at time of injury (76% for BAL \geq .08, vs. 41% and 33% for those $<$.08 and not tested, respectively).

Many agree that the acute medical treatment following injury is an opportunity for substance use intervention that should not be squandered, especially given the proven effectiveness of brief, educational interventions (c.f., Hungerford & Pollock, 2003). The advantages of intervention appear especially true for those in rehabilitation. The greater severity of the injury experienced by those requiring rehabilitation may be more a cause for reflection on risky behavior. Detoxification has occurred by the time rehabilitation commences. Family members may be more willing to intervene after experiencing the emotional trauma of serious injury to a loved one. And, pragmatically, there is longer period of contact with rehabilitation professionals than other acute medical personnel. However, for persons in rehabilitation for TBI, the period of hospitalization is marked by newly acquired cognitive impairments that affect both learning and memory. Thus, educational interventions that are going to take advantage of opportunities during acute rehabilitation will need to be specially tailored to the cognitive abilities typical for patients at this early phase of recovery from TBI.

Project Description

The objectives of the project are listed below. The remainder of this report is organized by the four objectives, describing activities and results related to each.

1. Develop, test and produce a 12-minute videotape specifically designed to educate patients with TBI and family members about alcohol and other drug use.
2. Compare attitudes, expectancies and information about alcohol and other drug use 1 month after hospital discharge among patients who received standard hospital practices without intervention, and those receiving a brief educational intervention, with and without the videotape.
3. Evaluate patient and family members' qualitative response to the educational videotape.
4. Provide rehabilitation facilities in Ohio that report to the Ohio Trauma Registry with a package of educational materials addressing alcohol and other drug use after TBI.

Development of the Videotape.

Clinicians and researchers in the Department of Physical Medicine and Rehabilitation at Ohio State University have developed clinical models for screening and education of persons with TBI during the acute phase

of recovery (*Substance Use and Abuse after Brain Injury: A Programmer's Guide*). Through the use of focus groups and field testing, we honed eight messages appropriate for substance use education during this phase of recovery. Those messages are presented in an educational brochure called the *User's Manual for Faster More Reliable Operation of a Brain After Injury*. In this project we developed an audio-visual medium for presenting the eight educational messages. A preliminary storyboard was reviewed by 18 professionals and 12 primary or secondary consumers. An alpha version of the actual videotape was created based on the final storyboard, and was subsequently reviewed by 68 professionals and 48 consumers. This videotape complements the *User's Manual for Faster More Reliable Operation of a Brain After Injury* when the two are used in concert. From funding gained from another source, we have been able to create Spanish versions of both the *User's Manual* and the videotape.

Relationship to Attitudes, Beliefs and Behavior

In the quantitative evaluation of the videotape we compared standardized measures taken 1-month after rehabilitation discharge for 3 groups: (1) baseline patients receiving the standard hospital educational methods; (2) patients randomly assigned to receive an educational intervention without use of the videotape; and (3) patients randomly assigned to receive an educational intervention with use of the videotape. The educational interventions for groups 2 and 3 occurred prior to discharge from the rehabilitation facility and were conducted in a standardized fashion by trained research staff. For both groups, the "*User's Manual for Faster More Reliable Operation of a Brain After Injury*" was introduced and provided to the patient, and family if present. For the no videotape condition, the interviewer orally reviewed the messages in the brochure. For the videotape condition, the interviewer played the tape. Both interventions lasted no more than 15 minutes.

This research was conducted on the Brain Injury Unit in Dodd Hall at the OSU Medical Center, where substance abuse is routinely addressed by rehabilitation personnel. Thus, the quantitative analysis compared whether a brief intervention enhanced the standard practice as evidenced by differences in attitudes, expectancies, and information one month after discharge. Patients were contacted by research staff who were blinded to the patient's group membership. The follow-up measures covered the following domains: (1) substance use since leaving the hospital using items from the TBI Model Systems National Database; (2) beliefs and expectations regarding alcohol use; and (3) recall of factual information provided in the intervention (i.e., recommendations regarding use after TBI and content of the eight educational messages regarding the risks of use). Because there is often a period of abstinence immediately following hospitalization, we did not expect recent use to differ among the

groups. We did expect that those patients who viewed the videotape would have the most favorable residual attitudes and information.

