DISPARITIES IN POST-ACUTE STROKE REHABILITATION UTILIZATION

BY

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TABLE OF CONTENTS

LIST OF ILLUSTRATIONS AND TABLES

LIST OF ABBREVIATIONS

ADL- Activities of Daily Living

COMPASS- COMprehensive Post-Acute Stroke Services

IADL- Independent Activities of Daily Living

NIHSS- National Institute of Health Stroke Scale

OT- Occupational Therapy

PAC- Post-Acute Coordinator

PT- Physical Therapy

ST- Speech Therapy

TIA- Transient Ischemic Attack

WFBMC- Wake Forest Baptist Medical Center

ABSTRACT

Despite the fact that rehabilitation services are integral in the recovery of an individual's functional abilities after stroke, the method by which these services are recommended and then utilized are ill-defined. This study analyzes data from the ongoing COMprehensive Post-Acute Stroke Services (COMPASS) pragmatic clinical trial to explore factors that may influence referrals to rehabilitation services at hospital discharge and clinic follow-up visits and receipt of those recommended rehabilitation services for patients who have experienced an acute stroke. Out of 1,695 enrolled COMPASS participants, 604 (35.6%) were referred to rehabilitation at hospital discharge. Factors that influenced referral included age, stroke severity category [National Institute of Health Stroke Scale (NIHSS)], and ambulatory status. Elderly participants (≥age 65) had the greatest odds referral at discharge (81%). Those with NIHSS scores in the minor category (NIHSS 1-4) had more than double the odds (OR=2.65) and those in the moderate to severe category (NIHSS 5-42) had more than five times the odds (OR=5.61) of being referred at discharge than those with no stroke symptoms (NIHSS 0). Participants unable to ambulate at discharge had more than eight times the odds (OR=8.81) of being referred than those who independently ambulated. Receipt of recommended rehabilitation, however, was low. Only 50 (44%) and 29 (35%) of participants referred for home health or to outpatient rehabilitation, respectively, actually received all the care to which they were referred, which limited the robustness of data analysis. Non-white participants had a 78% decreased odd of receiving recommended outpatient services. Ethnicity, gender, or hospital location did not influence receipt of services, even after adjusting for stroke severity, ambulatory status at admission and age. These findings indicate that a significant gap exists between referral to and receipt of recommended post-acute stroke rehabilitation services; mechanisms to bridge the gap are required to optimize functional outcomes and qualities of life of survivors of stroke.

INTRODUCTION

Stroke is the 2nd leading cause of death worldwide, and the 5th leading cause of death in the United States (Mozaffarian et al., 2015). Although the actual number of stroke deaths has declined 18.2% from 2003, 795,000 people continue to experience a new or recurring stroke each year (Mozaffarian et al., 2015), and the prevalence of stroke is expected to increase nearly 20% by the year 2030 (Ovbiagele et al., 2013). The majority of strokes are first events, accounting for 610,000 of the total stroke occurrences (Mozaffarian et al., 2015). Stroke is one of the major causes of disability in adults in the U.S(Mozaffarian et al., 2015). General recovery guidelines show that only 10% of stroke survivors recover completely, 25% recover with minor impairments, 40% have moderate to severe impairments requiring special care, and 10% require care in a long term facility (Winstein et al., 2016). Participation in rehabilitation is associated with improved outcomes such as reduced risk for functional disability (Veerbeek et al., 2014) and for recurrent stroke (Pollock et al., 2014a) (Cohen et al., 2010).

Health disparities are defined as any differences in health care processes or health outcomes amongst a specific population group (Braveman, 2006) . Disparities in stroke burden have been well documented (McNaughton et al., 2011). For example, African Americans are impacted more from stroke than any other minority group in the American population, having an almost doubled stroke mortality rate, earlier stroke onset, and higher stroke severity than their Caucasian counterparts (Cruz-Flores et al., 2011). Low socioeconomic status is associated with poorer outcomes after stroke, as well as more severe deficits and decreased likelihood of receiving evidence based stroke services (Chen et al., 2015). The majority (87%) of stroke deaths worldwide occur in low and middle income countries (Johnson, Onuma, Owolabi, & Sachdev, 2016). Geographic disparities exist in the United States, with highest stroke incidence and mortality in the southeast part of the country known as the "stroke belt." This eleven-state region of the U.S. has a 34% increased risk of stroke compared to the general population (Howard et al., 2016).

