Published in final edited form as:

J Neurosci Nurs. 2016 October ; 48(5): 260–268. doi:10.1097/JNN.0000000000000209.

Impaired Work Productivity Following Aneurysmal Subarachnoid Hemorrhage

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Abstract

Background—Aneurysmal subarachnoid hemorrhage (aSAH) is a sudden debilitating condition affecting individuals during the most productive times of their lives. Treatment advances have reduced mortality rates but increased the number of survivors facing deficits in physical and neuropsychological function.

Objective—This study examined associations between neuropsychological function and work productivity following aSAH.

Methods—Fifty two aSAH patients, employed prior to hemorrhage, were recruited from an ongoing NIH study. Work Limitations Questionnaire (WLQ), neuropsychological tests (executive function, psychomotor speed, attention and mental flexibility, memory) and Patient Assessment of Own Function were completed at 3 and 12 months after aSAH.

Results—Subjects in this analysis reported some level of difficulty in work productivity at 3 and 12 months (35% and 30% respectively) after hemorrhage. Lower WLQ scores in time management and mental/interpersonal subscales were associated with poorer performance in psychomotor function ($r=5, p=.04$ and $r=.42, p=.09$). Poorer mental flexibility and working memory correlated with time management difficulty at 3 months ($r=-.4, p=.09$ and $r=.54, p=.02$). Patients performing poorly on story recall tests were more likely to report difficulty with job physical performance ($r=-.42, p=.09$) and completing work effectively ($r=.61, p=.009$). Poorer working memory performance was associated with lower scores on mental/interpersonal WLQ subscales ($r=.45, p=.05$) and overall health related work productivity loss ($r=.47, p=.04$). WLQ areas also correlated with participants' perception of their neuropsychological function after aSAH.

Conclusions—These results suggest that neuropsychological deficits impact work quality after hemorrhage and provide strong impetus for future studies so that domain specific interventions can be implemented to improve outcomes that affect quality of life including work productivity.

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Disclosures: The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Work Performed at the University of Pittsburgh School of Nursing and University of Pittsburgh Medical Center Presbyterian

Keywords

subarachnoid hemorrhage; cognitive outcomes; neuropsychological outcomes; Work; Work Productivity

Background

Aneurysmal subarachnoid hemorrhage (aSAH) is a sudden debilitating condition that affects many individuals each year often during the most productive times of their lives.(de Rooij, Rinkel, Dankbaar, & Frijns, 2013) Advances in treatment options for persons with aSAH have resulted in a double-edged sword, yielding the benefit of reduced mortality rates but an increase in the number of survivors who now face deficits in both physical and neuropsychological function. Poorer neuropsychological function has been associated with older age, fewer years of education, and anterior location of the ruptured aneurysm.(Al-Khindi, Macdonald, & Schweizer, 2010) Memory, executive function and language are the most commonly affected neuropsychological domains after aSAH; with verbal memory most frequently impaired, followed by visual memory.(Al-Khindi et al., 2010) Although deficits in these domains may improve somewhat over time, many persons continue to experience neuropsychological deficits two to three years after aSAH. (Al-Khindi et al., 2010) These deficits can have a major impact on the individual's lifestyle, including his/her ability to return to work and/or work productively.

Current estimations are that 6-60% of persons return to work following an aSAH (Al-Khindi et al., 2010; Passier, Visser-Meily, Rinkel, Lindeman, & Post, 2011; Powell, Kitchen, Heslin, & Greenwood, 2002); some keeping their same job while others find it necessary to transition to less demanding jobs. aSAH tends to occur more frequently in persons between 20 and 60 years of age; prime years of both wage-earning and financial obligations. Ultimately, a decrease in return to work and altered work productivity negatively impact the individual, the family unit, and society.(Passier et al., 2011) Despite the increased prevalence of aSAH in females, the few studies that have evaluated post-aSAH employment suggest that persons who are able to return to work after aSAH are characteristically younger and male, in professional or engineering jobs, with aneurysms located on the right side near the posterior region.(Nishino et al., 1999) It is reasonable to hypothesize that neuropsychological deficits play a large role in the difficulty of maintaining employment (Al-Khindi et al., 2010; Passier et al., 2011; Powell et al., 2002), although this subject has received little attention. Similarly, while a few studies have investigated correlations between neuropsychological limitations and the ability to return to work in general; of equal or more importance, very few have evaluated whether neuropsychological function alters work productivity following SAH. The purpose of this study is to examine associations between neuropsychological function and work productivity following aSAH.