Twenty subjects were recruited into each of 3 groups. Not all subjects could be interviewed at 30 days after discharge from rehabilitation—7 of 60 were lost to follow-up, including 2 from the baseline group, 3 from the booklet only, and 2 from booklet plus videotape. Those lost did not differ from those followed in demographic characteristics, injury circumstances or premorbid substance abuse. Based analysis of data from the current project, we arrived at six conclusions, listed below. Data supporting each of these conclusions is briefly presented.

1. Few patients report using any alcohol by 30 days after discharge from acute rehabilitation; and none reported using illicit drugs.
2. Attitudes and beliefs regarding expectations for alcohol use (alcohol expectancies) and, to a lesser degree, whether an individual needs to change the amount they drink (readiness to change) were highly associated with drinking any alcohol at 30 days post-discharge.
3. Having knowledge about the negative effects of alcohol or illicit drug use after TBI was associated with positive attitudes and beliefs.
4. Problem use of alcohol or other drugs preceding injury also had a significant association with attitudes and beliefs after.
5. When those receiving educational interventions were able to recall 3 or more facts about TBI and substance at 30 days post-discharge, all were abstaining from alcohol and illicit drugs.
6. Among subjects with longer lengths of post-traumatic amnesia (and thus more likely to still be somewhat confused when provided the educational intervention), the videotape plus booklet intervention was superior to using the booklet only.

Few patients report using any alcohol by 30 days after discharge from acute rehabilitation; and none reported using illicit drugs. Among all subjects, 83% were abstaining from all alcohol as well as illicit drugs upon follow-up. Figure 1 shows the percentage of subjects from each group (baseline, booklet only, and booklet + videotape) who reported consuming any alcohol in the 30 days after leaving acute rehabilitation. The groups did not differ statistically, which was not expected. However, as additional analyses revealed a mediating effect for prior substance use disorder, and a moderating effect of length of post-traumatic amnesia, each of which served to obscure the impact of the videotape intervention.

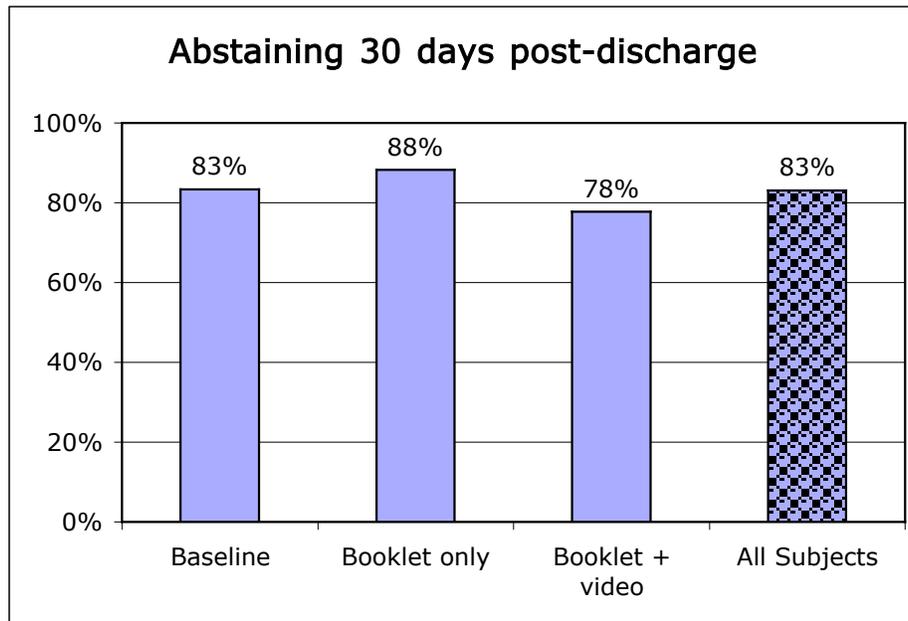


Figure 1. Percentage of subjects abstaining from all alcohol and illicit drugs at 30-day follow-up.

Attitudes and beliefs regarding positive expectations for alcohol use and whether an individual needs to change the amount they drink were highly associated with drinking any alcohol at 30 days post-discharge. Figure 2 depicts the complex relationships among premorbid characteristics, knowledge, attitudes and behavior. The strength of the relationships are indicated by the heaviness of the line, with dotted lines indicating relationships found previously in the literature but not tested in this study. Expectations for alcohol use were most associated with drinking alcohol, especially beliefs that social and physical pleasure increased, sexual functioning was enhanced, and greater relaxation/tension reduction could be accomplished. Each one of the corresponding scales accounted for over 10% of the variance in drinking at follow-up.

