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Social Problem Solving and Community Integration in Postacute Rehabilitation Outpatients With Traumatic Brain Injury

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Objective: To enhance understanding of the role that social problem solving (SPS) plays in community integration following traumatic brain injury (TBI). ***Study Design:*** Regression analysis. ***Participants:*** Forty-five adults with TBI participating in higher level outpatient cognitive rehabilitation and 15 uninjured adults. ***Main Outcome Measures:*** Measures of community integration, problem-solving ability, and SPS self-appraisal and performance. ***Results:*** Individuals with TBI demonstrated poorer problem-solving as measured by both neuropsychological and SPS methods; however, the largest effect size was observed for SPS self-appraisal. Only SPS self-appraisal predicted a significant proportion of the variance in community integration. ***Conclusions:*** It is important to assess brain-injured persons' confidence in their ability to cope with problems. A focus on objective test scores alone may lead to underdetection of disabling problem-solving deficits.

Global social indicators typically reveal difficulties in many areas of community functioning following traumatic brain injury (TBI; Schmidt, Garvin, Heinemann, & Kelly, 1995). Compared with their lives before injury, people with TBI have fewer community outings; fewer social contacts; and fewer work, school, or leisure activities (Dawson & Chipman, 1995; Santoro & Spiers, 1994). Although slowness, fatigue, and other physical impairments are common sequelae of brain injury (see, e.g., Hoofien, Gilboa, Vakil, & Donovick, 2001), the major impediments to successful community integration are rarely medical or physical (Ponsford, Olver, & Curran, 1995). In general, cognitive deficits, rather than any residual physical impairments per se, contribute most to the disruption of meaningful life activities for people with TBI (Cicerone et al., 2000).

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A major target of postacute cognitive rehabilitation is the remediation of problem-solving deficits (Cicerone et al., 2000), previously identified as a significant obstacle to the community integration of TBI survivors (Ben-Yishay & Prigatano, 1990). Intact problem-solving abilities are necessary to maintain a home, function in the community, or return to work (Adamovich, 1991); therefore, deficits in such abilities may prevent individuals with TBI from returning to productive personal and vocational lives (von Cramon, Matthes-von Cramon, & Mai, 1991). Conceptualized as the most complex of all intellectual functions (Goldstein & Levin, 1987), *problem solving* has been defined as a goal-directed cognitive activity that arises in situations for which there is no immediately apparent or available response (Luria, 1966; Sohlberg & Mateer, 2001). Problem-solving deficits have been characterized as deficiencies in purposeful, logical, analytical thought brought about by brain damage (von Cramon & Matthes-von Cramon, 1992). Such deficits may be thought of as part of a disturbance in executive function, a widely used concept in cognitive rehabilitation, but one that is not well defined (Benton, 1994).

In acute-stage inpatient rehabilitation samples, traditional neuropsychological measures of executive function predict subsequent postdischarge community-integration levels (Hanks, Rapport, Millis, & Deshpande, 1999). However, in higher level outpatient rehabilitation samples, relatively intact performance on such standard neuropsychological measures often belies the degree of real-life functional impairment (e.g., job loss, marital discord, loneliness) reported by patients and observed by significant others and clinicians (e.g., Hart & Hayden, 1986; Rath et al., 2003; von Cramon & Matthes-von Cramon, 1994).

Despite difficulties dealing with the types of practical problems that occur in everyday life, postacute rehabilitation outpatients with TBI may nonetheless perform within normal limits on demanding cognitive tests (von Cramon & Matthes-von Cramon,

1994). This does not imply an absence of cognitive deficits but rather reflects the challenge of assessing such deficits, especially in patients with above-average premorbid intellectual functioning, when evaluated with highly structured, emotionally neutral tests (Rath, Simon, Langenbahn, Sherr, & Diller, 2000). Thus, scores on conventional neuropsychological tests may misrepresent everyday functional behaviors (Hart & Hayden, 1986), and there is evidence that normal-level test scores do not necessarily indicate full recovery from injury (Dikmen, Temkin, & Armsden, 1989).

