# Psychosocial Comorbidities Related to Return to Work Following Aneurysmal Subarachnoid Hemorrhage

by

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**PSYCHOSOCIAL COMORBIDITIES RELATED TO RETURN TO WORK FOLLOWING ANEURYSMAL SUBARACHNOID HEMORRHAGE**

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Ability to return to work after stroke has been proven to have positive psychosocial benefits on survivors and caregivers. Even though one-fifth of aSAH survivors suffer from poor psychosocial outcomes, the relationship between such outcomes and ability to work post-stroke is limited in the literature. This project seeks to define the relationship between age, gender, race, marital status, household income, anxiety and depression and ability to return to work 3 and 12 months post aSAH.

121 subjects were included in this retrospective analysis. Anxiety was scored via the State-Trait Anxiety Inventory (STAI) while depression was measured using Becks Depression Inventory-II (BDI-II). Both variables were assessed at 3 and 12 months post-aSAH. Ability to return to work was dichotomized into ability to return or not and was measured at the same time points. The categorical variables - gender, race, and household income - were analyzed using chi-squares or Fisher's exact test, while continuous variables including age, BDI, State & Trait anxiety scores were analyzed using independent t-tests.

Age was significantly associated with failure to return to work 3 and 12 months post-aSAH in both adjusted and unadjusted analysis. High scores of depression, State anxiety, and Trait anxiety 3 and 12 months post-aSAH all had significant or trending associations with failure to return to work 12 months post-aSAH in both adjusted and unadjusted analysis. Female gender had a trending association with failure to return to work 12 months post-stroke. The interactive variables of older age and high State anxiety, older age and high Trait anxiety, and older age and

high rates of depression 3 and 12 months post-aSAH also were significantly associated with failure to return to work 12 months post-aSAH.

Patients who are older, female, and suffer from poor psychological outcomes such as depression or anxiety are at an increased risk of failing to return to work 1-year post-aSAH. The interactive results of this study give us information about which patients are at risk for poor outcomes and therefore can be streamlined for therapy that targets such psychosocial needs.

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## PREFACE

All types of strokes can have devastating effects on the physical, cognitive, and emotional wellbeing of survivors. But these effects are even more acutely felt for those affected by aneurysmal subarachnoid hemorrhage (aSAH). Because of their comparative youth (average age of 50 years old), aSAH survivors are more likely to be working at the time of stroke than their ischemic stroke counterparts (Manno, 2004). Moreover, treatment of aSAH has improved greatly in recent years, increasing rates of survival (Naval et al., 2013). Increased survival rates and a younger age of onset gives aSAH patients a higher likelihood of returning to work after recovery than other stroke populations. A failure to return to work can lead to feelings of isolation, which in turn can increase rates of morbidity and mortality (Gallo, Bradley, Teng, & Kasl, 2006).

Psychosocial factors like depression could possibly influence return to work rates as well. Many aSAH survivors experience poor psychosocial outcomes such as depression and anxiety (Hedlund, Zetterling, Ronne-Engstrom, Carlsson, & Ekselius, 2011; Morris, Wilson, & Dunn, 2004; Vilkki et al., 2004). In general, relevant literature suggests that negative psychosocial outcomes seem to reduce return to work rates post aSAH. However, there is an abundance of mixed results. While most studies found a significant correlation between depression and failure to return to work post aSAH, others found that there was no significant relationship between the outcomes (Harris, 2014; Hedlund et al., 2011; Morris et al., 2004; Powell, Kitchen, Heslin, & Greenwood, 2004). These mixed results were mirrored in a review of literature analyzing anxiety related to return to work post aSAH (Powell et al., 2004; Vilkki, Juvela, Malmivaara, Siironen,

& Hernesniemi, 2012). There is also a significant lack of evidence regarding race and household income related to return to work post aSAH. Demographic variables including age and gender have been studied more extensively, but also reveal mixed evidence in terms of the significance of their relation to return to work and quality of life post aSAH (Carter, Buckley, Ferraro, Rordorf, & Ogilvy, 2000; Czapiga et al., 2014; Harris, 2014; Quinn et al., 2014).

Inconsistency in instrumentation for the measurement of psychosocial factors most certainly contributes a large portion of the variability in outcomes found in the literature. For example, Powell et al. (2004) found an insignificant relationship between psychosocial outcomes and work capacity, but the instruments used in this study were very different from tests utilized in the other literature. Instead of looking at depression, anxiety, and PTSD separately, authors combined the HADS and Revised Impact of Events Scale (RIES) scores into one assessment of mood and measured its effect on productive employment – a self-reported measure of how engaged the patient is in work, childcare, or education (Powell et al., 2004). While this combined risk score still suggests that depression, anxiety, and PTSD do not affect working capacity, the relevance of these results in comparison to other pertinent literature comes into question. If the instruments measuring psychosocial and work outcomes are standardized, it becomes easier to compare and contrast the results of relevant studies and to come to more generalizable conclusions.

This thesis will seek to characterize the relationship between depression, anxiety, age, race, gender, and household income related to return to work post aSAH by using the standardized measurement tools of Beck's Depression Inventory (BDI-II) and the State-Trait Anxiety Inventory (STAI). Defining these relationships with more sound measurements, as well as complete demographic and clinical data will help guide the follow-up process for aSAH

patients, helping clinicians to conclusively flag patients at high risk for failing to return to work. Healthcare professionals can therefore streamline patients for counseling and other therapeutic services, helping to reduce the increased risk of morbidity and mortality associated with failure to return to work post aSAH (Gallo et al., 2006).

Research will be conducted via a secondary data analysis of data collected for a parent observational study on aSAH patients at UPMC Presbyterian. Patients were included in the parent study if they were 1) newly diagnosed with an aSAH verified via cerebral angiogram, 2) Hunt and Hess grade $\geq 2$ and/or Fisher grade $\geq 3$, 3) over 18 years, 4) able to read/speak English, and 5) had no prior history of neurological disorders. In the parent study, anxiety and depression were measured using the STAI and the BDI-II at 6 and 12 months. The demographic variables of age, race, gender, and household income data were obtained from hospital records. Return to work data was collected during follow-up interviews by asking whether the patient was able to return to previous employment at 6 and 12 months or not. Associations between individual demographic and psychosocial variables with the outcome measure of return to work will first be assessed independently. Those variables found to have significant relationships will then be incorporated into a larger regression model to test the predictive value of that set of variables on return to work at 6 and 12 months.

Many relevant studies in the literature were published more than 10 years ago and do not look at return to work specifically, but rather quality of life (Carter et al., 2000; Fertl et al., 1999; Morris et al., 2004). This thesis will update the evidence supporting factors affecting return to work post aSAH, giving clinicians a more recent and evidence-based foundation for their follow-up protocol. Studying return to work individually and not as a part of quality of life will offer a focused, longitudinal look at this complicated outcome that can directly affect mortality and

morbidity (Gallo et al., 2006). Conclusions from this thesis will give clinicians a clear reason why patients do not return to previous employment even after physically recovering. This reason could be psychological (anxiety, depression), demographic (age, race, gender), or economic (household income), and having a solid picture of what affects return to work post aSAH will help improve patient outcomes in the future.