Though the disparities in stroke incidence and outcome are well-recognized, post-stroke rehabilitative care received by individuals across differing demographic groups remains ill defined. According to Medicare data, 42% of patients are not referred any post-acute care (Bogasky, Gage, Morley, Spain, & Ingber, 2009), and 65% of patients under the age of 65 are discharged home without post-acute services (Prvu Bettger et al., 2015). Approximately 80% to 90% of stroke survivors have residual movement impairment after stroke, and are more at risk for inactivity, falls, and hospital readmission (Freburger, Li, Johnson, & Fraher, 2017). Also, quality of life significantly declines after each ischemic stroke an individual experiences (Dhamoon et al., 2010).

Physical rehabilitation services are the primary mechanism by which function and mobility recovery and the achievement of independence are promoted in patients with acute stroke (Pollock et al., 2014b). Services delivered in home health and outpatient settings, include the three major disciplines of stroke care- physical, occupational, and speech and language therapies. Physical therapy (PT) addresses neuromuscular problems that affect an individual's ability to move. Occupational therapy (OT) is commonly used to regain skills needed for activities of daily living (ADLs), such as personal hygiene, dressing, and feeding. Speech and language therapy addresses deficits in producing speech, understanding others speech, paying attention or problem solving, and feeding or swallowing, all of which are residual deficits after stroke. The specific deficits of each individual determine what types of rehabilitation services are needed (Pollock et al., 2014b).

The purpose of this study was to compare referrals to and receipt of those recommended services for post-stroke rehabilitative care among a diverse group of stroke survivors. We used data from a current ongoing trial, the COMprehensive Post-Acute Stroke services (COMPASS) Large Pragmatic Trial funded by the Patient Centered Outcomes Research Institute (NCT02588664).

COMPASS is a cluster randomized pragmatic trial, with hospital as the randomization unit and not the individual patient. The objective of the COMPASS trial is to compare the effectiveness of comprehensive post-acute stroke services on the primary outcome of functional status 90 days after stroke to usual care in patients discharged from 41 hospitals in North Carolina. The COMPASS model is a combination of early supported discharge and transitional care management for stroke survivors who are discharged home with a goal to assess how this affects functional outcomes post stroke compared to usual care. Although there is no specific standard for post-acute care delivery, transitional care management has been shown to be effective for the general medicine and geriatric populations (Naylor, Aiken, Kurtzman, Olds, & Hirschman, 2011) and early supported discharge has been shown to impact the gaps in care for stroke patients, but these studies were conducted in Europe (Langhorne et al., 2007). Early supported discharge has never been implemented in the U.S. health care system.

The COMPASS trial has three main objectives, with the first being to address the needs of stroke survivors as well as their caregivers in order to reach optimal recovery outcomes. The other objectives include bridging the gap between hospitals and community providers to better manage chronic disease, as well as working to develop an individualized patient specific care plan for each stroke patient. The model is first implemented in the hospital when a Post-Acute Coordinator (PAC) meets with the patient prior to discharge, followed by phone call to the patient and/or caregiver two days post discharge. Thereafter, a follow up appointment in the post-acute stroke clinic is scheduled for 7-14 days after patient discharge. Following the clinic visit, 30 and 60-day follow up calls are made to patients to determine if care that was referred has actually been received. The primary outcome of the COMPASS trial as a whole is the Stroke Impact Scale 16, a brief measure of functional status that is patient-reported (Duncan, Lai, Bode, Perera, & DeRosa, 2003).

The COMPASS model includes four main directions for patients and caregivers to find their way toward recovery, independence, and health. These directions include N for Numbers

(knowledge of blood pressure, for example), E for Engage (rehabilitation and recovery, depression, cognition, communication), W for Willingness to manage medications and lifestyle change, and S for Support (community and caregiver support for services). An iPad application is used to administer the post-stroke functional assessment at the 7-14 day clinic visit, which includes multiple questions related to the functional, social, and medical determinants of health to identify areas of concern. After the assessment is completed, proprietary algorithms produce results that are individualized based on the patient's answers to the questions in the assessment. The concerns are organized into the four directions.

Our focus for this project is on Engage, since this domain identifies patients who would benefit from rehabilitation services based on concerns identified in the post-stroke functional assessment (the basis for assessing referrals for these services). The engage domain stresses the need for individuals to be physically active for multiple reasons, the first being to manage stress and mood. This aspect of the domain encourages stroke patients to engage in physical activity and support groups to alleviate mental stress, as well as build effective relationships with family members and caregivers. The second aspect of the Engage domain promotes physical activity and safe mobility. This encourages the use of therapy to improve use of affected limbs, decrease muscle stiffness and spasticity, as well as decrease risk of falling. This domain also stresses that movement matters in stroke recovery, and being active decreases risk of another stroke. The final components of the Engage domain include managing communication recovery, and being engaged with your health care team. These components allow for addressing needs for aphasia, as well as managing doctor appointments to help manage stroke risk factors.

