Introduction:

Memory deficits are often the most disabling impairments for persons who have sustained a traumatic brain injury (TBI). More than half of people who experience severe TBI have chronic memory problems (Goldstein & Levin, 1991; Ylvisaker, et al., 2001). These subtle, long-term effects of TBI prevent persons from maintaining satisfactory employment and impact life-course and interpersonal relationships (Brooks, McKinley, Symington, Beattie, & Campsie, 1987; Devaney, Kreutzer, Halberstadt, et al., 1991; Webb, 1991).

Impaired memory function associated with TBI is characterized by relatively intact recognition memory but impaired new learning due to impaired encoding and retrieval processes (Baddeley, 1992; Sohlberg & Mateer, 1989). Studies of cognitive rehabilitation and memory retraining typically report improvements on standardized tests, however, generalization to functional tasks remains limited (Coehlo, DeRuyter, & Stein, 1996). Training the use of compensatory memory aids such as written schedules, diaries, and planners has been a rehabilitative strategy for clinicians working with persons with TBI (Sohlberg & Mateer, 2001). Metamemory deficits in persons with TBI often result in misplaced or neglected external aids (Freeman, et al., 1992) and difficulty using external memory aids at appropriate times (Camp, Foss, Stevens, & O'Hanlon, 1996). Training automatic, independent use of compensatory strategies is vital to prevent dependence on others to prompt aid use.

Spaced Retrieval (SR), an errorless learning technique for improving recall over increasing time intervals, has been effective in teaching clients with dementia to remember to use compensatory memory aids (Bourgeois et al., 2001; Brush & Camp, 1998); recently Melton & Bourgeois (2005) replicated these effects with 7 persons with mild TBI. It is thought that SR training procedures capitalize on relatively intact nondeclarative memory systems of persons with dementia (Camp, Foss, O'Hanlon, & Stevens, 1996; Cherry, Simmons, & Camp, 1999) and of persons with TBI (Baddeley, 1992). In contrast, other memory training strategies, such as trial and error learning, massed practice, association, visual imagery, and others, are thought to require more effort on the part of the learner and to address deficits in declarative memory systems (Evans et al., 2000). The generalized use of trained memory strategies has been disappointingly sparse in the TBI population; even when clients are reported to attain goal mastery in the clinic, there is very little reported generalized use of these goals in their everyday situations (Sohlberg & Mateer, 2001). Telephone-delivered therapy has the potential to delivery intervention in the environment in which the trained behaviors need to be performed, thereby increasing the likelihood of generalization. Joltin, Camp, and McMahon (2003) reported the successful use of SR over the telephone with 3 persons with dementia. Therefore, the purpose of this study was to investigate the extent to which SR delivered by phone: 1) produces efficient goal mastery, 2) enhances maintenance of therapy goals, and 3) produces generalized effects on other related everyday memory problems in persons with chronic TBI in comparison to the effects of a "usual care" memory strategies control condition.

Methods:

Subjects with chronic TBI were recruited from support groups and outpatient clinics in North Florida, Georgia, and Wisconsin. Subjects had to be more than one year post-TBI, pass the Spaced Retrieval

Screen (Brush & Camp, 1998), report functional memory problems, and live with a person who agreed to participate in the study. Subjects were administered the Rivermead Behavioral Memory Test (Second Edition; Wilson, Cockburn, & Baddeley, 2003) to document severity of memory impairment. Three functional goals to address everyday memory problems were developed for each participant through subject, family member, and investigator consensus. The frequency of each memory problem was then tracked by the subject and caregiver over a one week period before training began. Subjects were matched (yoked) by gender and race and randomly assigned to either the treatment or control condition.