The data collected in this study is also much more comprehensive than other pertinent literature. Patients are followed longitudinally post-stroke and are asked about symptoms of anxiety and depression as well as their working status at each follow-up appointment. Having this data gives researchers a timeline for development of depression or anxiety in relation to return to work, allowing them to lean towards a causal relationship between development of psychosocial issues and failure to return to work. For example, a patient could report feelings of depression 3 months post-stroke. If the patient is unable to return to work even after they have physically recovered at 4 months, it is reasonable to lean towards the assumption that their depression had a negative impact on their ability to work.

It is expected that anxiety and depression will be negatively associated with return to work post aSAH. Older age brings patients closer to retirement, therefore leading to a probable failure to return to work, and lower household income will most likely give patients the financial incentive to return to work post stroke. It is also hypothesized that male gender and non-Caucasian race will also be associated with a failure to return to work. The results of this study can be used to alter follow-up protocols, thus improving long-term functional outcomes in aSAH patients.

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## Introduction

*Background*

Aneurysmal subarachnoid hemorrhage (aSAH) is a devastating stroke that affects 10 to 15 people per 100,000 every year in the US (Labovitz et al., 2006; Shea et al., 2007). Most occur between ages 40 and 60, but young children and the elderly are not immune (Jordan, Johnston, Wu, Sidney, & Fullerton, 2009; Rinkel, Djibuti, Algra, & van Gijn, 1998). The event itself is often fatal: the case fatality rate of aSAH is 50%, and one in eight victims die outside of the hospital (van Gijn, Kerr, & Rinkel, 2007). If victims survive, 1 out of 5 will suffer poor long-term psychological consequences, including anxiety and depression (Morris, Wilson, & Dunn, 2004). The ability to return to work after stroke can have profound positive psychosocial benefits long-term, including increased coping skills and self-empowerment (Medin, Barajas, & Ekberg, 2006).

When analyzing the economic impact, aSAH costs more than other types of stroke, including intracranial hemorrhage (ICH) or ischemic stroke. Average medicare expenditures from the time of the initial event to four years post-stroke were $48,327 for aSAH, $38,023 for ICH and $39,396 for ischemic stroke (Lee, Christensen, Joshi, & Pashos, 2007). The higher cost is due to increased direct costs (prescriptions, hospital stay, etc.). Indirect costs, although not included in these numbers, are also higher in the aSAH population. One indirect cost attributing to this is work productivity, which is significantly lower in the aSAH population. These patients tend to be younger and more physically impaired post-stroke, rendering them physically incapable of returning to work while also unable to retire for a longer period of time when compared to their ischemic stroke counterparts (Lee et al., 2007; Taylor et al., 1996).

Identifying the factors that influence ability to return to work post-aSAH will inform interventions that can help mitigate the negative impact of aSAH. Relevant literature suggests that the poor psychosocial outcomes that many aSAH survivors face post-stroke, including anxiety and depression, can potentially impact ability to return to work. The evidence, however, is somewhat mixed. While most studies found a significant relationship between depression and failure to return to work post-aSAH (Buunk, Groen, Veenstra, & Spikman, 2015; Hedlund, Zetterling, Ronne-Engstrom, Carlsson, & Ekselius, 2011; Morris et al., 2004), others found no significant relationship between these variables (Harris, 2014; Powell, Kitchen, Heslin, & Greenwood, 2004). The literature also suggests a mixed relationship between anxiety and return to work post-aSAH – some suggest that high anxiety can affect return to work as far as 10 years post-stroke, whereas others find no such relationship (Powell et al., 2004; Vilkki, Juvela, Malmivaara, Siironen, & Hernesniemi, 2012). Demographic factors, specifically race/ethnicity and household income, have not been explored at all as possible factors that can influence return to work post-stroke. Age and gender, while studied more extensively, also show mixed evidence in terms of their relation to return to work and quality of life post-aSAH (Carter, Buckley, Ferraro, Rordorf, & Ogilvy, 2000; Czapiga et al., 2014; Harris, 2014; Quinn et al., 2014).. But other demographic factors, specifically race and household income, have not been explored at all as possible factors that can influence return to work post-stroke.

*Aim*

This project seeks to characterize the relationship between depression, anxiety, age, race, gender, marital status, and household income related to return to work post aSAH using the standardized measuring tools of Beck's Depression Inventory (BDI-II) and State-Trait Anxiety Inventory (STAI). Exploring these relationships with valid and reliable instrumentation, as well

as complete clinical and demographic data, will help guide the rehabilitation process for aSAH patients and clinicians by allowing the identification of patients at higher risk for failure to return to work. Healthcare professionals can therefore streamline patients for counseling and other therapeutic services, helping to increase the psychosocial wellbeing of survivors (Medin et al., 2006). Improving rates of return to work post-aSAH will also impact patients and healthcare professionals economically by lowering post-aSAH costs, therefore freeing up finances that can be better spent on rehabilitation.

## Methods

*Research Subjects*

This work constitutes a secondary data analysis of a NIH funded parent study involving aSAH patients (NR R01NR004339. Patients were included in the parent study if they were 1) newly diagnosed with aSAH verified via cerebral angiogram, 2) had a Hunt and Hess grade $\geq$ 2 and/or Fisher grade $\geq$ 3, 3) were over 18 years, 4) were able to read/speak English, and 5) had no prior history of neurological disorders Patients were included in this analysis if they were administered the Work Limitations Questionnaire at their 3 month follow up appointment before December 2015, which gave us the dependent variable of return to work or not before we began data analysis. Only patients who were previously employed were administered this questionnaire. Patients included in this analysis were administered the questionnaire between January 2010 and June 2015.

*Measures*

Anxiety and depression were measured using the STAI and BDI-II at 3 and 12 months. The STAI measures both State(anxiety related to a situation), and Trait anxiety (anxiety as a part of an individual's personality). Scores range from 20-80, and higher scores reveal greater

anxiety. Evidence suggests that STAI is considerably reliable with internal consistency coefficients ranging from 0.86-0.95 and test-retest reliability scores from 0.65-0.75 over 2 months (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). Moreover, considerable evidence attests to the validity of the STAI as a measure of both State and Trait anxiety (Spielberger, 1989). The BDI-III measures depression, with scores ranging from 0-83 with higher scores suggesting more severe depression. The validity of the BDI-II at measuring depression post-stroke is confirmed by internal consistency scoring at 0.83 (Aben, Verhey, Lousberg, Lodder, & Honig, 2002). This assessment tool is also reliable, with internal consistency coefficients ranging from 0.79-0.90 (Smarr & Keefer, 2011). Medical records were used to obtain demographic variables of age, race, gender, and marital status at the time of stroke. Race was self- or proxy-report and categorized as Caucasian, African-American, Pacific Islander, and Asian. Household income data were stratified into five different categories via patient report at 3-month follow up. The five categories were as follows - $0-$19,999, $20,000-$39,999, $40,000-$59,999, $60,000-$99,999, and $100,000+. Return to work data was collected during follow-up interviews at 3 and 12 months and was dichotomized into ability to return to work or not. Marital status was dichotomized into married or not married, which encompassed patients who were single, divorced, and widowed. All participants fell into one of these categories of marital status.

*Statistical Analysis*

Bivariate associations between each individual demographic and psychosocial variable with the outcome of return to work were first assessed independently. The categorical variables - gender, race, and household income - were analyzed using chi-squares or Fisher's exact test, while continuous variables including age, BDI-II, State & Trait anxiety scores were analyzed

using independent t-tests. Statistical significance was set at an alpha of <0.05. A multiple regression model was then performed controlling for all covariates, including age, gender, race, and marital status. These demographics were chosen as covariates based on their inclusion in preliminary analysis. Household income was excluded from multiple regression analysis because data was missing in 60/121 subjects. The interaction between relevant variables was checked. Trending significance was set at an alpha of <0.10. SPSS Version 24.0.0.0 software was used for all data analysis.