Compared with the task demands of most neuropsychological tests, real-life problem solving relies more heavily on acquired practical and social knowledge (Channon & Crawford, 1999). Typical tests of problem solving are insensitive to deficits in the diffusely organized operations that underlie everyday, real-world functions; thus, such tests may not adequately represent behaviors that occur in natural or less contrived settings (Rath et al., 2000). As aptly noted by Rosenthal and Millis (1992), "the dissimilarity between many traditional neuropsychological measures and complex real-life situations may confound whatever positive or negative findings that result from research studies" (p. 3).

Cognitive–behavioral perspectives such as the social problem-solving approach (D'Zurilla & Goldfried, 1971; D'Zurilla & Nezu, 1982, 2001) may address some of the concerns about the ecological validity of neuropsychological tests. In contrast to a neuropsychological approach that focuses on the cognitive infrastructure of problem solving and involves finding fixed solutions to specified problems (Rath et al., 2000), the social problem-solving perspective emphasizes motivational, attitudinal, and affective aspects of real-life problem resolution. The term *social problem solving* refers to problem solving as it occurs in everyday life; the adjective *social* does not restrict problem solving to any particular domain but instead indicates that problem solving occurs in the everyday social environment (D'Zurilla & Maydeu-Olivares, 1995). Social problem solving thus encompasses all types of problems in living, including both intra- and interpersonal problems. In their seminal model, D'Zurilla and associates (D'Zurilla & Goldfried, 1971; D'Zurilla & Nezu, 1982, 2001) conceptualized social problem solving as a process involving five recursive and interacting steps: problem orientation (i.e., maintaining an adaptive attitudinal, motivational, and affective approach to everyday problems), problem definition and formulation (i.e., identifying the conditions and constraints of problems and setting realistic goals), generation of alternatives (i.e., brainstorming a range of possible solutions), decision making (i.e., examining potential consequences of options and selecting an optimal one, given the conditions and constraints of the problem), and solution implementation and verification (i.e., instituting solutions, monitoring effectiveness, and making modifications as necessary).

Measures of social problem solving have been linked to a variety of adjustment criteria relevant to medical and rehabilitation populations. For example, social problem solving has been linked to health complaints and health-related expectancies (Elliott & Marmarosh, 1994); compliance with substance-abuse treatment (Herrick & Elliott, 2001); complications in surgical patients (see Heppner & Baker, 1997); regimen adherence in diabetics (Toobert & Glasgow, 1991); caregiver physical and psychological distress (Elliott, Shewchuk, & Richards, 2001); and levels of depression, psychosocial impairment, acceptance of disability, and pressure-sore occurrence in adults with spinal cord injury (Elliott, 1999; Elliott, Godshall, Herrick, Witty, & Spruell, 1991; Elliott, Shewchuk, & Richards, 1999).

Despite a growing body of rehabilitation-related social problem-solving research over the past decade, we found no studies investigating the relationship of social problem-solving with community integration in individuals with TBI. Although several studies (i.e., Acker & Davis, 1989; Hanks et al., 1999; Millis, Rosenthal, & Lourie, 1994; Ross, Millis, & Rosenthal, 1997) examined the relation between scores on conventional neuropsychological tests and community-integration level, none utilized social problem-solving measures per se. As noted by Kendall, Shum, Halson, Bunning, and Teh (1997), "the relationship between social problem-solving deficits and adjustment in people with TBI has been frequently postulated, but to date has not been empirically demonstrated" (p. 76).

The present study was designed to examine the relation between social problem solving and community integration in higher level postacute rehabilitation outpatients with TBI, a population in which conventional neuropsychological measures may be relatively insensitive to disabling problem-solving deficits. Specifically, we expected that (a) individuals with TBI would perform more poorly than uninjured persons on both a neuropsychological measure of problem solving and innovative measures of social problem solving; (b) compared with a neuropsychological measure of problem solving, social problem-solving measures would be more sensitive to deficits; and (c) compared with a neuropsychological measure of problem solving, social problem-solving measures would be more robust predictors of community-integration level in persons with TBI.