Methods

Data for this analysis were obtained from a large prospective longitudinal study examining acute complications and outcomes of patients with aSAH (NIHR01NR004339). Inclusion criteria were adults (age 21-75 years) with verified SAH from a ruptured cerebral aneurysm.

Persons with traumatic, mycotic or non-aneurysmal SAH as well as persons with a history of debilitating or degenerative neurological disease were excluded from the study. Participants who were able to complete an in-person interview at three and 12 months after hemorrhage were considered for this analysis. Participants were recruited from the Neurovascular Intensive Care Unit at a level 1 trauma center which serves as a major referral source for aSAH for western Pennsylvania, northern West Virginia, and Eastern Ohio. Informed consent was obtained for all participants based on an approved Institutional Review Board protocol. Following acute hospitalization, follow-up outcome visits were completed at 3 and 12 months after hemorrhage and measures were administered face to face by trained research assistants.

Patient information and history

Clinical diagnosis, Hunt and Hess (HH) criteria and Fisher score were evaluated and graded by the admitting physician and extracted from the medical record. Hunt and Hess is a specific SAH clinical severity grading scale where 1 is mild to moderate headache and 5 is deep coma.(Hunt & Hess, 1968) Fisher score is indicative of the amount of intracranial blood on initial CT scan after SAH where grade 1 is no blood on CT scan and grade 4 is intracerebral or intraventricular clots with diffuse or no subarachnoid blood.(Fisher, Kistler, & Davis, 1980) Data related to symptom onset as well as past medical history and medication use was obtained from the participants and/or their proxy. Years of education was obtained from the participant at the outcome interview.

Measures

Work functioning was assessed using the Work Limitations Questionnaire (WLQ); a 25 item self-report measure.(Lerner et al., 2001) The WLQ yields 4 subscale scores (Time, Physical, Mental and Interpersonal, and Output) that reflect the percentage of time in the past two weeks that the respondent was limited in performing a specific dimension of his/her job. The WLQ subscales have shown good reliability (.88-.90) and validity (.53 - .83) for use among several different job and chronic health condition groups.(Lerner et al., 2001) The Time Management subscale addresses difficulty with time and scheduling demands encountered in job performance. The Physical Demands subscale refers to physical ability to perform job tasks including body strength, movement, endurance, coordination and flexibility. The mental/interpersonal domain assesses both the difficulty performing cognitive job tasks or tasks involving the processing of sensory information as well as the problems with on-the-job personal interactions. The Output subscale refers to difficulty meeting demands for quantity, quality, and timeliness of completed work. In addition to subscale scores, a total WLQ Productivity Loss Score is formed by summing the four subscale scores and indicates the percentage of decrement in work output due to health problems. The WLQ Productivity Loss Score expresses the estimated percent differences in output compared to employees who do not have health-related work limitations.

Neuropsychological Assessment was conducted at three and 12 months after hemorrhage. Objective measures of executive function, psychomotor, attention, mental flexibility, memory and working memory were included for analysis. In addition, participant's perceived cognitive function was assessed.