## Results

*Demographics*

The average age of subjects (n = 121) was 53.92 years (SD +/- 11.16), and thethe majority were female (71.1%), white (91.7%), and married (67.8%). The household income range of $20,000-$39,999 occurred most frequency (15.7%), while the least frequent range was $100,000+ (6.6%). Average BDI score at 3 months was 7.54 (SD +/- 6.66) and was 8.12 (SD +/- 6.54) at 12 months. State anxiety averaged 34.24 (SD +/-12.09) at 3 months and 34.40 (SD +/- 12.95) at 12 months, whereas Trait anxiety had a mean of 34.16 (SD +/- 10.83) at 3 months and a mean of 31.19 (SD +/- 11.98) at 12 months).

**Table 1. Demographics**

| Characteristics | Mean or Frequency (%) | SD (+/-) |
|---|---|---|
| Age | 53.92 | 11.16 |
| Gender | Male – 35 (29%)<br>Female – 86 (71%) | |
| Race | Caucasian – 111 (91.7%)<br>Asian, Pacific Islander & African American – 10 (8.3%) | |
| Household Income | $0-$19,999 – 9 (7.4%)<br>$20,000-$39,999 – 19 (15.7%)<br>$40,000-$59,999 – 14 (11.6%)<br>$60,000-$99,999 – 11 (9.1%)<br>$100,000+ - 8 (6.6%) | |
| Marital Status | Married – 82 (67.8%)<br>Not Married (Single, Divorced, Widowed) – 36 (32.2%) | |
| BDI Score (3 months) | 7.54 | 6.66 |
| BDI score (12 months) | 8.12 | 6.54 |
| State Anxiety Score (3 months) | 34.24 | 12.09 |
| State Anxiety Score (12 months) | 34.40 | 12.95 |
| Trait Anxiety Score (3 months) | 34.16 | 10.83 |
| Trait Anxiety Score (12 months) | 35.19 | 11.98 |

*Unadjusted Analysis*

Older age at stroke onset was significantly associated with failure to return to work at 3 and 12 months post-aSAH **(Tables 2, 3, & 4)**. People who did not return to work 3 months post-aSAH present as scoring higher on BDI-II and State Anxiety assessments 3 months post-aSAH. These differences, however, do not reach statistical significance (**Table 2)**. Trait anxiety scores 3 months post-aSAH had no statistical relation to ability to return to work 3 months post-aSAH **(Table 2)**.

An increased level of State anxiety 3 months post-aSAH was significantly associated with failure to return to work 12 months post-aSAH (**Table 3)**. Higher BDI and Trait anxiety scores at 3 months had a trending relationship with failure to return to work at 12 months post-aSAH (**Table 3)**. High BDI, State anxiety, and Trait anxiety scores 12 months post-aSAH all also had trending associations with failure to return to work 12 months post aSAH **(Table 4)**.

The relationship between female gender and failure to return to work was a trending association at both 3 and 12 months post aSAH **(Tables 5 & 6)**. Household income and race were not significantly associated with return to work at 3 or 12 months post-aSAH **(Tables 5 & 6)**.

**Table 2. Independent Impact of Age, BDI 3, State Anxiety 3, & Trait Anxiety 3 on RTW 3**

| | Return to Work | | Significance (p-value) |
|---|---|---|---|
| | Yes | No | |
| Age | 45.75 (± 12.35) | 55.70 (± 10.22) | **0.001** |
| BDI | 5.98 (± 4.68) | 9.14 (± 7.38) | 0.103 |
| State Anxiety | 32.38 (± 12.86) | 35.27 (± 12.13) | 0.402 |
| Trait Anxiety | 35.44 (± 8.97) | 34.19 (± 11.68) | 0.691 |

**Table 3. Independent Impact of Age, BDI 3, State Anxiety 3, & Trait Anxiety 3 on RTW 12**

| | Return to Work | Significance |
|---|---|---|

| | Yes | No | (p-value) |
|---|---|---|---|
| Age | 49.28 (± 8.83) | 56.09 (± 11.91) | **0.006** |
| BDI | 5.77 (± 4.42) | 8.02 (± 6.97) | 0.095 |
| State Anxiety | 30.76 (± 10.51) | 37.38 (± 11.54) | **0.047** |
| Trait Anxiety | 30.94 (± 9.67) | 36.13 (± 10.01) | 0.076 |

**Table 4. Independent Impact of Age, BDI 12, State Anxiety 12, & Trait Anxiety 12 on RTW 12**

| | Return to Work | | Significance (p-value) |
|---|---|---|---|
| | Yes | No | |
| Age | 49.28 (± 8.83) | 56.09 (± 11.91) | **0.006** |
| BDI | 7.21 (± 4.20) | 9.54 (± 7.37) | 0.132 |
| State Anxiety | 33.33 (± 10.83) | 35.82 (± 13.93) | 0.470 |
| Trait Anxiety | 32.14 (± 8.55) | 37.00 (± 13.34) | 0.074 |

**Table 5. Independent Impact of Gender, Household Income 3 and Race on RTW 3**

| | | RTW | | Significance (p-value) |
|---|---|---|---|---|
| | | Yes | No | |
| Gender | Male | 8 (34.8%) | 15 (65.2%) | |
| | Female | 8 (14.0%) | 49 (86.0%) | 0.061 |
| Household Income | $0-$19,999 | 1 (11.1%) | 8 (88.9%) | |
| | $20,000-$39,999 | 4 (22.2%) | 14 (77.8%) | |
| | $40,000-$59,999 | 2 (14.3%) | 12 (85.7%) | 0.662 |
| | $60,000-$99,999 | 4 (36.4%) | 7 (63.6%) | |
| | $100,000+ | 2 (28.6%) | 5 (71.4%) | |
| Race | White | 16 (22.2%) | 56 (77.8%) | |
| | Black/Asian | 0 (0.0%) | 8 (100.0%) | 0.347 |

**Table 6. Indepdent Impact of Gender, Household Income 3, and Race on RTW 12**

| | | RTW | | Significance (p-value) |
|---|---|---|---|---|
| | | Yes | No | |
| Gender | Male | 11 (47.8%) | 12 (52.2%) | |
| | Female | 14 (23.7%) | 45 (76.3%) | 0.060 |
| Household Income | $0-$19,999 | 1 (14.3%) | 6 (85.7%) | |
| | $20,000-$39,999 | 3 (25.0%) | 9 (75.0%) | |
| | $40,000- | 3 (42.9%) | 4 (57.1%) | |

| | | | | |
|---|---|---|---|---|
| | $59,999 | | | 0.616 |
| | $60,000-$99,999 | 3 (42.9%) | 4 (57.1%) | |
| | $100,000+ | 2 (50.0%) | 2 (50.0%) | |
| Race | White | 23 (31.5%) | 50 (68.5%) | |
| | Black/Asian | 2 (22.2%) | 7 (77.8%) | 0.715 |

*Adjusted Analysis*

Scores of BDI-II, State anxiety, and Trait anxiety were highly correlated at 3 and 12 months post-aSAH **(Tables 7 & 8)**. Therefore, these measures could not be run together in multiple regression analysis.