Method

Participants

Participants were 45 individuals with TBI who were recruited from higher level cognitive remediation groups on the Adult Outpatient Neuropsychology Service at the Rusk Institute of Rehabilitation Medicine (RIRM), New York University Medical Center (NYUMC; see Sherr & Langenbahn, 1992, for a comprehensive description of the service), and 15 healthy controls without brain injury. On the basis of current level of functioning, rather than severity of brain injury, prescribed minimum criteria for inclusion in higher level outpatient cognitive rehabilitation groups at RIRM include the ability to (a) sustain attention for an hour-long session, (b) take organized notes, (c) give and receive feedback, (d) state cognitive strengths and weaknesses, and (e) relate to others with adequate social skills (see Langenbahn, Sherr, Simon, & Hanig, 1999). Additional selection criteria included Verbal IQ (VIQ) scores of 85 or above (or, if VIQ scores were unavailable, Wechsler Adult Intelligence Scale—Third Edition [WAIS–III; Wechsler, 1997] Comprehension subtest scaled score of 10 or above), age between 18 and 65 years, no coexisting overt physical disability (e.g., spinal cord injury), and English language skills sufficient for testing. Despite at least normal-range IQ scores, all participants with TBI had documented impairments in psychosocial functioning. To avoid possible confounds, potential participants whose psychological assessment records indicated psychoses, active substance abuse, other neurological conditions, or severe lateralized deficits (i.e., left visual neglect or aphasia) were ineligible for participation in the study.

The TBI group consisted of 18 men and 27 women (35 were White, 2 Black, 4 Latino, and 4 Asian) with a mean age of 43.1 years ($SD = 11.6$; range = 22–64). VIQ scores were available for 40 of the participants with TBI; the mean score was 104.8 ($SD = 12.2$; range = 85–130). For the five

participants whose VIQ scores were unavailable, WAIS–III Comprehension subtest scaled scores ranged from 11 to 16, with a mean of 13.4. The mean level of education for the TBI group was 15.7 years (SD = 2.4; range = 11–20), and the mean WAIS–III Comprehension subtest scaled score was 12.7 (SD = 2.7; range = 8–19).

Injury characteristics (i.e., severity, cause, and time since onset) are reported in Table 1. As can be seen in Table 1, severity of injury ranged from mild to severe, according to a conventional classification system (Geffen, Hinton-Bayre, Geffen, & Geffen, 1998); however, this is clearly a well-educated, high-functioning group, with age and gender characteristics consistent with those reported for mild brain-injury rehabilitation samples (see, e.g., Donders, Tulsky, & Zhu, 2001; Paniak, Toller-Lobe, Reynolds, Melnyk, & Nagy, 2000). It is important to note that the normal-range (or better) performance on standard IQ tests was not reflective of the real-life functional impairments (e.g., job loss, marital discord, loneliness) reported by patients and observed by significant others and clinicians in this well-educated, higher level outpatient sample.

Recruited from the community, participants in the uninjured comparison group included friends of individuals in the TBI group, as well as students, staff members, and trainees from various programs at NYUMC. None of these participants exhibited neurological problems, overt physical disabilities, psychiatric conditions, or active substance abuse. The comparison group consisted of 8 men and 7 women (10 were White, 2 Black, 1 Latino, and 2 Asian) with a mean age of 35.7 years (SD = 8.8; range = 24–56 years). The mean level of education was 16.9 years (SD = 1.3; range = 15–19), and the mean WAIS–III Comprehension subtest scaled score was 13.3 (SD = 2.6; range = 10–18).

Measures

Community integration. The Community Integration Questionnaire (CIQ; Willer, Ottenbacher, & Coad, 1994) is composed of 15 multiple-choice items designed to assess social, home, and vocational integration in individuals with TBI; it is the most widely used global measure of community integration (Dijkers, 1997). Scores on the three dimensions can be summed to obtain a total score with a range of 0 to 29; higher scores indicate greater independence and integration. The CIQ has high test–retest reliability over 7–10 days (r = .91) and adequate internal consistency (α = .76). Scores are normally distributed both when completed by people without disabilities and when completed by those with TBI (Corrigan & Deming, 1995; Willer et al., 1994). Consistent with the hypotheses under investigation, CIQ total scores were used in the present study.