Experimental subjects received SR therapy over the telephone to train recall of compensatory strategies for the 3 goals; sessions occurred on a daily basis (Monday-Friday) for up to 30 minutes each. Subjects were asked a prompt question at increasing intervals (30 sec., 1 min., 2 min., etc.) if correct responses were given immediately. If the subject responded incorrectly, the investigator modeled the correct response, the subject repeated the correct response, and the next prompt was given after an interval equal to that of the last successful response. Response intervals were filled by conversation unrelated to the goal. If the subject answered the first prompt of a session correctly, training began on a subsequent goal. A goal was considered mastered when a correct response was given to the first prompt for three consecutive sessions. Once all three goals were mastered SR therapy was concluded. Control subjects received the same amount (total time) of therapy (a variety of memory strategies such as association, verbal rehearsal, imagery) as their yoked counterparts. During control sessions, the experimenter discussed a different memory strategy with the subject, helping them to identify a problem to which that strategy could be applied, and encouraging them to try it after the session. SR goal maintenance, control memory strategy use, frequency of targeted memory problems, and generalization to related behaviors were re-measured 1-week and 1-month after therapy concluded. Inter-rater agreement of at least 80% agreement was achieved for 100% of training sessions.

Results and Discussion:
To date, 10 yoked pairs of subjects have completed all phases of the study (we will report data for an additional 5-8 yoked pairs currently in progress). Experimental subjects have required an average of 6 training sessions to achieve goal mastery (range 4-11). Ninety-seven percent of subjects have maintained goal performance at the 1-month follow-up. Generalization to related functional behaviors was reported for 63 % of trained goals. Control subjects reported using 36% of strategies at follow-up. Generalized strategy use was reported for 26% of strategies. Preliminary analysis of the pre- and post-test measures of self- and caregiver reported frequency of everyday problem behaviors, memory self-efficacy, and community integration confirm the hypothesized direction of treatment effects on these related outcomes. Problems encountered in obtaining baseline measures, in identifying functional memory goals, and in verifying generalization reports, and their solutions, will be discussed.

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Introduction

Individuals with certain forms of aphasia may be under considerable stress related to their linguistic skills (Code, Hemsley, & Herrmann, 1999; Heeschen, Ryalls, & Hagoort, 1998; Marshall & Watts, 1976; Murray & Ray, 2000; Ryalls, 1984). Stress is generally experienced

when an individual is confronted with a situation that is appraised as personally relevant and threatening, and for which adequate coping resources are unavailable (Lazarus, 1985). Such stress elicits a physiological stress response that serves to adapt the organism to the changing demand. Recently, Laures-Gore, Heim, & Hsu (under review) explored a method to study physiologic and perceived stress in individuals with aphasia. Using salivary cortisol as a biologic marker of stress, they found that individuals with aphasia lack cortisol reactivity when confronted with a perceived stressor. Their study, however, did not assess the coping resources available to modulate the physiologic stress response in those with aphasia. Psychological factors such as coping resources, perceived stress, and life experiences are important in the activation of the physiologic stress response, particularly neuroendocrine activity (Kirschbaum, Pirke, & Hellhammer, 1993; Lutgendorf & Costanzo, 2003).

Previously, psychological changes related to stroke and linguistic impairment have been systematically studied in individuals with aphasia (Code, Hemsley, & Herrmann, 1999; Code & Herrmann, 2003; Gainotti, 1997), however, research relating the overall psychosocial perspective of aphasia to physiological stress, perceived stress, coping resources, and life experiences for this population is limited. Since the medical model addressing the physical impairment dominates health-care systems, the psychosocial perspective is often neglected (Code & Herrmann, 2003; Taylor Sarno, 1993). However, because the psychosocial consequences often exceed the communication impairment (Herrmann, Johannsen-Horbach, & Wallesch, 1993), exploration of these factors and changes may provide insight into the rehabilitation process.

The purpose of the current study is to examine coping resources, perceived stress, life experiences, and the basal salivary cortisol levels in individuals with aphasia. The following theoretically and clinically relevant questions will be addressed: 1. Is basal salivary cortisol levels in individuals with aphasia related to coping resources, perceived stress, and life experiences?; 2. Is there a difference in coping resources and perceived stress between individuals with aphasia and healthy controls?