Older age was a significant predictor of failure to return to work at 3 and 12 months post-aSAH even when other predictors were held constant **(Tables 9, 10, 11, 12, 13, 14, 15, 16, & 17)**. To further investigate the relationship between age and ability to return to work, age was categorized into five-year intervals and the percent chance of returning to work in each category was calculated. As suspected, higher age categories are significantly associated with higher percent chance of not returning to work **(Graph 1&2)**.

Moreover, higher BDI score at 3 months post-aSAHwas trending predictor of failure to return to work 3 months post aSAH **(Table 9)**. Female gender, white race, being married, higher State anxiety scores, and higher Trait anxiety scores were non-significant predictors of failure to return to work 3 months post-aSAH **(Tables 9, 10, 11, & 12)**.

Even after controlling for other covariates, higher scores of depression, State anxiety and Trait anxiety at 3 and 12 months were all significant predictors of failure to return to work at 12 months post-aSAH **(Tables 12, 13, 14, 15 & 16)**. In some of the multiple regression analyses, female gender was been shown to be a trending predictor of failure to return to work 12 months

post-aSAH (**Tables 12 & 16).** White race and being married were not significant predictors of failure to return to work 12 months post-aSAH **(Tables 12, 13, 14, 15, 16 & 17).**

**Table 7. Pearson Correlations between BDI 3, State Anxiety 3, and Trait Anxiety 3**

| | BDI 3 | State Score 3 | Trait Score 3 |
|---|---|---|---|
| **BDI 3** | 1 | 0.737* | 0.703* |
| **State Score 3** | 0.737* | 1 | 0.822* |
| **Trait Score 3** | 0.703* | 0.822* | 1 |

* = Correlation significant at the 0.01 level (2-tailed)

**Table 8. Pearson Correlations between BDI 12, State 12, and Trait 12**

| | BDI 12 | State Score 12 | Trait Score 12 |
|---|---|---|---|
| **BDI 12** | 1 | 0.690* | 0.617* |
| **State Score 12** | 0.690* | 1 | 0.757* |
| **Trait Score 12** | 0.617* | 0.757* | 1 |

* = correlation is significant at the 0.01 level (2-tailed)

**Table 9. Regression (Age, Gender, Race, Marital & BDI 3 on RTW 3)**

| | Significance (p-value) | Odds Ratio (95% CI) |
|---|---|---|
| **Age** | **0.003** | 1.111 (1.033-1.197) |
| **Gender** | 0.326 | 0.501 (0.127-1.987) |
| **Race** | 0.999 | 0.000 (0.000) |
| **Marital** | 0.462 | 0.600 (0.154-2.341) |
| **BDI 3** | 0.091 | 1.118 (0.982-1.273) |

**Table 10. Regression (Age, Gender, Race & State Anxiety 3 on RTW 3)**

| | Significance (p-value) | Odds Ratio (95% CI) |
|---|---|---|
| **Age** | **0.005** | 1.109 (1.032-1.192) |
| **Gender** | 0.394 | 0.564 (0.152-2.103) |
| **Race** | 0.999 | 0.000 (0.000) |
| **Marital** | 0.414 | 0.576 (0.153-2.165) |
| **State Score 3** | 0.377 | 1.025 (0.970-1.083) |

**Table 11. Regression (Age, Gender, Race & Trait Anxiety 3 on RTW 3)**

| | Significance (p-value) | Odds Ratio (95% CI) |
|---|---|---|
| **Age** | **0.006** | 1.101 (1.028-1.179) |
| **Gender** | 0.408 | 0.578 (0.157-2.121) |
| **Race** | 0.999 | 0.000 (0.000) |
| **Marital** | 0.448 | 0.602 (0.163-2.232) |
| **Trait Score 3** | 0.595 | 0.984 (0.928-1.043) |

**Table 12. Regression (Age, Gender, Race & BDI 3 on RTW 12)**

| | Significance (p-value) | Odds Ratio (95% CI) |
|---|---|---|
| **Age** | **0.011** | 1.083 (1.018-1.152) |
| **Gender** | 0.081 | 0.325 (0.092-1.150) |
| **Race** | 0.777 | 0.762 (0.115-5.023) |
| **Marital** | 0.614 | 0.730 (0.215-2.481) |
| **BDI 3** | **0.031** | 1.115 (1.011-1.245) |

**Table 13. Regression (Age, Gender, Race & State Anxiety 3 on RTW 12)**

| | Significance (p-value) | Odds Ratio (95% CI) |
|---|---|---|
| **Age** | **0.018** | 1.110 (1.018-1.210) |
| **Gender** | 0.249 | 0.404 (0.086-1.888) |
| **Race** | 0.799 | 0.700 (0.045-10.879) |
| **Marital** | 0.598 | 0.689 (0.173-2.752) |
| **State Score 3** | **0.015** | 1.099 (1.018-1.186) |

**Table 14. Regression (Age, Gender, Race & Trait Anxiety 3 on RTW 12)**

| | Significance (p-value) | Odds Ratio (95% CI) |
|---|---|---|
| **Age** | **0.025** | 1.102 (1.013-1.199) |
| **Gender** | 0.268 | 0.417 (0.089-1.957) |
| **Race** | 0.869 | 0.799 (0.056-11.434) |
| **Marital** | 0.610 | 0.706 (0.186-2.688) |
| **Trait Score 3** | **0.028** | 1.105 (1.011-1.207) |

**Table 15. Regression (Age, Gender, Race & BDI 12 on RTW 12)**

| | Significance (p-value) | Odds Ratio (95% CI) |
|---|---|---|
| **Age** | **0.014** | 1.101 (1.019-1.188) |
| **Gender** | 0.284 | 0.460 (0.111-1.906) |

| | | |
|---|---|---|
| **Race** | 0.458 | 0.369 (0.034-4.576) |
| **Marital** | 0.422 | 0.569 (0.143-2.253) |
| **BDI 12** | **0.048** | 1.155 (1.002-1.332) |

**Table 16. Regression (Age, Gender, Race & State Anxiety 12 on RTW 12)**

| | Significance (p-value) | Odds Ratio (95% CI) |
|---|---|---|
| **Age** | **0.002** | 1.138 (1.047-1.238) |
| **Gender** | 0.078 | 0.289 (0.073-1.147) |
| **Race** | 0.682 | 1.713 (0.189-15.539) |
| **Marital** | 0.468 | 0.612 (0.162-2.308) |
| **State Score 12** | **0.016** | 1.085 (1.016-1.159) |

**Table 17. Regression (Age, Gender, Race & Trait Anxiety 3 on RTW 12)**

| | Significance (p-value) | Odds Ratio (95% CI) |
|---|---|---|
| **Age** | **0.002** | 1.137 (1.048-1.233) |
| **Gender** | 0.327 | 0.525 (0.145-1.902) |
| **Race** | 0.628 | 1.751 (0.181-16.912) |
| **Marital** | 0.578 | 0.688 (0.184-2.570) |
| **Trait Score 12** | **0.007** | 1.094 (1.025-1.168) |