Executive Function was assessed using the Stroop Color Word Test and Interference Score and the Rey-Osterrieth Figure Test (ROCF). For the Stroop Color Word Test (Golden, 2002), participants are given a booklet with the colors blue, red, or green listed in random order in 5 columns of 20 colors. They are asked to read the colors out loud going down each column as fast as they can. The test consists of three trials measuring the relative speed of one's ability to read the names of colors (W), naming colors (C), and naming colors from words of colors printed with an incongruently colored ink. The Stroop Color Word Test is scored by reporting the number of colors read in 45 seconds for each trial and assesses executive functioning and cognitive inhibition (interference). To complete the ROCF (Rey & Osterrieth, 1993), participants are instructed to carefully copy a figure and then to redraw the figure immediately after the figure is removed and again in, approximately 30 minutes, a delayed recall. The ROCF assesses visual perceptual, skills, spatial organization, constructional ability, and visual memory (immediate and delayed recall).

Psycho-motor/Speed was measured using the Grooved Peg Board Test (Trites, 1989). This test uses a metal board with rows of slotted holes angled in different directions. The task is to insert 25 metal pegs with ridges on the sides into each hole in sequential order. Participants are asked to do the first trial with their dominant hand, which is then repeated with their non-dominant hand. Two scores are yielded, the time taken to fill in all the holes and the number of pegs dropped for each trial; higher scores indicate poorer function in both conditions. The Grooved Peg Board Test evaluates psychomotor speed, fine motor control, and visual-motor coordination.

Attention and Mental Flexibility was assessed using Trail Making Test (TMT A & B). (Reitan, 1955) Both Trail Making Tests consist of 25 circles distributed across a sheet of paper. In Test A, circles are numbered from 1-25 and the participant is asked to draw lines connecting the numbers in ascending order. In Test B, the circles include both numbers (1-13) and letters (A-L). Similar to Test A, the participant is asked to connect the circles in ascending order, but with the additional task of alternating between letters and numbers (i.e., 1-A-2-B-3-C, etc.). Participants are instructed to draw lines connecting the circles in order as quickly as possible for each test without lifting the pencil from the paper. The TMT scores reflect the total number of seconds taken to complete each trial. The TMT tests assess executive function and mental flexibility and attention.

Memory was evaluated using Wechsler Memory Scale III, Logical Memory Subtest (WMS-III, LM I-II, Stories A&B).(Wechsler, 1997b) In this measure, participants are read aloud two short stories and asked to retell the stories from memory immediately and after a 30 minute delay. Story A is read only once, whereas Story B is read twice. Participants are credited for each correctly recalled story detail (maximum of 25) and for general themes (maximum Story A=7, Story B=8). The WMS-III assesses verbal learning and memory (short- and long-term), logical memory and retention. The immediate- and delayed recall conditions of the Rey-Osterrieth Figure Test were also included as a measure of visual memory.

Working Memory was assessed using the Digit Symbol Coding Subtest of the Wechsler Adult Intelligence Scale III.(Wechsler, 1997a) In the Digit Symbol Coding Subtest,

participants are presented with a key of symbols paired with numbers under which is a series of rows with randomly ordered numbers. Using the key, participants are instructed to draw the corresponding symbol under each number as fast as they can. The score is determined by the number of symbols correctly drawn within a 120 second time limit.

Perceived neuropsychological function was measured by the Patient's Assessment of Own Functioning (PAOF), a 33 item self-report measure designed to elicit participants' perceptions of how adequately they function in everyday tasks and activities that reflect their neuropsychological strengths and weaknesses. Items are grouped into 5 subscales; language/communication, memory for specific information, cognitive/intellectual, general memory and orientation, and sensorimotor.(Chelune, 1986) A total score is the sum of the responses to each item; subscale scores are the sum of responses to items in each subscale. Administration time is 5 minutes. The PAOF was sensitive to changes in perceived functioning in 598 participants referred for neuropsychological evaluation as compared to 105 normal controls ($p<.05$). Internal consistency of the subscales were: language/communication (.91), memory (.87), cognitive/intellectual (.85), and sensorimotor (.80). (Chelune, 1986)

Analysis

Correlation analyses were completed to examine the relationship between neuropsychological and PAOF domains and with work limitations in each WLQ subscale as well as the total sum score. Since data were not normally distributed, non-parametric correlations are reported. All analyses were performed using SPSS version 19.