With the purpose of this study being to identify disparities among referrals and receipt of rehabilitation services, we hypothesized that disparities would exist within the characteristics of age, race, ethnicity, NIHSS score, ambulatory status at discharge, and insurance status. Among those patients who were referred at discharge or in the clinic, we used data obtained from the

clinic visit, and 30-day follow up calls to determine which individuals received the rehabilitation services. The hypothesis was tested in the following aims:

Aim 1: Identify COMPASS patient characteristics associated with referral to rehabilitation services.

Aim 1a assesses referral at hospital discharge and Aim 1b assesses referral at the follow-up clinic visit. The outcome of this aim is referral to any type of rehab at each time point, with explanatory variables including race, gender, ethnicity, age, insurance, hospital location, stroke severity, and ambulatory status at admission.

Aim 2: Estimate associations between patient characteristics and receipt of any type of home health and outpatient rehabilitation services at discharge or the clinic visit. Aim 2 will use the same explanatory variables listed in aim 1.

Aim 3: Describe the frequencies of physical and communication deficits identified at the clinic visit among patients referred to home health rehabilitation services. Variables from the ENGAGE domain of the post-stroke functional assessment include falls risk, ADL limitations, physical and mobility and safety, and speech and language deficits.

Aim 4: Describe the relationships between the receipt of all referred rehab services and psychosocial determinants of health. Variables from the ENGAGE domain include depression, stress experienced by the patient, stress on relationships, and lack of transportation.

The use of the aims stated above determined the characteristics of individuals who were referred or not referred or who received or not received rehabilitative care, and whether race,

gender, or geographic disparities exist, and if so, whether the disparity was independently associated with the actual receipt of rehab after pre-stroke disability status is taken into account. The rationale for this was to evaluate the general patterns of utilization of referrals identified in the post-stroke functional assessment. When the COMPASS trial is concluded, we will be able to determine whether the receipt of referred rehabilitation and the associated patient characteristics ultimately impact the primary outcome, physical function.

METHODS

We examined data obtained from the COMPASS trial. A total of 1,695 participants were included in the initial analysis. To address aim 1a, we computed unadjusted odds ratios and 95% confidence intervals to measure the strength of the association between explanatory variables and outcomes. This population included participants that were enrolled in the COMPASS intervention, excluding those who withdrew or those who had missing data for the outcome or any explanatory variable. We also computed adjusted odds ratios and 95% confidence intervals using logistic regression where possible in order to analyze the influence of potential confounders. The same methods of analysis were used to address Aim 1b as well as Aim 2. Aim 1b included participants enrolled in COMPASS intervention who were not referred rehabilitation at discharge, and who had completed the clinic visit. Exclusion criteria for this Aim were participants who had withdrawn, or who had clinic non-consent. Aim 2 included populations of participants enrolled in COMPASS who were referred to either 1) to home health or 2) outpatient rehabilitation at discharge or the clinic visit. This analysis excluded participants with a missing clinic visit, an incomplete 30-day call, or who had clinic non-consent. For Aim 3, a descriptive analysis was performed to calculate the frequency of physical and speech deficits identified at the clinic visit among participants that were recommended home health rehabilitation services. This population included participants enrolled in the COMPASS trial intervention who had a recommendation on the eCare plan for home health PT/OT/SL. The exclusion criteria for this

population were individuals who had withdrawn, or had a missing eCare plan. Aim 4 also used a descriptive analysis to estimate relationships among receipt of referred rehabilitation services and depression, stress on patients and caregivers, and transportation limitations. This population included participants enrolled in COMPASS who received a referral to any rehabilitation at discharge or the clinic visit. The rehabilitation referral included any type of outpatient or home health rehabilitation. Patients in this population also had a completed 30-day call. Exclusions for this Aim were patients who had withdrawn or had missing outcome or variable data. Receipt of care was considered to be receipt of all care exactly as it had been referred.