**Figure 1. Percent Chance of Failing to RTW 3 Based on Five-Year Age Category**

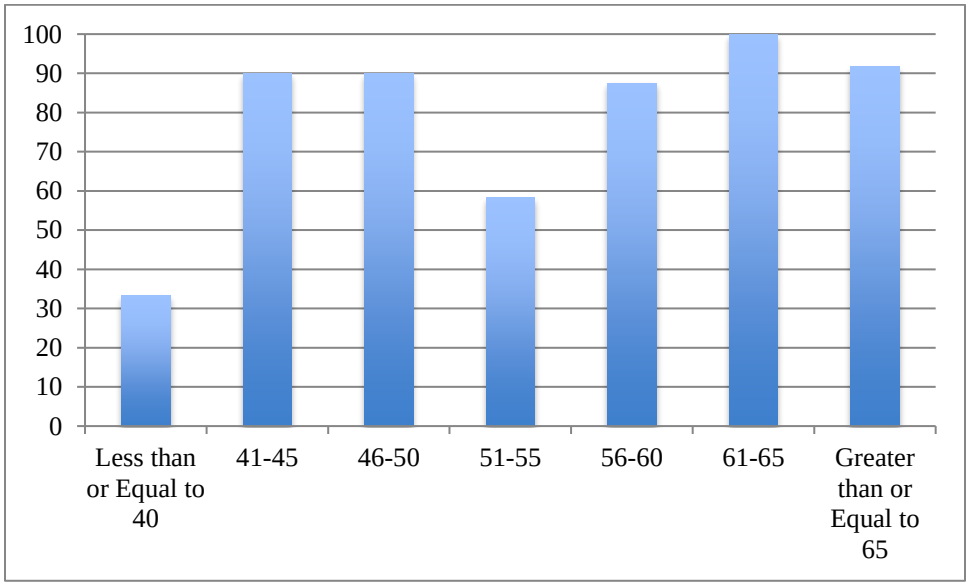
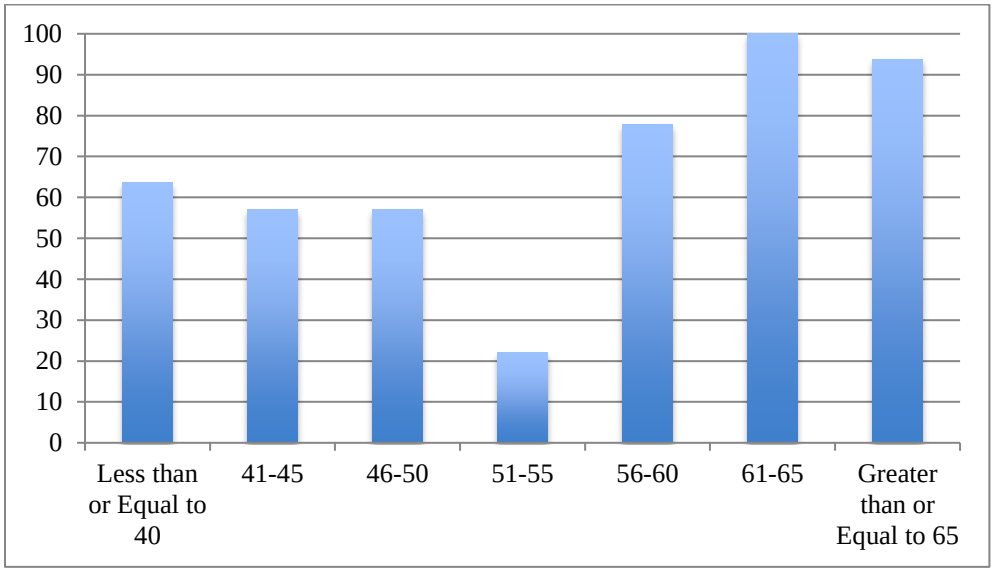


**Figure 2. Percent Chance of Failing to RTW 12 Based on Five-Year Age Category**




*Interactions*

The interactions between older age & high 3-month State anxiety, older age & high 3-month Trait anxiety, older age & high 12-month Trait anxiety all significantly predicted failure to return to work 12-months post-aSAH (Table 22, 25 & 26). There was a trend for the relationship between older age and high 3-month BDI as a predictor of failure to return to work 3 months post-aSAH (Table 18). Moreover, there was a trend for the relationship between failure to return to work 12 months post-aSAH and older age & high 3-month BDI, older age & high 12-month BDI, and older age & high 12-month State anxiety (Table 19, 20 & 23). The interactions between older age & high 3-month State anxiety, older age & high 3-month Trait anxiety, and marital status & gender were insignificant predictors of failure to return to work 3 months post-aSAH (Tables 21, 24 & 27). The marital status and gender interaction also had an insignificant association with failure to return to work 12 months post-aSAH (Table 28).

**Table 18. Regression (Age, Gender, Race, Marital & Interaction of Age/BDI3 on RTW 3)**

| | Significance (p-value) | Odds Ratio (95% CI) |
|---|---|---|
| **Age** | **0.010** | 1.098 (1.023-1.179) |
| **Gender** | 0.292 | 0.476 (0.119-1.894) |
| **Race** | 0.999 | 0.000 (0.000) |
| **Marital** | 0.458 | 0.598 (0.154-2.327) |
| **Age/BDI3** | 0.089 | 1.002 (1.000-1.005) |

**Table 19. Regression (Age, Gender, Race, Marital & Interaction of Age/BDI3 on RTW 12)**

| | Significance (p-value) | Odds Ratio (95% CI) |
|---|---|---|
| **Age** | **0.028** | 1.065 (1.007-1.127) |
| **Gender** | 0.086 | 0.334 (0.095-1.170) |
| **Race** | 0.667 | 0.665 (0.103-4.276) |
| **Marital** | 0.703 | 0.792 (0.239-2.626) |
| **Age/BDI3** | 0.052 | 1.002 (1.000-1.004) |

**Table 20. Regression (Age, Gender, Race, Marital & Interaction of Age/BDI12 on RTW12)**

| | Significance (p-value) | Odds Ratio (95% CI) |
|---|---|---|
| **Age** | **0.041** | 1.073 (1.003-1.147) |
| **Gender** | 0.325 | 0.499 (0.125-1.989) |
| **Race** | 0.299 | 0.272 (0.023-3.170) |
| **Marital** | 0.454 | 0.597 (0.155-2.300) |
| **Age/BDI12** | 0.077 | 1.002 (1.000-1.005) |

**Table 21. Regression (Age, Gender, Race, Marital & Interaction of Age/State3 on RTW 3)**

| | Significance | Odds Ratio (95% CI) |
|---|---|---|
| **Age** | **0.019** | 1.090 (1.014-1.172) |
| **Gender** | 0.368 | 0.545 (0.146-2.042) |
| **Race** | 0.999 | 0.000 (0.000) |
| **Marital** | 0.400 | 0.566 (0.150-2.134) |
| **Age/State3** | 0.330 | 1.001 (0.999-1.002) |

**Table 22. Regression (Age, Gender, Race, Marital & Interaction of Age/State3 on RTW 12)**

| | Significance | Odds Ratio (95% CI) |
|---|---|---|
| **Age** | 0.272 | 1.042 (0.968-1.122) |
| **Gender** | 0.268 | 0.422 (0.092-1.939) |

| | | |
|---|---|---|
| **Race** | 0.596 | 0.478 (0.031-7.307) |
| **Marital** | 0.558 | 0.666 (0.171-2.599) |
| **Age/State3** | **0.025** | 1.002 (1.000-1.003) |

**Table 23. Regression (Age, Gender, Race, Marital & Interaction of Age/State12 on RTW 12)**

| | **Significance** | **Odds Ratio (95% CI)** |
|---|---|---|
| **Age** | **0.032** | 1.073 (1.006-1.143) |
| **Gender** | 0.115 | 0.337 (0.087-1.302) |
| **Race** | 0.797 | 1.314 (0.163-10.597) |
| **Marital** | 0.582 | 0.683 (0.188-2.555) |
| **Age/State12** | 0.052 | 1.001 (1.000-1.003) |