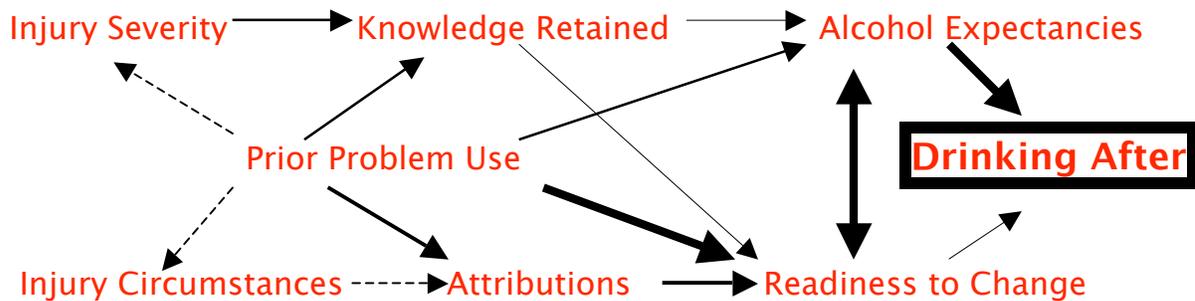


Figure 2. Strength of Relationship among Injury Characteristics, Knowledge, Attitudes and Behavior

Having knowledge about the negative effects of alcohol or illicit drug use after TBI was associated with positive attitudes and beliefs. Also depicted in Figure 2 is the relationship between knowledge about TBI and substance use and both alcohol expectancies and readiness to change alcohol use. Retaining 3 or more facts about the negative consequences of substance use after TBI was related to global positive expectations about alcohol use, as well as expecting social and physical pleasure. Though those differences only approached statistical significance ($p < .052$ and $p < .057$, respectively), they accounted for approximately 7% of variance.

Problem use of alcohol or other drugs preceding injury also had a significant association with attitudes and beliefs after. Figure 2 also shows that problem substance use prior to injury is associated with several factors in the model. While the direct relationship with actual drinking at follow-up was modest (accounting for approximately 2% of variance), relationships with attitudes and beliefs were considerably more substantial (sharing 44% of the variance with readiness to change, 17% with attribution of blame for the injury, 10%-15% with certain alcohol expectancies). Problem use was also significantly related to recall of facts ($p = .01$), accounting for approximately 12% of variance in those recalling 3 or more facts. Additionally, we found that the prior problem use in our sample was not evenly distributed across the three groups. The booklet + videotape group had more subjects with prior problems, both those randomly assigned and actually followed (see Figure 3).