RESULTS

Description of the cohort

Table 1. The total number of participants enrolled who did not withdraw was 1,695. Out of these participants who did not withdraw, 604 (35.6%) were referred to rehabilitation at discharge. There were 659 (38.9%) participants that completed the clinic visit out of the total population and out of those participants, 399 (60.5%) were not referred rehabilitation at discharge. Out of the group of 399 participants not referred rehabilitation at discharge, 52 (13.0%) were referred rehabilitation at the clinic visit. There were 369 (21.8%) individuals out of the total 1,695 that completed the clinic visit as well as a 30-day follow up call. Out of the individuals that completed the clinic visit and the 30-day call, 176 (48%) had documented rehabilitation recommendations.

Summarized demographic characteristics in Table 2 shows out of the total participant population of 1695, 686 (40.5%) were <age 65 and 1009 (59.5%) were ≥65. The population was 52.5% male, and 47.5% female. A large percentage, 97.8%, of the population identified their ethnicity as non-Hispanic. The majority of the population at 78.3% identified their race as white,

with 18.3% identifying as African American, and 1.4% identified as "other." Over half of the population, 60.8%, was treated at a hospital considered to be in a metropolitan area. Ischemic stroke was the diagnosis of 60.5% of the population, with the next frequent diagnosis of TIA at 32.5%. Seventy-two participants were diagnosed with intracerebral hemorrhage, accounting for 4.2% of the population, followed by 40 (2.4%) participants having a nonspecific ischemic stroke documented, and 7 (0.4%) participants with documented ischemic stroke with hemorrhage. Ambulatory status at admission in this cohort was 94.5% that were able to ambulate without assistance upon admission, and only 1.4% completely unable to ambulate at admission. At discharge, 69.9% of participants were able to ambulate without assistance, and 22.5% had missing reports of discharge ambulatory status. Of the participants with NIHSS scores, 26.6% of the population had a score of 0, meaning no stroke symptoms, with the next highest percentage at 20.6% missing the stoke scale score. Participants with an NIHSS score of one accounted for 16.7% of the population, 10.9% scored a two, 12.0% scored between three and four, 7.3% scored between five and seven, and 6.0% of the population had a score greater than seven. One of the most critical explanatory variables was insurance, and in our cohort, 58.4% had Medicare, 9.1% Medicaid, 31% private, 3.1% VA/Champus insurance, and 9.1% self-pay or uninsured.

Our first analysis was conducted in order to measure associations between chosen variables and rehabilitation referral status at discharge, as displayed in Table 3a. After Bonferroni correction, and adjustment for age, NIHSS, and ambulatory status at admission, only ambulatory status at discharge was significantly associated with referrals. Age greater than 65 was associated with an 81% increased odds of receiving a referral to rehabilitation at discharge compared with those less than age 65 (OR = 1.81, 95% CI 1.42, 2.31). Participants with minor severity (NIHSS scores of 1-4), had a more than double the odds (OR 2.64, 95% CI 2.01-3.49), and those with the moderate to severe category (NIHSS 5 – 42) had more than five times the odds (OR 6.61, 95% CI 3.90-8.06) of referral to rehabilitation compared to those with NIHSS scores of

0. Participants who were unable to ambulate independently at discharge had more than eight times the odds of being referred rehabilitation at discharge compared to those who were independent (OR 8.81 95% CI 4.45, 17.43). The subsequent analysis, Table 3b, presents associations between rehabilitation referrals made not at discharge but at the clinic visit. For each age category, it is reported that only 13% of individuals who attended the clinic visit were actually referred for rehabilitative care. While no significant associations were identified in analysis, it is consistent throughout all characteristics of interest that less than half in each category were referred rehab.

After analyzing the receipt of recommended home health rehabilitation, represented in Table 4a, our study found that less than half (43.5%) of participants received recommended home health rehabilitation. Of participants less than age 65, 44.1% actually received recommended home health rehabilitation, as well as only 43.2% in the greater than 65 age category. The analysis of receipt of recommended outpatient services, Table 4b, revealed that even smaller percentages, 34% in each age category, actually received recommended outpatient rehabilitation services. Although these analyses showed less than half of our participants received actual referred care, they did not reveal significant associations between characteristics of interest and the receipt of actual care from home health or outpatient recommendations. Non-white participants were less likely to receive recommended outpatient services than whites, with only 15.0% reporting receipt of recommended outpatient services. While this does not meet statistical significance after a conservative Bonferroni correction, there still appears to be an association (unadjusted p-value=0.04, OR 0.22 95% CI 0.05-0.95).