**Table 24. Regression (Age, Gender, Race, Marital & Interaction of Age/Trait3 on RTW 3)**

| | **Significance** | **Odds Ratio (95% CI)** |
|---|---|---|
| **Age** | **0.007** | 1.112 (1.030-1.202) |
| **Gender** | 0.410 | 0.579 (0.158-2.127) |
| **Race** | 0.999 | 0.000 (0.000) |
| **Marital** | 0.448 | 0.602 (0.163-2.231) |
| **Age/Trait3** | 0.586 | 1.000 (0.999-1.001) |

**Table 25. Regression (Age, Gender, Race, Marital & Interaction of Age/Trait3 on RTW 12)**

| | **Significance** | **Odds Ratio (95% CI)** |
|---|---|---|
| **Age** | 0.385 | 1.034 (0.959-1.114) |
| **Gender** | 0.312 | 0.462 (0.103-2.066) |
| **Race** | 0.623 | 0.515 (0.037-7.255) |
| **Marital** | 0.624 | 0.719 (1.193-2.685) |
| **Age/Trait3** | **0.042** | 1.002 (1.000-1.003) |

**Table 26. Regression (Age, Gender, Race, Marital & Interaction of Age/Trait12 on RTW 12)**

| | **Significance** | **Odds Ratio (95% CI)** |
|---|---|---|
| **Age** | 0.057 | 1.066 (0.988-1.138) |
| **Gender** | 0.329 | 0.534 (0.151-1.883) |
| **Race** | 0.764 | 1.397 (0.158-12.359) |
| **Marital** | 0.610 | 0.712 (0.194-2.620) |
| **Age/Trait12** | **0.017** | 1.002 (1.000-1.003) |

**Table 27. Regression (Age, Gender, Race, Marital & Interaction of Marital/Gender on RTW 3)**

| | Significance | Odds Ratio (95% CI) |
|---|---|---|
| **Age** | **0.009** | 1.097 (1.024-1.176) |
| **Gender** | 0.140 | 0.180 (0.018-1.756) |
| **Race** | 0.999 | 0.000 (0.000) |
| **Marital** | 0.153 | 0.209 (0.024-1.794) |
| **Marital/Gender** | 0.224 | 0.176 (0.011-2.891) |

**Table 28. Regression (Age, Gender, Race, Marital & Interaction of Marital/Gender on RTW 12)**

| | Significance | Odds Ratio (95% CI) |
|---|---|---|
| **Age** | **0.024** | 1.058 (1.008-1.112) |
| **Gender** | 0.365 | 0.410 (0.059-2.830) |
| **Race** | 0.547 | 0.568 (0.090-3.571) |
| **Marital** | 0.819 | 1.241 (0.196-7.870) |
| **Marital/Gender** | 0.959 | 1.062 (0.107-10.573) |

## Discussion

The findings of this study show that ability to return to work can be significantly impacted by demographic and psychosocial variables post aSAH. Older age, female gender, and higher scores of BDI, State & Trait anxiety all have significant or trending associations with failure to return to work 3 and 12 months post aSAH in either adjusted or unadjusted analysis. Moreover, interactions such as age and 3-month State anxiety, were found to have a significant association with return to work 3 and 12 months post stroke. These results give a better idea of what kind of patients are at risk for failing to return to work and thus a slower functional recovery. Other studies have not explored these synergistic relationships; therefore our significant results are innovative in their clinical applicability.

When looking at 12-month return to work rates, the interaction between older age and higher rates of 3 or 12 month BDI, State anxiety, or Trait anxiety all are significant or trending predictors of failure to return to work. In other words, older patients who suffer from moderate to severe depression or anxiety have a high likelihood of failing to return to work 1-year post-aSAH. The systematic review of factors affecting return to work in a variety of illnesses also found that patients who were older and suffered from depression were less likely to return to work (Cancelliere et al., 2016).

In both adjusted and unadjusted analysis, older age was a significant predictor of failure to return to work 3 and 12 months post aSAH. This agrees with the literature on this topic (Carter et al., 2000). While proximity to retirement age could be the simple and most obvious reason for this trend, other factors such as increased comorbidities and decreased cognition still need consideration as potential influencing factors.

Gender also has been shown to be a trending predictor of failure to return to work post aSAH in both adjusted and unadjusted analysis. Being female is also associated with failure to return to work after an acute MI (Dreyer et al., 2015), and in a systematic review that spanned many general health and injury conditions, female sex was also significantly associated with failure to return to work (Cancelliere et al., 2016). In our analysis of the interactive effect of female sex and marital status, married women were not significantly more likely to fail to return to work than non-married women. We can speculate that other factors such as societal expectations or worse clinical outcomes were impacting females' ability to return to work.

In all adjusted analysis, higher rates of depression at 3 and 12 months significantly predicted a failure to return to work 3 and 12 months post aSAH. Moreover, high BDI scores 3 months post aSAH had a trending association with failure to return to work 12 months post

stroke in unadjusted analysis. One study found that major depression was significantly associated with failure to return to work 7 months post-stroke (Hedlund et al., 2011), whereas another study found that patients who failed to return to work were more likely to score moderately or high on the HADS depression scale (Morris et al., 2004). The reduced motivation, poor self-care, and low productivity associated with severe depression make sense as possible reasons why depressed patients are less likely to return to work post stroke.

State anxiety at 3 and 12 months is a significant predictor of failure to return to work 12 months post aSAH in adjusted analysis. Additionally, high State anxiety at 3 months is also significantly associated with failure to return to work 12 months post aSAH in unadjusted analysis. This means that when looking at recovery over a whole year, high levels of State anxiety 3 months post stroke can still significantly affect a patient's ability to return to work 12 months later. This idea is supported in other literature: one study found that moderate to severe anxiety was associated with lower employment levels as far out as 10 years post-aSAH (Vilkki et al., 2012). Anxious patients are therefore at a severe risk of inability to return to work for a long period of time after physical recovery.

Furthermore, Trait anxiety 3 and 12 months post-aSAH was significantly associated with a failure to return to work 12 months post stroke in adjusted analysis. This builds on the finding that anxious patients are less likely to return to work 1 year post-aSAH. Quinn et al. also found that people who were unable to return to work 12 months post stroke were more likely diagnosable or borderline for a WSRS mood disorder (measure of both depression and anxiety) 12 months post stroke (Quinn et al., 2014). Symptoms of anxiety such as racing thoughts, fear, poor concentration, and fatigue could be why these patients experience lower likelihood of returning to work.

One limitation of this study was missing data, specifically for household income. We were unable to include this variable in adjusted analysis because we were missing 61 cases. Household income could be a significant push to return to work, especially if the family is financially relying on the patient. Our overall sample size was generally smaller than similar research, which limits the generalizability of our findings. The novelty of our interactive findings as well as how we pulled out more information about age and percent chance of failing to return to work increase the significance of our findings in light of this small sample size. Another variable that could have skewed our results is the pull of other familial relationships besides marital status, including care giving of children or parents. This could be a significant factor influencing a patient's decision to return to work or not. Future research should look at other potential influencers such as household income or familial relationships as possibly impacting ability to return to work, and should also look at how functional these patients are at returning to work in terms of part-time work and work productivity.