Results

A total of 52 aSAH subjects were included in this pilot analysis from a sample of 84 participants recruited for the parent study since implementing the WLQ because they reported being employed prior to aSAH. Following aSAH; 44% of the subjects were working at three months and 52% were working at 12 months after hemorrhage. All remaining results presented are from the 52 participants who returned to work. The mean age of the sample was 50.4 years (SD 10.5) and the majority were female (65%) (consistent with aSAH populations)(Rose, 2011) and Caucasian (92%) (indicative of the ethnicity in the recruitment area). More than half of the participants who survived and returned to work presented with little to no focal deficits (Hunt and Hess grade I or II; 62%) and had small to moderate blood load on admission (Fisher grade 2; 60%). Most participants had successful aneurysm repair without invasive surgery (73% endovascular embolization, 27% surgical clip). (Table 1)

Using the International Standard Classification of Occupations, the majority of participants were professionals (23%) or service workers (23%). (Table 2) Subjects in this analysis reported some level of difficulty in work productivity at 3 and 12 months (35% and 30% respectively) after hemorrhage. (Table 3) Areas of *concentration* as described by 'work without losing your train of thought'(39%) and 'keeping your mind on work' (30%) and had the highest report of difficulty along with 'difficulty with eyes' (35%), 'difficulty working the required number of hours' (30%), 'need to take break or rest period' (26%) and 'making

mistakes' (26%). These same 6 areas remained the most reported areas of difficulty at 12 months with little change in the overall percentage of patients reporting difficulty between 3 and 12 months after hemorrhage. (Table 3)

Work Quality and Objective Neuropsychological Function

Areas of work quality were correlated with objective neuropsychological measures at 3 months after aSAH. (Table 4) Lower scores on time management and mental/interpersonal subscales of the WLQ were associated with poorer performance on the measure of psychomotor function ($r=5$, $p=.04$ and $r=.42$, $p=.09$ respectively). Poorer performance on measures of mental flexibility and working memory were also associated with time management difficulty at 3 months ($r=-.4$, $p=.09$ and $r=.54$, $p=.02$). Patients who performed more poorly on the immediate and delayed story recall test were more likely to report difficulty with the physical performance of their job ($r=-.42$, $p=.09$) and the ability to complete work effectively ($r=.61$, $p=.009$).

Two areas of work quality remained significantly associated with neuropsychological measures at 12 months after hemorrhage (Table 4). Poorer performance on measures of working memory were associated with lower scores on mental/interpersonal subscales of the WLQ ($r=.45$, $p=.05$) as well as overall percentage of health related work productivity loss ($r=.47$, $p=.04$).

Work Quality and Subjective Neuropsychological Function

Work quality areas were also correlated with participants' perception of their own neuropsychological function following aSAH. (Table 4) At 3 months after hemorrhage, perception of poor memory performance was significantly associated with lower scores on each area of the WLQ including time management ($r=.59$, $p=.01$), mental/interpersonal skills ($r=.53$, $p=.03$), output ($r=.52$, $p=.03$) and overall percentage of health related work productivity loss ($r=.72$, $p<.01$). Perception of sensory limitations was associated with lower scores in physical work ($r=.53$, $p=.03$), mental/interpersonal work performance ($r=.42$, $p=.09$) and overall health related work productivity loss ($r=.56$, $p=.02$). Finally, perceptions of language, cognitive and intellectual skills were associated with lower mental and interpersonal work scores ($r=.63$, $p=.01$) and overall work productivity loss ($r=.6$, $p=.01$) 3 months after hemorrhage.

Twelve months after aSAH, the association between patients' perception of limitations in language, cognitive and intellectual skills and lower scores of poor mental/interpersonal work performance ($r=.57$, $p<.01$) and overall loss of work productivity remained significant ($r=.55$, $p=.01$) along with poor time management performance ($r=.61$, $p<.01$). (Table 4) Poor sensory perception remained significantly associated with lower scores of mental/interpersonal work skills ($r=.42$, $p=.07$) and overall percentage of health related work productivity loss ($r=.4$, $p=.08$) 12 months after hemorrhage.