Table 5 summarizes select characteristics from the ENGAGE domain within the population that was receiving home health rehabilitation recommendations at the time of or after the clinic visit. We found that 42.9% were classified as having a fall risk, 38.3% had limitations

in ADLs, 67.1% had physical mobility and safety limitations, and 16.11% had communication deficits.

A summary of characteristics identified at the clinic visit of individuals that received all recommended rehabilitation services, Table 6, demonstrated that of 173 participants, (33.5%) reported depression. Out of 58 participants who reported depression, 36 (62.07%) did not receive all recommended rehabilitation services. Out of participants reporting stress, 66.04% did not receive therapy. Out of participants that received recommended rehabilitation, 60% reported stress on their relationships. Only one participant reported having a lack of transportation; however, they still reported receipt of all recommended rehabilitation.

DISCUSSION

Assessment of utilization of rehabilitation referrals and actual receipt of rehabilitation from that referral is critical to understanding how health systems deliver care to stroke patients in the post-acute setting. The primary factors in this study that influenced this process include the severity of the stroke, residual deficits and disability, and pre-stroke disability. Our study also found that having a non-independent ambulatory status at discharge was positively associated with receiving a referral for rehabilitation at discharge, and that negative associations exist within insurance statuses and discharge referral status, as well as non-white race and receipt of recommended outpatient rehabilitation services. Results also display that less than half of our study population who were referred to either home health or outpatient rehabilitation services actually received those services by the 30-day follow up call.

The process of receiving rehabilitation services, whether in the home health or outpatient setting, begins with a rehabilitation referral. It is important to note that the rehabilitation services delivered to stroke patients in the United States are broad and heterogenous, varying in both the type of care setting used, and interventions delivered (Winstein et al., 2016). That being said,

patient-level characteristics may serve as causes for health care providers to refer rehabilitation. Characteristics of age and stroke severity displayed significant associations, and as also expected, ambulatory status at discharge significantly influenced receiving a rehabilitation referral. Prior research has shown that use of a standardized assessment of ambulatory status could better predict the need and direction of post-acute stroke care and help limit the variability in addressing stroke care needs (Stein et al., 2015). Capturing ambulatory status at discharge could also be pivotal to a patient receiving a referral to rehabilitation by first showing a need and justification for rehabilitation to insurance providers. Medicare policies state that home health care payments are determined by a patient's condition and expected use of services, and Medicare does not require a copayment or payment to coinsurance from the patient for home health services (Buntin, Colla, Deb, Sood, & Escarce, 2010). This could serve as an explanation of why patients with Medicare were more likely to be referred services at discharge.

Because of the nature of the disease, stroke patient's conditions may improve or worsen after being discharged home from the hospital, which in turn changes the type and amount of rehabilitation services they may have originally needed. The COMPASS trial accounts for these changes by assessing needs of participants at the clinic visit 7-14 days after discharge from the hospital, and provides a second opportunity to refer participants to rehabilitation who may have a need. Similarly, many patients are not aware of deficits they may have until they are trying to complete everyday tasks at home, and would have a missed opportunity for a rehabilitation referral without attending the clinic visit. It is also crucial to note that out of the total sample, less than half of participants in the cohort received a referral for rehabilitation services. The majority of patients also fell into the NIHSS categories of showing no stroke symptoms, or having only minor stroke symptoms, which would likely not leave them with deficits requiring therapy. The substantial amount of TIA diagnoses in the cohort likely influenced the amount of patients

referred rehabilitation services due to their symptoms subsiding and not leaving residual effects that require therapy services (Winstein et al., 2016).

An important utilization metric is whether or not participants are actually receiving recommended care after the rehabilitation referral. While current literature suggests that disparities in stroke care exist, surveillance of rehabilitation referrals translating into actual receipt of care for a patient is not well documented. Because the primary outcome of the COMPASS trial is physical function, utilization of recommended stroke services is important to capture with the expectations that receiving rehabilitation services will improve an individual's functional deficits. After the analysis of the receipt of all recommended home health rehabilitation, the same patient characteristics that influenced a referral (age, NIHSS score, ambulatory status at discharge) did not have a significant impact on the receipt of care. This data is consistent with prior studies that suggest there are other factors aside from patient characteristics that influence utilization of rehabilitation, such as patient and family preferences, availability of services, and the patients' geographic location (Buntin et al., 2010). Access and availability of services has been shown to be associated with use of referred rehabilitation services in prior studies (Buntin et al., 2005), so we could infer that participants in the cohort who were treated in a non-metropolitan hospital reside in a rural area and may have less access to post-acute rehabilitation. Geographic location could also influence where home health care was offered (Benjamin, 1986), in conjunction with insurance, and may have shown more of an association between receiving home health had we known where individuals were residing. Prior research has found that Medicare data shows that only 15% of stroke patients insured with Medicare receive home health services, and different insurance accounts for variance in care coverages (Shen & Washington, 2007) (Cormier, Frantz, Rand, & Stein, 2016). Medicare policies also claim to provide full coverage of home health services, while only covering 80% of outpatient rehabilitation visits (Buntin et al., 2010). With a large portion of the cohort reported