Table 1
Injury Characteristics for the Traumatic Brain Injury Group

Characteristic	*n*
Loss of consciousness (severity)	
Less than 5 min (mild)	18
5 min to 6 hr (moderate)	7
6 hr to 1 week (severe)	5
1–4 weeks (severe)	6
More than 4 weeks (severe)	2
Not available in medical record	7
Cause of injury	
Traffic accident	20
Fall	8
Assault	5
Sporting accident	5
Other type of impact (falling object, etc.)	6
Diffuse brain damage due to stroke	1
Time since onset (months)	
M (SD) = 43.7 (39.5)	
Mdn = 28.4	
Range = 9–215	

Note. Loss-of-consciousness classification from Geffen et al. (1998).

Problem-solving ability. The Wisconsin Card Sorting Test (WCST; Heaton, Chelune, Talley, Kay, & Curtis, 1993) is one of the most widely used neuropsychological instruments (Butler, Retzlaff, & Vanderploeg, 1991); it has been used extensively as an indicator of problem-solving ability in individuals with brain injury (Daniel, Webster, & Scott, 1986; King & Snow, 1982; Wiegner & Donders, 1999). In a national survey, Rabin (2001) found the WCST to be by far the most common measure of problem solving in rehabilitation settings. Perseverative Responses, the most useful diagnostic measure derived from the WCST (Heaton, 1981), was employed in the present study. Lower Perseverative Responses scores indicate better performance on the WCST.

Social problem-solving self-appraisal. The Problem Solving Inventory (PSI; Heppner, 1988) assesses self-appraisal of problem-solving behaviors and attitudes. The PSI consists of 32 six-point Likert-type items, generated to fit D'Zurilla and Goldfried's (1971) social problem-solving model, in which participants are asked to agree or disagree with statements describing their own problem-solving. Several of the items are worded negatively, so the scores for these items are reversed.

The PSI has high discriminant validity with measures of intelligence and social desirability and convergent validity with behaviors and attitudes, such as locus of control, typically associated with problem solving (Heppner, 1988). Reliability estimates indicate that the PSI is internally consistent (α = .90) across a number of populations and cultures (Heppner & Baker, 1997) and that it is stable (r = .89) over a 2-week period. The PSI distinguishes high-level cognitive rehabilitation outpatients from uninjured adults (Rath et al., 2000, 2003), and it is sensitive to improvements following cognitive rehabilitation (Rath, Simon, Langenbahn, Sherr, & Diller, in press).

Items correspond to three factors: The first, *Problem-Solving Confidence*, is defined as self-assurance while engaging in problem-solving; the second, *Approach–Avoidance Style*, is defined as the general tendency to approach or avoid different types of problem-solving activities; and the third, *Personal Control*, is defined as a belief in one's control over emotions and behavior while problem solving (Heppner & Baker, 1997). Although scores corresponding to the three factors can be computed, the PSI total score, with a range of 32 to 192, is the most popular measure used in research (D'Zurilla & Maydeu-Olivares, 1995). Lower scores indicate more positive self-appraisal of social problem-solving abilities.

Social problem-solving performance. The Personal Problem-Solving System (PPSS; Ronan, 1990) is a performance-based measure that uses standard stimuli (i.e., Thematic Apperception Test Cards 1, 2, and 4; Murray, 1943) to evoke social problem-solving processes that are then scored using a standardized rating system (Ronan, Colavito, & Hammontree, 1993; Ronan, Date, & Weisbrod, 1995; Ronan et al., 1996). These stimuli are conceptualized as depicting social and personal problems to which the participant is asked to respond. Specifically, participants are given the following instructions:

> This is a problem-solving task. I have some pictures that I am going to show you. For each picture, identify the main character and describe what his or her problem might be. Develop a story around the problem. Be sure to note how the problem developed, what is happening now, how the problem will be resolved, and what the outcome might be. (Ronan & Gibbs, 1997, p. 51)

As in the development of the PSI, the development of the PPSS relied heavily on D'Zurilla and Goldfried's (1971) seminal five-step model. The scoring criteria consist of 19 items that assess constructs related to effective social problem solving; 17 of the items are arranged in a 5-point Likert-type rating format (−1 to 3), and the remaining two items require counting the number of solutions generated.