The findings of this study give clinicians a focused picture of what kind of patients are at risk for failing to return to work after physical recovery. These patients, who are often older and suffer from depression and/or anxiety, can therefore be streamlined for therapy that targets their psychosocial needs. Through such dedicated care aSAH patients will therefore be able to return to a higher quality of life for years after their stroke.

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# APPENDIX A

# LITERATURE REVIEW

## Introduction

Strokes can have devastating effects on the physical, cognitive, and emotional wellbeing of survivors. These effects are especially felt by those affected by aneurysmal subarachnoid hemorrhage (aSAH). Because of their comparative youth (average age~50 years old), aSAH survivors are more likely to be working at the time of stroke than those affected by ischemic stroke [7]. Moreover, treatment of aSAH has improved in recent years, increasing rates of survival [9]. Increased survival rates and a younger age gives aSAH patients a higher likelihood of returning to work after recovery than other stroke populations.

Psychosocial factors could also influence rates of return to work. Many aSAH survivors experience poor psychosocial outcomes such as depression, reductions in cognitive functioning, anxiety, and post-traumatic stress disorder (PTSD) [5, 8, 15]. About 1/3 of all aSAH patients have cognitive impairments or suffer from PTSD, and about 1/5 experience anxiety or depression [8]. The aim of this literature review is to characterize the impact of psychosocial outcomes on working capacity post aSAH. We aim to make neuroscience nurses aware of which factors are essential to ability to return to employment. Conclusions could be used to improve follow-up protocols after stroke, and to direct research.

## Methods

The online databases PubMed, CINAHL, PyschINFO, and Google Scholar were searched in September 2016. Searches used the headings and free-text terms “return to work”, “subarachnoid hemorrhage”, “depression”, “executive function”, “cognitive function”,

"cognitive impairment", "anxiety", and "post-traumatic stress disorder". Terms were combined using "and" for each psychosocial variable. The reference lists of included articles were searched for other relevant literature, and a reverse-citation search on Google Scholar was performed to capture articles published recently. Articles were included if they 1) provided a quantitative rate of return to previous employment or working capacity, 2) were published before September 2016, 3) reported on aSAH subjects, 4) were published in English, and 5) reported a statistical measure of the relationship between return to work rates and depression, anxiety, cognitive/executive function, or PTSD. Quantitative rate of return to work was defined as providing a rate of return to previous employment or working capacity after aSAH. Cognitive/executive functioning was defined as any quantitative assessment of memory, intelligence, or decision-making.

**Results**

Twenty-one studies were found under these terms, but only eleven met inclusion criteria. The majority of the articles were published from 2004-2013, and the earliest article was published in 1999. Some studies examined multiple psychosocial variables. Of the literature, 7 measured depression, 6 executive function, 3 anxiety, and 2 studies PTSD (**Figure 1**). Included articles measured depression using Beck's Depression Inventory (BDI), Zung Self-Rating Depression Scale (SDS), or the Hospital Anxiety and Depression Scale (HADS) scale. Patients were considered depressed if they scored on the severe or moderate level on any of these assessments. Studies often measured anxiety using HADS. PTSD was measured using the Structured Clinical Interview for axis I disorders (SCID-1) and patients were included if they resulted in either diagnosable or subsyndromal PTSD.

*Depression*

Most studies found that depression was associated with reduced working capacity. For example, one study (N=83) found that a history of major depression was associated with lower return to full-time work rates 7 months after aSAH [7]. Minor or major depression after aSAH indicated a reduced likelihood of return to full-time work [7]. Patients who failed to return to work more than a year after aSAH were likely to score on the moderate to severe level on HADS (N=52) [8]. Other studies also found that depression correlated with reduced working capacity [2, 14, 15]. However, not all the literature agrees. In a study of factors affecting return to work 19 months post-stroke, there was no difference in depression rates between patients who did and did not return to work. The study measured depression in 134 patients using the Functional Status Questionnaire (FSQ), a questionnaire that assesses mental health and social interaction, and return to work was dichotomized [4]. Another study added that combined risk scores of depression, PTSD, and anxiety did not indicate altered rates of productive employment on the Brain Injury Community Rehabilitation Outcome scale (BICRO-39) [10].

*Cognitive function*

Depression is not the only psychosocial comorbidity related to return to work that is with mixed evidence. In a similar fashion, the relationship between cognitive function and return to work is unclear. Kreiter et al. [6] studied the effect of both depression and cognitive function on health-related quality of life, including working ability. Depressive symptoms were measured in 192 subjects using the Center for Epidemiological Studies-Depression (CES-D) scale, cognitive function using the Telephone Interview for Cognitive Status (TICS) scale, and health-related quality of life using the Sickness Impact Profile (SIP) scale. They found that return to work rates were associated with depression but were not with cognitive function 3 and 12 months post-stroke. Depression was also associated with lower working capacity [6].

On the other hand, other studies found that impairments in cognitive function were associated with reduced working capacity. One small study (N=32) using the Montreal Cognitive Assessment (MoCA) found that performance on the Animal Naming and Abstraction MoCA subtest was associated with higher rates of return to any level of work [12]. Similarly, impairments in the Trail Making Test and the Wechsler Digit Span Test were associated with reductions in working ability [2]. Speech memory problems (measured by The Everyday Memory Questionnaire (EMQ)) were also associated with lower rates of return to work at one-year post-stroke (N=214) [11].

Other researchers have focused on executive function after aSAH. Lower scores on the Culture Fair Intelligence Test correlated with a failure to return to work at one year [15]. Persistent executive function impairments after aSAH have been shown to affect work outcomes in the distant future. Superior performance on the Culture Fair Intelligence test 12 months after aSAH were associated with high employment rates 9-13 years after aSAH in a sample of over 100 patients [14].

*Anxiety*

The literature also showed mixed evidence regarding anxiety. In one study, mood (described by the authors as an analysis of both anxiety and depression) was measured using the Wimbledon Self-Report Scale (WSRS), in which the patient rates the frequency of thirty moods from a scale of 0 (none) to 4 (often). People who did not return to work at 12 months post-stroke were borderline or diagnosable for a mood disorder (N=214) [11]. Similarly, moderate to severe anxiety was associated with lower rates of return to previous employment as long as a decade after aSAH (N=101) [14].

The majority of evidence supported the hypothesis that anxiety is associated with reduced employment post aSAH. However, some studies did not support the association of anxiety and working productivity. For instance, in 52 subjects, anxiety scores combined with PTSD and depression assessments, were not associated with productive employment at 18 months post-stroke [10].

*PTSD*

Although there are not many studies looking at the relationship between PTSD and return to work, existing literature has also resulted in mixed evidence. A PTSD diagnosis following aSAH likely would be associated with reduced working capacity [7]. But a combined score of depression, anxiety and PTSD was not associated with reduced productive employment more than a year post-stroke [10].

**Discussion**

In general, negative psychosocial outcomes seem to reduce return to work rates and working capacity post aSAH. There is, however, an abundance of mixed evidence. Each variable – depression, cognitive impairment, anxiety and PTSD – showed mixed results in its relationship with working capacity.

Return to work post aSAH is a very individualized outcome: age, education, socioeconomic status, and social support can also affect return to work. In a sample of 101 patients, those that were unemployed had lower cognition, but this was mostly due to age and education [14]. Those patients with higher incomes pre-stroke are more likely to return to work [13]. Marital status and social support also differed between patients who did and did not return to work. In a sample of 134 subjects, patients who were married reported financial responsibility to return to work, while those with low social support reported that feelings of isolation prevented

returning [4]. Assessments on return to work rates after stroke should include such demographic measurements to support targeted interventions, an area that is currently lacking. In a small qualitative study, some stroke patients expressed a desire for more support from clinicians and their employers in the return to work process [3].