Discussion

aSAH primarily affects people during years of prime wage-earning and financial obligations. Improvements in the care of the aSAH patient has resulted in nearly 20% less mortality,

(Andreano & Cahill, 2009) however survivors must cope with long term deficits which affect resumption of vital life roles including return to work and work quality. In spite of recovery to the point where they can be discharged to home, persons who survive aSAH continue to report persistent symptoms of post-traumatic stress, increased dependence on others for physical and psychological needs and inability to return to work.(Powell et al., 2002) In general, the ability to return to work is associated with higher levels of satisfaction (Passier et al., 2011), however following aSAH it is estimated that only 6 to 60% of patients return to work.(Al-Khindi et al., 2010; Passier et al., 2011; Rinkel & Algra, 2011) In congruence with other studies, less than 50% of patients in this sample had returned to work at one year after hemorrhage; with office type professionals returning to work later (12 months) than service workers and laborers. Unfortunately, the sample size prohibited analysis of relationships between job classification and return to work.

This analysis is one of the first to evaluate work productivity in addition to return to work. Over a quarter of our participants identified difficulties in six areas of work productivity. Importantly, difficulties in these same domains were reported in over 20% of participants at 12 months after hemorrhage, indicating that work productivity problems persist in a significant portion of the participant population for at least a year following insult.

The purpose of this study was to examine associations between neuropsychological function and work quality/productivity following aSAH. Objective measurements of memory were associated with work areas and output at 3 and 12 months after hemorrhage. Specifically, objective measures of delayed verbal memory were more affected more than working and visual memory; a finding consistent with other studies evaluating neuropsychological deficits after aSAH. (Al-Khindi et al., 2010) The fact that these findings were more significant at three months than twelve months may reflect improving memory over time or that persons with aSAH have adapted to compensate for memory problems. Al-Khindi et al. proposed a similar hypothesis after examining decision-making deficits and work status following aSAH in a sample of 30 patients, suggesting that patients may be compensating to maintain work status.(Al-Khindi, Macdonald, & Schweizer, 2014)

Measurements of psychomotor ability were associated with work quality domains. Poor performance on the measure of psychomotor function was associated with more difficulties in time management. In addition, poorer psychomotor abilities were also associated with work related mental and interpersonal skills, which may reflect difficulty performing cognitive job tasks, processing sensory information as well as problems with on-the-job personal interactions. Impairment in psychomotor speed and information processing speed has been reported after aSAH and stroke however no study was found that evaluated poor psychomotor performance and work quality. In a study of 215 stroke patients (including hemorrhagic stroke), severe impairment was most common in psychomotor speed and was associated with instrumental activities of daily living (IADL) which include tasks such as managing finances, driving, shopping and housekeeping.(Middleton et al., 2014) Deficits of visual memory and psychomotor functioning have been reported as significant predictors of IADL impairment after SAH.(Mayer et al., 2002) Similarly, aSAH patients performed significantly worse than matched controls on information processing speeds when compared

to healthy matched controls at 5 years after hemorrhage.(Chahal, Barker-Collo, & Feigin, 2011)

The presence of perceived or subjective cognitive complaints is reported after neurologic injury including traumatic brain injury, stroke and SAH.(van Rijsbergen, Mark, de Kort, & Sitskoorn, 2013a, 2013b) In many studies, self-described deficits and cognitive complaints are more frequently reported than measureable objective neuropsychological abnormalities, (Al-Khindi et al., 2010; Passier et al., 2011; Rinkel & Algra, 2011) and are predictive of return to work status.(Harris, 2014) Because there has not been a strong correlation between subjective deficits and objective measurements of cognitive performance, subjective perceptions are often attributed to mood, affect and depression. The prevalence of persistent patient perceived cognitive complaints after brain injury has prompted discussion and research to provide insight and further evaluation with regards to the significance of these complaints and how to address these perceptions during rehabilitation.(Lamb, Anderson, Saling, & Dewey, 2013; Rath, Hradil, Litke, & Diller, 2011; van Rijsbergen et al., 2013a; van Rijsbergen, Mark, de Kort, & Sitskoorn, 2014)