The PPSS has high convergent validity with other performance-based measures of problem solving (Ronan et al., 1993). It also demonstrated discriminative validity by finding expected mean differences between groups hypothesized to have different levels of problem-solving ability

(Ronan et al., 1996), and it is sensitive to social problem-solving training (Ronan et al., 1995). Interrater reliability estimates range from $r = .83$ to $r = .92$ (Ronan & Gibbs, 1997). Test–retest reliability was $r = .82$ after 45 days.

Scoring criteria are grouped into subscales that correspond to the problem orientation, problem definition and formulation, generation of alternatives, decision making, and solution implementation and verification components of the D'Zurilla and Goldfried (1971) model (Ronan et al., 1993). According to Ronan and Gibbs (1997), the PPSS is best used to assess general social problem-solving skill level, and a principal-components analysis indicated that all subscales loaded on a single dimension that accounted for 73% of the variance in the total score (Ronan et al., 1993). Therefore, consistent with the hypotheses under investigation, the PPSS total score was used in the present study. Higher scores indicate better social problem-solving performance.

Procedure

Participants completed the measures for this study as one part of a National Institutes of Health-funded program of research on rehabilitation of problem-solving deficits in adults with TBI. In addition, for 35 participants in the TBI group, CIQ data also were obtained from a significant-other informant.

Statistical Analyses

One-tailed independent *t* tests were used to evaluate the a priori directional hypothesis that, compared with the uninjured comparison group, the TBI group would perform more poorly on both conventional (WCST) and social (PSI, PPSS) problem-solving measures. Prior to the *t*-test analyses, *z*-score transformations were computed on the three problem-solving measures. The *z* scores for each group were examined for univariate outliers, and no extreme scores meeting the criterion of $z \geq 3.29$ were identified (Tabachnick & Fidell, 1996). However, to avoid any possible confounds due to treatment effects, we excluded from the *t*-test analysis the scores of 6 individuals in the TBI group who had participated in a problem-solving-based cognitive rehabilitation treatment program (see Rath et al., in press).

To examine the sensitivity of the measures to deficits, we used a weighted average of the within-group standard deviations (taking into account unequal sample sizes and unequal variances) to calculate *d* (i.e., the effect size [ES] index for independent means; Cohen, 1992) for each variable.

A hierarchical multiple regression analysis (WCST scores entered at Step 1; PSI and PPSS scores entered at Step 2) was used to test the hypothesis that, compared with the most commonly used neuropsychological measure of problem solving (WCST), measures of social problem solving (PSI, PPSS) would be better predictors of community integration. Because problem solving and community integration were hypothesized to covary, all cases from the TBI group, regardless of exposure to the problem-solving treatment program, were included in the multiple regression analysis. Prior to analysis, WCST Perseverative Responses scores were transformed logarithmically in order to reduce extreme skewness and kurtosis, and *z* scores were computed for CIQ total and transformed WCST Perseverative Responses scores. No univariate outliers were identified; however, using Mahalanobis distance at the $p < .001$ level (Tabachnick & Fidell, 1996), one case was identified as a multivariate outlier and deleted, leaving 44 cases for the multiple regression analysis.

Results

Between-Groups Differences

Compared with uninjured participants, individuals with TBI had more negative self-appraisals of social problem-solving abilities, $t(50.58) = 3.85$, $p < .001$, one-tailed;[1] poorer social problem-solving performance scores, $t(52) = -1.73$, $p < .05$, one-tailed; and more perseverative responses on the WCST, $t(51.65) = 2.26$, $p < .05$, one-tailed.

As can be seen in Table 2, large between-groups effects were obtained for social problem-solving self-appraisal (PSI) and community-integration level (CIQ), $d = -.90$ and $d = .84$, respectively. In contrast, medium effects of $d = .53$ and $d = -.51$ were obtained for social problem-solving performance (PPSS) and WCST perseverative responses, respectively (ES conventions for *d* are small = .30, medium = .50, and large = .80; Cohen, 1992).