Method

Participants. Fourteen individuals with aphasia (3 females, 11 males) and 14 healthy controls (3 females, 11 males) participated. Mean age was 53.86 years for individuals with aphasia and 54.21 years for the control group. Mean months post onset for the group with aphasia was 26.86 months.

Procedures and Measures.

Psychosocial. Assessment of psychosocial parameters in individuals with aphasia involves

methodological concerns due to the problems with adaptation of examination procedures to individuals with aphasia and the questionable reliability of proxy evaluations (Epstein, Hall, Tognetti, Son & Conant, 1989; Herrmann, 1997). Although there are instruments designed to be answered by individuals with aphasia about psychosocial adjustment (Code & Muller, 1992), there appears to be no measures specifically designed to assess coping, perceived stress and life events sensitive to the linguistic limitations observed in individuals with aphasia. To collect psychosocial information others have used measures standardized on non-brain injured individuals (e.g., Croteau & LeDorze, 1999), which was the model used in this study. To assess coping skills in the present study the *Coping Resources Inventory for Stress (CRIS)* (Matheny, Curlett, Aycock, Pugh, & Taylor, 1987) was administered. The CRIS is a 280-item true-false inventory measuring 15 coping resources, and is based on transactional models of stress (Cox, 1978; Folkman & Lazarus, 1984; Mason, 1975). The *CRIS* has high validity and reliability (Curlette, Aycock, Matheny, Pugh, & Taylor, 1992; Matheny, Aycock, Curlette & Junker, 1993). The *Perceived Stress Scale (PSS)* (Cohen, Kamarck, & Mermelstein, 1983) is a 14 Likert-item scale that offers a nonspecific measure of appraised stress with internal consistency reliabilities ranging from .84 to .86. It is an appropriate measure of global stress experience with all age groups (Cohen, Kessler, & Gordon, 1995). The *Life Experiences Survey (LES)* is a standardized 57-item self-report measure in which participants indicate events that they have experienced over the last year in 6 month intervals (Sarason, Johnson, & Siegel, 1978). These events are representative of those frequently experienced by individuals in the general population. Participants rate the desirability and impact of the events on a 7-point scale (Sarason et al., 1978). The investigator provided written and verbal instructions regarding completion of the forms to the participant and his friend/spouse/caregiver. The caregiver read the question aloud and visually presented the items to the participant. Participants provided the answers and the caregivers recorded the response.

Cortisol. Following a 30-minute baseline period consisting of relaxation, each participant provided a salivary cortisol sample by chewing on a Salivette (Sarstedt Inc., Rommelsdorf, Germany) for 60 seconds.

Results

In order to examine differences between the control group and the group with aphasia on the CRIS, PSS, and LES scores at six and 12 months, we first ran an overall MANOVA and then followed up with F tests of the significance of differences between means. The main effect of the groups ($\lambda = .488$) was significant ($p < .01$). The control group had significantly greater overall coping resources ($M = 80.37$) than the group with aphasia ($M = 54.15$) [$F(1,25) = 19.53, p < .01$], and perceived less stress ($M = 14.75$) than the group with aphasia ($M = 23.92$) [$F(1,25) = 9.73, p < .01$]. Pearson's correlation revealed that salivary cortisol was not related to scores of the CRIS,

PSS, or LES at 12 months, however, there was a moderate negative correlation between cortisol and LES scores at 6 months ($r = -.47$).

Discussion

This study examined coping resources, perceived stress, and life experiences in individuals with aphasia. The relation of these measures to basal salivary cortisol levels was also explored. Results indicate that individuals with aphasia have fewer coping resources and greater perceived stress. Interestingly, basal salivary cortisol levels are not associated with perceived stress, but are related to life experiences in the previous six months. The results regarding perceived stress and salivary cortisol are similar to Laures-Gore et al. (under review). Further discussion will focus on the clinical and theoretical implications of these findings.

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