In this analysis, perceived memory deficits were strongly associated with all areas of work quality at three months after hemorrhage including time management, physical work ability, mental and interpersonal skills and overall percentage of health related work productivity loss. Similar relationships were found with objective measures of neuropsychological function; these findings were significant at three months and may suggest improvement in memory or compensation. The significant correlation between perceived verbal memory deficits and work quality may also represent a gender effect. It has been suggested that language processing is more bilateral in women and more left-localized in men (Andreano & Cahill, 2009) and that overall, women frequently perform better on verbal memory tests. (Andreano & Cahill, 2009; Badcock, Dragovic, Dawson, & Jones, 2011) In this case, females may notice changes in verbal memory and its effect on work performance more than males. Since this (67%) and most SAH populations are predominately female, these deficits would be particularly important areas for intervention.

Patient's overall perception of deficits in cognitive and intellectual ability was significantly associated with reported difficulties in time management, mental and interpersonal skills and overall percentage of health related work productivity loss. Interestingly, perceived neuropsychological and intellectual deficits remained significantly correlated with 12 month work quality measurements. Without controlling for depression, anxiety, and mood it is difficult to interpret the significance of these findings. However, as with other outcome studies following aSAH, patients report a large degree of perceived limitations. These limitations have an effect on work quality and productivity which warrant additional investigation.

Results from this study provide strong impetus for future studies to evaluate the effect of aSAH on both return to work and work quality so that domain specific interventions can be implemented following insult to improve productivity and quality of life. These results suggest that neuropsychological deficits have a strong impact on work quality at three months after hemorrhage, and some may have long-lasting implications at 12 months. In

addition, perceived deficits demonstrated an association with overall work productivity after aSAH. Future work should include both subjective and objective measures of neuropsychological function with the goal of creating targeted interventions to improve outcomes for survivors of aSAH. Furthermore, cost analysis would be greatly beneficial in these studies to examine the financial impact of poor work quality on families and society.

Implications for Nursing

Due to improvements in the treatment of aSAH, mortality rates have declined. Unfortunately, morbidity rates are much higher. The most common comorbid condition after SAH is alterations in cognitive function. Cognitive dysfunction is often a “hidden” condition, patients appear “normal” on the outside, but have a difficult time returning to work or maintaining pre-insult productivity. Nurses caring for these patients throughout their recovery have an opportunity to assist patients and families by anticipating complications and providing ongoing patient and caregiver teaching. The most important role for nurses is in helping to identify cognitive dysfunction during follow up visits and making the appropriate referrals for neuropsychological therapy. Therapies can help patients gain skills in critical thinking and attention that are paramount to resuming previously held roles.

Limitations

The current study has limitations that need to be considered. The small sample size and number of confounders was prohibitory to run a regression analysis. In a larger population mood, anxiety, depression, sleep, fatigue and treatment should be assessed for influences on outcomes. In at least two studies, it was shown that people with left-sided infarctions were far less likely to return to work.(Al-Khindi et al., 2010; Vilkki et al., 2004) In addition 5-50% of people survive suffer from depression following aSAH (Al-Khindi et al., 2010), a confounding variable as well as a possible explanation for why people do not return to work or return at a later time. Due to our small sample size, we were unable to look at the potential influence of these confounding factors. Finally, a full assessment of return to work should include evaluating ability to resume previous positions and responsibilities.

Conclusions

In addition to return to work, reductions in work productivity may have a negative impact on the individual, family, and society. The majority of the SAH literature focuses on quality of life and life satisfaction which are influenced by return to work, however work productivity has not been well described. The majority of people affected by SAH have significant financial responsibilities. However, due to neuropsychological deficits, whether perceived or objective, it may be difficult for patients who have survived aSAH to return to work, maintain employment or their pre-aSAH performance level at work. Loss of work productivity could adversely affect self-esteem and family dynamics due to the perception that the patient is no longer able to contribute in the work force or to their family’s financial needs. Early identification of patients with actual or potential work quality deficits could lead to interventions that could improve vocation and work quality benefitting the patient, their loved ones and society.