Relation of Problem-Solving Measures to Community Integration

As can be seen in Table 3, only social problem-solving self-appraisal, as indicated by PSI scores, was significantly associated with community-integration level, $\beta = -.45$, $t(44) = -3.14$, $p < .01$. Entered as a block in the second step of a hierarchical regression equation, the social problem-solving measures predicted a significant 21% of the variance in community-integration level, $\Delta F(2, 40) = 5.24$, $p < .01$. A relation of this size corresponds to an f^2 (i.e., the ES index for multiple regression; Cohen, 1992) of .27, a moderate to large effect (ES conventions for f^2 are small = .02, medium = .15, and large = .35; Cohen, 1992). Contrary to expectations, neither WCST Perseverative Response scores nor social problem-solving performance (PPSS) scores were significantly related to community integration.

Post Hoc Analyses

After testing the hypothesized directional relation, we examined additional associations between demographic and research variables, using two-tailed tests of significance. A correlation matrix for all variables is reported in Table 4. Educational level was significantly related to both community integration, $r(44) = .37$, $p < .05$, two-tailed, and social problem-solving self-appraisal, $r(44) = -.31$, $p < .05$, two-tailed.[2] A partial correlation of CIQ total scores with PSI total scores indicated that even after controlling for education, social problem-solving self-appraisal was still significantly related to community integration, $r(44) = -.39$, $p < .01$, two-tailed (see Footnote 2). In a hierarchical multiple regression analysis, with educational level entered first and PSI total scores entered second, social problem-solving self-appraisal predicted an additional 13% of the variance in community integration, over and above that predicted by education, $\Delta F(1, 41) = 7.41$, $p < .01$. Combined, the two variables predicted 27% of the variance in community integration, $F(2, 41) = 7.62$, $p < .01$. A relation of this magnitude corresponds to $f^2 = .37$ (a large ES; Cohen, 1992).

Post hoc examination of PSI subscale scores indicated that the Problem-Solving Confidence subscale had the strongest correlation with community integration, $r(44) = -.53$, $p < .01$, two-

[1] When necessary to correct for unequal variances, degrees of freedom were adjusted by using Welch's corrected *t* test (Overall, Atlas, & Gibson, 1995).

[2] Direction of correlation is negative because lower PSI scores indicate more positive self-appraisal of social problem-solving abilities.

Table 2
Between-Groups Differences: TBI and Comparison Groups

Scale	TBI[a] *M*	TBI[a] *SD*	Comparison[b] *M*	Comparison[b] *SD*	Effect size (*d*)
PSI	101.36	36.34	73.53	16.58***	−.90
PPSS	11.58	6.70	14.92	5.36*	.53
WCST	12.05	13.18	6.60	4.50*	−.51
CIQ	17.06	5.56	21.70	5.01***	.84

Note. Higher scores indicate better performance on the PPSS and the CIQ. Lower scores indicate better performance on the PSI and the WCST. Effect-size conventions for *d* are as follows: small = .30, medium = .50, large = .80 (Cohen, 1992). TBI = traumatic brain injury; PSI = Problem Solving Inventory total score; PPSS = Personal Problem-Solving System total score; WCST = Wisconsin Card Sorting Test Perseverative Responses score; CIQ = Community Integration Questionnaire total score.
[a] $n = 39$. [b] $n = 15$.
* $p < .05$, one-tailed. *** $p < .001$, one-tailed.

tailed (see Footnote 2). In a hierarchical multiple regression analysis, with educational level entered first and problem-solving confidence entered second, problem-solving confidence predicted an additional 20% of the variance in community integration, over and above that predicted by educational level, $\Delta F(1, 41) = 12.24$, $p < .001$. Combined, the two variables predicted 34% of the variance in community integration, $F(2, 41) = 10.45$, $p < .001$. For a relation of this magnitude, $f^2 = .52$ (a large ES according to Cohen, 1992).