Inconsistency in instrumentation for the measurement of psychosocial factors contributes to the mixed evidence. For example, Powell et al. [10] found an insignificant relationship between psychosocial outcomes and working capacity (N=52), but the instruments used were different from tests utilized in the other literature. Instead of looking at depression, anxiety, and PTSD separately, authors combined the HADS and Revised Impact of Events Scale (RIES) scores into a single assessment and measured its effect on productive employment – a self-reported measure of engagement in work, childcare, or education [10]. Thus, it is difficult to compare these results to other literature. If the instruments measuring outcomes are standardized, it becomes easier to compare and generalize conclusions. The PROMIS initiative, a project funded by the NIH in order to identify a set of self-report measurement tools that are reliable and comparative, could bring about this standardization (http://www.nihpromis.org/).

Another question that arises is how work should be measured. Some studies studied work productivity, while others reduced return to work to a binary variable. A simple return to work does not equate to a return to full capacity. One study dichotomized work status into patients who did and did not return to work, and found that depression did not differ between the two groups (N=134) [4]. But in another sample of similar size, almost half of those that did return to work reduced their working capacity (N=138) [15]. This suggests that the most important assessment might be the patient's ability to function at work compared to their previous ability.

It is important to remember that return to work is not solely related to the capacity to work. For example, despite having full working capacity, some patients eligible for retirement choose not to return to work [14]. Surviving a life-threatening stroke can reorder priorities related to work and family. In some patients, this may lead them to spend the time they have left with loved ones instead of working. No studies included in this review asked patients their decision making process on return to work. A qualitative study capturing these ideas could elucidate the reasons patients do not return to work despite full capacity.

Although most of the studies in this review looked at the psychosocial outcomes separately, these outcomes are likely interrelated. Some patients have suggested that depression resulted from not being able to return to work, while anxiety caused them to not return to work to begin with [8]. It is also important to consider the idea that returning to work could affect psychosocial outcomes. Vilkki et al. [14] found that patients who returned to work within 2 to 3 months following aSAH reported fewer symptoms of anxiety and depression at follow-up. This suggests that work and psychosocial outcomes are interrelated.

It is also important to remember that clinicians' assessments of cognitive impairment often vary from the patient's perception. Patients' and partners' ratings of impairments are often more significant predictors of reduced working capacity than clinical assessments [15]. While a patient may seem functional the clinical setting, they might not have the cognitive ability to work effectively.

Identifying which aspect of cognitive function has the greatest impact on working capacity can focus the clinicians' assessment. The included articles found significant associations for working memory, executive functioning, and working capacity. The ability to memorize new

information and make decisions may be the most important factors. Assessing these aspects of cognition can help flag patients at highest risk for failure to return to work.

Racial and ethnic background was not mentioned in a majority of included articles. The one study that examined the effect of racial or ethnic background on return to work found an insignificant association between the variables [4]. This study was limited by small subgroup sizes (89 Caucasians, 38 African Americans, 5 Asians, and 2 persons from "other" backgrounds) [4]. But other work shows that people of African ancestry exhibit reduced rates of returning to work at one year in ischemic stroke, although only European and African ancestry were considered [1]. Thus, data is lacking for other racial/ethnic backgrounds, and for return to work after subarachnoid hemorrhage specifically.

Discussing definitive findings from this review is further complicated by the varying study designs (**Table 1**). Different time periods for assessment (ranging from months to years after stroke) limit the impact psychosocial variables can be concluded to have on working capacity. Furthermore, premorbid conditions were only considered in the Hedlund et al. [5] study. Patients with a history of major depression or treatment with antidepressants prior to aSAH had a significantly lower rate of return to work than those without any psychiatric history [5]. It may be possible that premorbid psychiatric history, combined with the impact of an aSAH, results in difficulties in returning to work independent of other factors. But more research is needed in this area, as all other included articles did not consider premorbid conditions.

Despite these limitations, the majority of evidence in this review suggests that poor psychosocial outcomes negatively impact working capacity post aSAH. Nurses need to be properly educated on the prevalence of such outcomes to allow early identification of those most at risk. Once admitted to a stroke unit, a detailed psychosocial history should be collected to help

identify those at a higher risk for developing psychological impairments post aSAH. Directed conversations about the patient's previous employment and future plans can also guide nursing intervention. Those individuals that are desirous of returning to work, but who are at risk for an inability to do so based on psychosocial factors, can be streamlined for counseling and other services [5]. This period is an ideal time for psychosocial and medical interventions, which would be enacted with the hopes of bringing more patients back to their level of previous employment. Open communication between nurses and patients about possible interventions can help the patient feel informed throughout recovery.

**Conclusions**

Despite some mixed results, evidence suggests that poor psychosocial outcomes lead to reductions in working capacity. Nurses should seek to identify patients at risk for poor psychosocial outcomes early in the recovery process, so timely interventions can be started. Future researchers in this area should consider standardized measurement tools that account for the interrelatedness of psychosocial outcomes, and also consider the demographic and clinical factors related to working capacity.

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## APPENDIX B

## SUMMARY

Conclusions

- RTW post-aSAH is an extremely individualized outcome requiring a multi-faceted approach
- Costs of aSAH are much higher than other strokes, partially due to the decreased work productivity (the younger age and higher morbidity rate renders them physically incapable of returning to work while also unable to retire)
- Older age, female gender, and high scores of depression and/or anxiety make patients at higher-risk for failing to RTW post-aSAH
- Results of this study give clinicians a focused picture of high-risk patients, who can then be streamlined for therapy targeting their psychosocial needs

Presentations

- Association of Apolipoprotein E Genotype with Activities of Daily Living after Aneurysmal Subarachnoid Hemorrhage
    - Annual Scholarly Poster Presentation Symposium, University of Pittsburgh School of Nursing
    - Pittsburgh, PA
    - October 31st, 2016
- Association of Apolipoprotein E Genotype with Activities of Daily Living after Aneurysmal Subarachnoid Hemorrhage
    - Sigma Theta Tau International Research Congress
    - Cape Town, South Africa
    - July 21st-24th, 2016
- Getting the WORDOUT on Type 2 Diabetes: Risk and Prevention in a Food-Insecure Population
    - Community Engagement Presentations, University of Pittsburgh Honors College
    - Pittsburgh, PA
    - April 21-22nd, 2016
- Functional Recovery after Aneurysmal Subarachnoid Hemorrhage: The Relationship Between Apolipoprotein E Genotype and Activities of Daily Living
    - National Student Nurses Association Convention
    - Orlando, FL
    - March 30th-April 2nd, 2016
- Using Web-Based Interventions to Support Caregivers of Patients with Cancer: A Systematic Review
    - Sigma Theta Tau Honors Night, University of Pittsburgh School of Nursing
    - Pittsburgh, PA
    - March 15th, 2015

Awards

- Rising Star of Research and Scholarship
    - Sigma Theta Tau International Nursing Honors Society
    - July 2016
- BSN Scholarship Recipient
    - Nightingale Awards of Pennsylvania
    - November 2016
- Honors College Ambassador
    - University of Pittsburgh
    - August 2016
- Merit Scholarship
    - University of Pittsburgh
    - August 2012-Present