Acknowledgments

Financial Support: NIH-NINR R01NR004339

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TABLE 1**DEMOGRAPHICS**

	All (N=52)	3 Month (N=23)	12 Month (N=27)
Gender			
Female	34 (65%)	13 (56.5%)	16 (59%)
Male	18 (35%)	10 (43.5%)	11 (41%)
Race			
Caucasian	48 (92%)	23 (100%)	27 (100%)
Other	4 (8%)	0 (0%)	0 (0%)
Hunt and Hess			
1	3 (6%)	3 (13%)	3 (11%)
2	29 (56%)	14 (61%)	14 (52%)
3	16 (31%)	5 (22%)	8 (30%)
4	3 (6%)	1 (4%)	2 (7%)
5	1 (2%)	0 (0%)	0 (0%)
Fisher			
2	31 (60%)	15 (65%)	16 (59%)
3	18 (35%)	7 (30%)	10 (37%)
4	3 (6%)	1 (5%)	1 (4%)
Intervention			
Surgical Clip	14 (27%)	6 (26%)	6 (22%)
Embolization	38 (73%)	17 (74%)	21 (78%)
Education (mean $\pm$ SD)	13.9 $\pm$ 2.5	14.8 $\pm$ 2.03	14.3 $\pm$ 2.2
Age (mean $\pm$ SD)	50.4 $\pm$ 10.5	47.5 $\pm$ 11.2	48.2 $\pm$ 11

Table 2

Job Classifications

	Pre- SAH (N=52)	3 Month (N=23)	12 Month (N=27)
Professionals	12 (23%)	3 (13%)	6 (22%)
Managers	4 (8%)	2 (9%)	2 (7%)
Clerical workers	4 (8%)	2 (9%)	2 (7%)
Sales workers	7 (13%)	4 (17%)	4 (15%)
Service workers	12 (23%)	6 (26%)	6 (22%)
Skilled agricultural, forestry and fishery workers	0 (0%)	0 (0%)	0 (0%)
Production, plant and machine operators, laborers	10 (19%)	5 (22%)	6 (22%)
Multiple jobs	1 (2%)	0 (0%)	0 (0%)
Not specified	2 (4%)	1 (4%)	1 (4%)

Table 3

WLQ Responses

WLQ Area	Item	3 month	12 month
Time management	Work required number or hours	26%	18%
	Get going easily at the beginning of the workday	17%	15%
	Start on your job as soon as you arrived at work	8%	11%
	Do you work without stopping to take breaks or rests	26%	20%
	Stick to a routine or schedule	8%	4%
Physical	Walk or move around different work locations	13%	7%
	Lift, carry, or move objects at work weighing greater than 10 pounds	17%	11%
	Sit, stand or stay in one position for longer than 15 minutes	13%	7%
	Repeat the same motions over and over again while working	9%	7%
	Bend, twist, or reach while working	17%	11%
Mental and Interpersonal	Use hand-held tools or equipment	4%	4%
	Keep in mind on your work	30%	26%
	Think clearly when working	22%	22%
	Do work carefully	17%	18%
	Concentrate on your work	22%	23%
	Work without losing your train of thought	39%	27%
	Easily read or use your eyes when working	35%	30%
	Speak with people in-person, in meetings or on the phone	8%	7%
	Control your temper around people when working	22%	22%
	Help other people to <i>get</i> work done	0 %	4%
Output	Handle the workload	13%	11%
	Work fast enough	9%	7%
	Finish work on time	13%	11%
	Do your work without making mistakes	26%	26%
	Done what your are capable of doing	17%	15%