Finally, CIQ data collected from significant others (spouse, other family member, etc.) were examined for 35 participants in the TBI group. Agreement between participants with TBI and their significant others for CIQ total scores was found to be consistent with that reported by the test's authors (Willer, Rosenthal, Kreutzer, Gordon, & Rempel, 1993), $r(35) = .84$, $p < .001$, two-tailed. The correlation between significant others' report of community-integration level and the brain-injured individual's problem-solving confidence was −.37, $p < .05$, two-tailed (see Footnote 2). In a multiple regression analysis, the combination of educational level and problem-solving confidence predicted 25% of the variance in community integration as reported by a significant other, $F(2, 32) = 5.36$, $p < .01$. A relation of this size corresponds to an f^2 of .33 (a moderate to large ES; Cohen, 1992).

Table 3
Summary of Hierarchical Multiple Regression Analysis for Community Integration (N = 44)

Variable	β	R^2	ΔR^2	*df*	Δ*F*	*F*
Step 1		.01		1, 42	0.39	
WCST	−.04					
Step 2		.22	.21	2, 40	5.24**	
PPSS	.03					
PSI	−.45**					
Full model				3, 40		3.65*

Note. WCST = Wisconsin Card Sorting Test Perseverative Responses score; PPSS = Personal Problem-Solving System total score; PSI = Problem Solving Inventory total score.
* $p < .05$. ** $p < .01$.

Table 4
Intercorrelations Between Demographic and Research Variables for the TBI Group (N = 44)

Variable	CIQ	Age	Educ.	PSI	PPSS
Age	.21	—			
Educ.	.37*	−.17	—		
PSI	−.46**	−.18	−.31*	—	
PPSS	.11	−.01	.34*	−.18	—
WCST	−.10	.23	−.04	.13	−.05

Note. Higher scores indicate better performance on the CIQ and the PPSS. Lower scores indicate better performance on the PSI and the WCST. TBI = traumatic brain injury; CIQ = Community Integration Questionnaire total score; Age = age in years; Educ. = education level in years; PSI = Problem Solving Inventory total score; PPSS = Personal Problem-Solving System total score; WCST = Wisconsin Card Sorting Test Perseverative Responses score.
* $p < .05$, two-tailed. ** $p < .01$, two-tailed.

Discussion

Compared with uninjured participants, individuals with TBI demonstrated poor problem solving, as assessed by both conventional neuropsychological and social problem-solving self-appraisal and performance measures. Social problem-solving self-appraisal (PSI) distinguished individuals with TBI from uninjured participants more robustly than either the WCST or the social problem-solving performance measure (PPSS). A large between-groups ES was found for the PSI, whereas ESs were in the moderate range for the WCST and PPSS.

Social problem-solving self-appraisal, as indicated by PSI scores, predicted a significant proportion of the variance in community integration as measured by the CIQ. Neither conventional neuropsychological (WCST) nor social problem-solving performance (PPSS) scores were significantly associated with community integration. Thus, in comparison to the most frequently used neuropsychological measure of problem solving (see Rabin, 2001), social problem-solving self-appraisal was a better predictor of community integration. This finding is consistent with clinical and research reports indicating that standard neuropsychological tests may not accurately assess real-life deficits, especially in higher level outpatient TBI samples. Social problem-solving self-appraisal's unique contribution to the variance in community integration remained significant even after controlling for educational level, a commonly used estimate of premorbid functioning.

The differential utility of conventional neuropsychological and social problem-solving self-appraisal measures for predicting community integration may be a reflection of intrinsic differences in the two approaches. Conventional measures focus on the cognitive infrastructure of problem solving and involve finding fixed solutions to specified problems (Rath et al., 2000). In contrast, social problem-solving self-appraisal measures emphasize problem orientation, the affective, attitudinal, and motivational self-regulatory component of problem solving, notably absent from neuropsychological approaches to assessment.