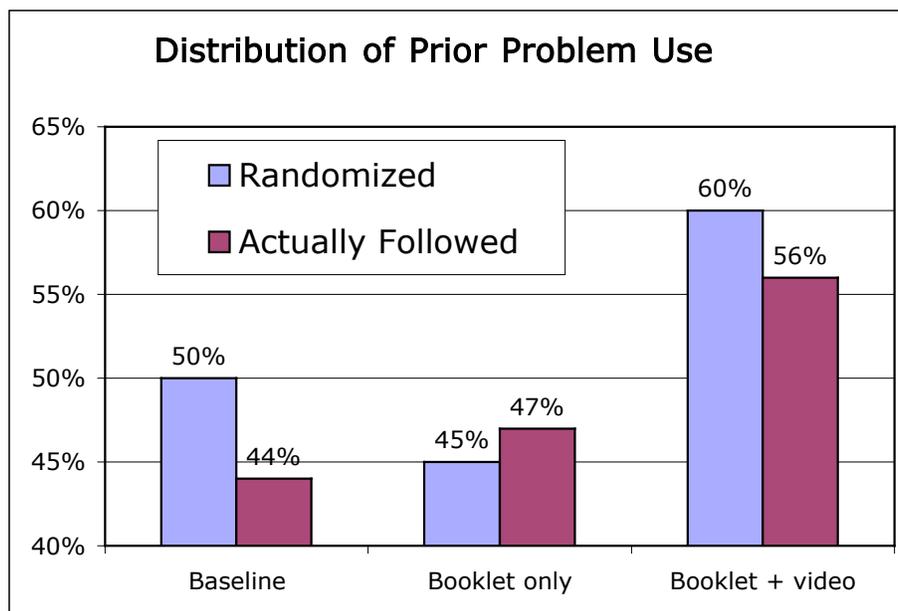


Figure 3. Percentage of subjects with Problem Substance Use Prior to Injury

When those receiving educational interventions were able to recall 3 or more facts about TBI and substance use at 30 days post-discharge, all were abstaining from alcohol and illicit drugs. We observed a very pronounced relationship between recalling facts about substance use and TBI and drinking at follow-up. For all subjects, 94% of those who recalled 3 or more facts abstained from any use 30 days after discharge, while 78% of those who recalled fewer facts did not. For both groups receiving educational interventions, no subject who recalled 3 or more facts consumed any alcohol or illicit drugs at follow-up.

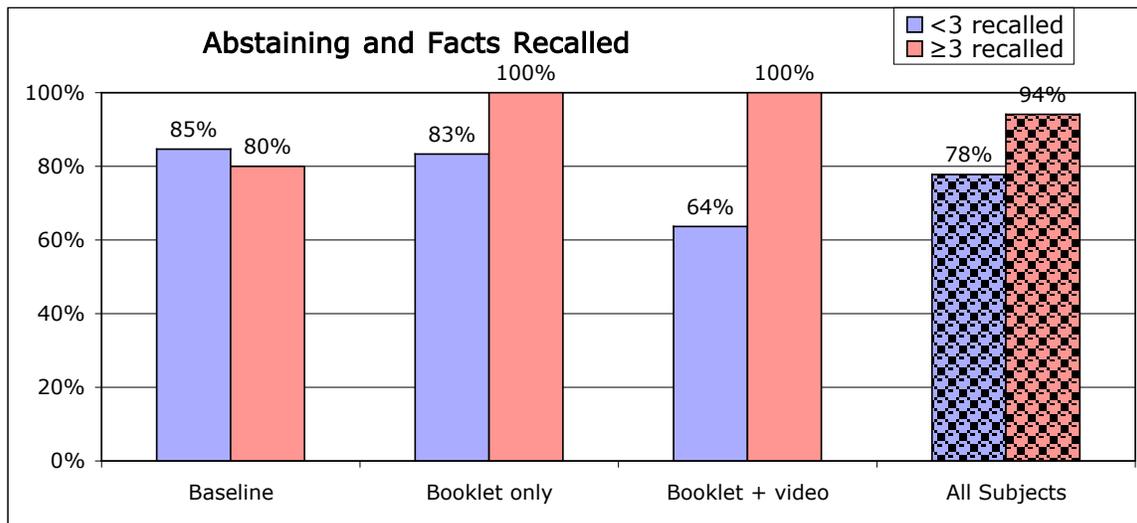


Figure 4. Abstaining at Follow-up and Facts Recalled.

Among subjects with longer lengths of post-traumatic amnesia (and thus more likely to still be somewhat confused when provided the educational intervention), the videotape plus booklet intervention was superior to using the booklet only. We observed that for subjects with longer lengths of post-traumatic amnesia (PTA), the booklet + videotape condition was superior to booklet alone. Figure 5 shows that for the baseline and booklet only conditions, there was a significant difference in average length of PTA between those recalling 3 or more facts and those who could not. However, for the booklet + video condition, there was no difference. PTA duration indicates greater injury severity, as well as a greater likelihood that some residual confusion was present at the time of the educational intervention. While PTA duration was related to recall of facts for the other groups, the use of the videotape may have allowed those with more severe injuries or residual confusion to benefit from the intervention.