all percentages represent level of difficulty or trouble

Table 4

Correlations – WLQ, NP Test, PAOF

WLQ Area	Test	Domain	3 month	12 month
Time Management	PAOF Memory	PAOF Memory	$r = .59^*$	N.S.
	PAOF HL Cog & Intel	PAOF HL Cog & Intel	N.S.	$r = .61^{**}$
	Non-Dominant Hand Pegboard	Psychomotor	$r = .5^*$	N.S.
	Trails B	Mental Flexibility	$r = .54^*$	N.S.
	Dominant Hand Pegboard	Psychomotor	$r = .41$	N.S.
	Backword Digit Span	Working Memory	$r = -.41^*$	N.S.
	PAOF Memory	PAOF Memory	$r = .53^*$	N.S.
	PAOF Lang & Communication	PAOF Lang & Communication	$r = .65^{**}$	N.S.
Mental & Interpersonal	PAOF HL Cog & Intel	PAOF HL Cog & Intel	$r = .63^{**}$	$r = .57^{**}$
	PAOF Sensory Percept	PAOF Sensory Percept	$r = .42$	$r = .42$
	Dominant Hand Pegboard	Psychomotor	$r = .42$	N.S.
	Forward Digit Span	Working Memory	N.S.	$r = .45^*$
	PAOF Memory	PAOF Memory	$r = .48^*$	N.S.
	PAOF Sensory Percept	PAOF Sensory Percept	$r = .53^*$	
	Story A Immediate	Memory	$r = .5^*$	N.S.
	PAOF Memory	PAOF Memory	$r = .52^*$	N.S.
Physical	PAOF HL Cog & Intel	PAOF HL Cog & Intel	N.S.	$r = .39$
	Story A Delay	Memory	$r = .61^{**}$	N.S.
	PAOF Memory	PAOF Memory	$r = .72^{**}$	N.S.
	PAOF Lang & Comm	PAOF Lang & Comm	$r = .55^*$	N.S.
	PAOF Sensory	PAOF Sensory	$r = .56^*$	$r = .4$
	PAOF Memory	PAOF Memory	$r = .52^*$	N.S.
	PAOF HL Cog & Intel	PAOF HL Cog & Intel	N.S.	$r = .39$
	Story A Delay	Memory	$r = .61^{**}$	N.S.
Output	PAOF Memory	PAOF Memory	$r = .52^*$	N.S.
	PAOF HL Cog & Intel	PAOF HL Cog & Intel	N.S.	$r = .39$
	Story A Delay	Memory	$r = .61^{**}$	N.S.
	PAOF Memory	PAOF Memory	$r = .72^{**}$	N.S.
	PAOF Lang & Comm	PAOF Lang & Comm	$r = .55^*$	N.S.
	PAOF Sensory	PAOF Sensory	$r = .56^*$	$r = .4$
	PAOF Memory	PAOF Memory	$r = .52^*$	N.S.
	PAOF HL Cog & Intel	PAOF HL Cog & Intel	N.S.	$r = .39$
% Health Related Work Prod Loss	Story A Delay	Memory	$r = .61^{**}$	N.S.
	PAOF Memory	PAOF Memory	$r = .72^{**}$	N.S.
	PAOF Lang & Comm	PAOF Lang & Comm	$r = .55^*$	N.S.
	PAOF Sensory	PAOF Sensory	$r = .56^*$	$r = .4$
	PAOF Memory	PAOF Memory	$r = .52^*$	N.S.
	PAOF HL Cog & Intel	PAOF HL Cog & Intel	N.S.	$r = .39$
	Story A Delay	Memory	$r = .61^{**}$	N.S.
	PAOF Memory	PAOF Memory	$r = .72^{**}$	N.S.

WLQ Area	Test	Domain	3 month	12 month
	Percept	Percept		
	PAOF HL Cog &	PAOF HL Cog &	$r = .6^*$	$r = .55^*$
	Intel	Intel		
	Forward Digit	Working Memory	N.S.	$r = .47^*$
	Span			

N.S. – non significant

$p < .1$

*
 $p < .05$

**
 $p < .01$