As can been seen in Table 4, there was virtually no concordance between the three methods for measuring what is presumably a single construct (see Rath et al., 2003). Although independence of assessment methods might be viewed as a sign of invalidity, in

their seminal article, Campbell and Fiske (1959) noted that such findings can point to inherent complexities in the construct under investigation. However, given the well-known association between impaired self-awareness and poor psychosocial outcome following TBI (see, e.g., Malec & Moessner, 2000; Ownsworth, McFarland, & Young, 2000; Sherer et al., 1998), the observed discrepancy between social problem-solving performance and self-appraisal warrants comment. The American Psychological Association Board of Professional Affairs Psychological Assessment Work Group (Meyer et al., 2001) found that even in individuals without brain injury, "self-reported characteristics are essentially unrelated to conceptually similar constructs measured by performance tasks" (Meyer et al., 1998, p. 87). Past research (e.g., Heppner & Petersen, 1982; Ronan et al., 1993) has consistently found no significant relationship between social problem-solving self-appraisal and performance in a variety of samples without brain injury. Thus, rather than implying impaired self-awareness in our higher level rehabilitation outpatient sample, the observed discrepancy between performance and self-appraisal is consistent with both the complex nature of problem solving and past research involving persons without brain injury.

Limitations of the Study

The failure to detect a relation between social problem-solving performance and community integration in the present study was unexpected. This may be related to a failure to adequately operationalize social problem-solving performance. Diller and associates (Rath et al., in press) found pre- to postintervention treatment effects by using ratings of staged interpersonal problem-solving scenarios. Perhaps such direct behavioral observations would have better captured the construct of social problem-solving performance (see Foxx & Faw, 2000). It also must be noted that the definition of the dependent variable, community integration, was limited; psychometric concerns regarding the CIQ are well-known (e.g., Hall, Bushnik, Lakisic-Kazazic, Wright, & Cantagallo, 2001). Additionally, the operationalization of "community integration" did not include quality-of-life criteria; the CIQ assesses only level of integration, not satisfaction with that level.

The possibility that the observed association between social problem-solving self-appraisal and community integration was a function of self-report cannot be ruled out. As noted by Elliott (1999), "evidence linking problem-solving with self-reported adjustment may be confounded by ongoing levels of distress" (p. 316). However, community-integration level was not solely self-reported in the present study, but in fact, corroborated by significant others. Self-appraised problem-solving confidence remained predictive of community integration, even when significant others' report was substituted for self-reported community-integration level.

In addition, although both the TBI and comparison groups were composed of well-educated, intelligent adults, the groups were not ideally matched. Participants in the comparison group were somewhat younger than participants in the TBI group (36 vs. 43 years). However, as can be seen in Table 4, correlation coefficients did not suggest significant relations between age and any of the problem-solving variables. Finally, although the sample size was sufficient to detect the moderate to large magnitude results, the relatively small sample is a concern. Future research in this area might best be pursued with larger samples.

Implications for Practice

The findings concerning problem-solving self-appraisal and community integration are theoretically consistent with current understanding of adjustment following brain injury. In an outpatient brain-injury sample, Montgomery, Kern, Lund, and Patterson (1999) found that Beck Depression Inventory (Beck, 1987) and a symptom rating scale scores predicted eventual job placement and correlated so highly as to suggest "a common dimension of confidence–distress over neuropsychological functioning" (p. 794). Such findings underscore the necessity of assessing brain-injured persons' confidence in their ability to cope with symptoms; a focus on objective test performance alone may be too narrow (Montgomery et al., 1999; see also, Meyer et al., 2001).

In a national survey, Rabin (2001) found the WCST to be the most commonly used measure of problem-solving in rehabilitation settings. The relative insensitivity of the WCST in the current study underscores the need for measures sensitive to deficits in well-educated, higher level, postacute rehabilitation outpatients. These findings have important policy implications, because conventional neuropsychological measures may lead to underdetection of disabling problem-solving deficits in this population. From a clinical standpoint, the virtue of problem-solving self-appraisal measures is that they elicit the individual's acknowledgment of functional difficulties within a model that provides a framework for guiding remedial efforts. It may be productive for rehabilitation psychologists to supplement neuropsychological test results with data from sources such as self-appraisal measures, especially in higher level outpatient settings.

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