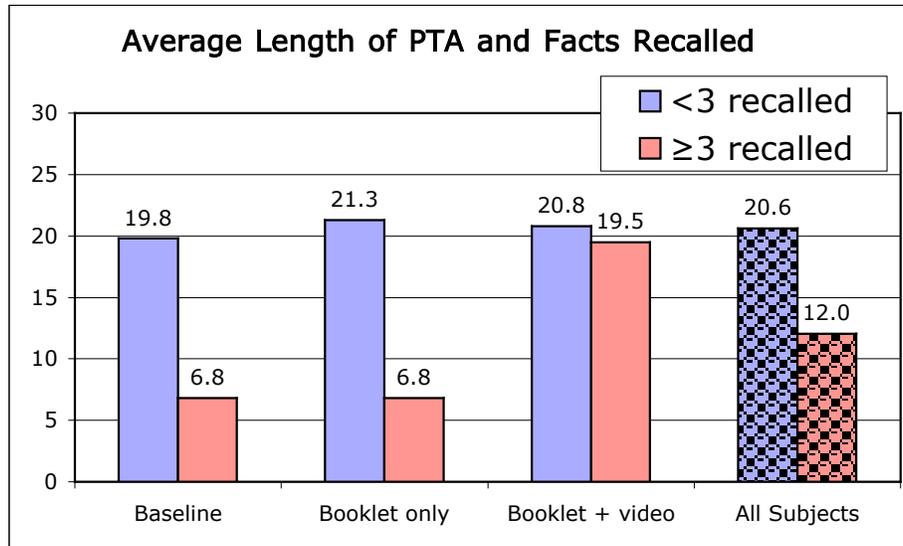


Figure 5. Average Length of Post-Traumatic Amnesia and Facts Recalled

Patient and Family Members' Response

We also sought feedback from the staff administering the interventions to discern qualitative information about patient and family member responses. One impression was that reactions seemed to be either very positive or neutral. There were very few negative reactions noted, and those instances involved subjects with extensive prior histories of use. As one interviewer put it, “people were either very interested and said things like ‘Wow, I never thought about that’ or were disinterested and expressed essentially a ‘whatever’ attitude.” If a family member was present for viewing of the videotape, they were generally more likely to be appreciative than dismissive. This was especially true of spouses. Without being aware of the results described above, the interviewers also observed that subjects who had recently cleared PTA were less attentive, whether being shown the booklet, or both booklet and videotape. Finally, they also observed that subjects whom they could tell had prior problems with substance use were more likely to dismiss the information, even if they were espousing that they “had learned their lesson” and were intending to change their use behavior. Those who blamed themselves for their accident may have been more attentive.

Distribution to Rehabilitation Facilities

As indicated in the grant application, we have attempted to make information about addressing substance use during TBI rehabilitation available to all rehabilitation facilities in Ohio. Letters were sent to 64 facilities

targeted by the Ohio Trauma Registry for reporting of rehabilitation patients. We offered to send them, free of charge, a “Tool Box” of resources that rehabilitation programs can use to address substance abuse among patients with acquired brain injury. The Tool Box included:

- *Substance Use and Abuse after Brain Injury: A Programmer’s Guide* provides a step-by-step approach for a rehabilitation programs to establish a program of secondary prevention for substance use and abuse.
- *User’s Manual for Faster...More Reliable Operation of a Brain after Injury*—a 14-page booklet for individuals with brain injury and their family members explaining the problems of substance use after injury. This pamphlet is available in English and Spanish (a copy is enclosed with this letter).
- A video companion to the *User’s Manual*, also available in English and Spanish.

As of this report we have provided the Tool Box to 13 facilities, approximately 20% of those originally contacted. Since we would expect that only a fraction of rehabilitation facilities treat patients with TBI, we feel this has been a very good response.

Conclusions

Because of the significant impact of adverse selection factors, a majority of adolescents and adults provided acute rehabilitation for TBI will have pre-existing substance use disorders. Still others are vulnerable to developing such problems in the months and years after injury. We contend that acute rehabilitation is an opportunity for intervention that should not be squandered despite the challenge created by residual confusion and newly acquired cognitive impairments. This project has provided preliminary support for the effectiveness of educational interventions provided during this early phase of recovery. The results are tempered by the relatively small sample size and follow-up being limited to 30 days post-discharge from the rehabilitation hospital. Future studies will need to examine larger samples for behavior that is further post-injury. This research also points to the necessity in future studies to account for prior history of substance use when looking at the effectiveness of educational interventions. A final limitation of the study is that it was only performed at one facility. Given the Brain Injury Program at Dodd Hall provides information about substance abuse as part of its standard of care, comparisons with the baseline group are particularly “hard” tests of intervention effectiveness. Nonetheless, the project suggests that a combined booklet plus videotape educational intervention conveys information that is retained at least one month later, despite residual confusion and cognitive impairment. This knowledge appears to affect attitudes that in turn impact substance use.

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