being covered by Medicare insurance, being costlier to the patient could serve as an explanation as to why less than half of individuals actually received recommended outpatient rehabilitation. It is essential to note that inclusion of patients in the receipt of recommended care analyses required that subjects received all services referred by the 30-day call, and those that received partial referred services were treated the same as those receiving none. Table 1, the summary of the cohort, implies that there are 17 patients that received a referral for both home health and outpatient rehabilitation. This supports the possibility of change in a patient's functional status, as they may have been referred to home health at discharge and switched to outpatient at the clinic visit.

Racial and ethnic disparities in health care in the United States, especially in stroke care, are long standing (Ellis & Egede, 2009). Our data supports these disparities with evidence showing that non-white patients were less likely to receive recommended outpatient rehabilitation. The absence of significant differences in referral status of racial minorities compared to the association found in receiving outpatient rehabilitation suggests that this racial disparity likely originates after a rehabilitation recommendation has been made. This finding suggests that patient characteristics other than medical necessity influence receiving recommended outpatient rehabilitation, and are likely caused by interrelationships between socioeconomic status, geographic location, and cultural factors rather than race alone (Sandel et al., 2009). Significant racial disparities in functional outcomes have been reported, and understanding why the racial disparity in stroke rehabilitation utilization exists will help future studies improve functional outcomes for racial minorities (Howard et al., 2016) .

The use of home health services allows physicians and practitioners to utilize the concept of early supported discharge from the hospital after experiencing an acute stroke (Gonalves-Bradley et al., 2017). The recommendation of home health services is appropriate for patients who are stable enough to return home, but meet home-bound criteria making the patient not

appropriate for outpatient therapy. In order to meet Medicare home-bound criteria, a patient must need the help of another person or medical equipment to leave their home and their condition is likely to worsen if they leave their home. Summarizing physical characteristics of patients identified at the clinic visit for patients receiving recommended home health rehabilitation in Table 5 revealed which characteristics, when present, could serve as indicators for the need of home health services. Our study identified participants with a fall risk, ADL limitations, IADL limitations, physical mobility and safety concerns, and communication deficits, which when flagged, allowed for our rehabilitation algorithm to recommend home health services as appropriate. Questions on the post-stroke functional assessment identified fall risks by asking how many falls the participant had within the last three months, if injuries resulted from a fall that required a doctor or emergency department visit, and if the participant had fallen since their stroke or discharge. Qualifiers for the ADL limitation category were derived from questions on the post-stroke functional assessment that queried participants on their ability to bathe/shower and dress themselves independently, as well as any difficulties controlling their bladder or bowels. IADL questions assessed a participant's ability to use a telephone, prepare meals and do housework without assistance, and drive to and from places since their stroke. The post-stroke functional assessment addressed a participant's physical mobility and safety by asking if they could walk without feeling unsteady, and if they could walk for 15 minutes without getting short of breath or needing to rest. Communication deficits were captured from an advanced practice provider assessment, which asked if there were any communication deficits such as severe dysarthria, expressive or receptive aphasia that required speech therapy. Our data found that over half (67.1%) of participants who were receiving home health rehabilitation had documented physical mobility and safety limitations. Although this was descriptive data, future statistical analysis could test for significant associations between receiving recommended care versus not.

After experiencing a stroke, one-third of stroke survivors report suffering from post-stroke depression (Hackett & Pickles, 2014), and it is well documented that functional outcomes in stroke survivors experiencing depression are lower than those who do not report depression (Watkins, Daniels, Jack, Dickinson, & Van Den Broek, 2001). Studies have shown that most stroke survivors did not notice the onset of their depression until they returned home and realized they could not perform their everyday tasks or do things they previously enjoyed around their home due to their new functional impairment (Paolucci, 2008). Predictors of post-stroke depression include physical disability, stroke severity, cognitive impairment, and pre-stroke depression(Towfighi et al., 2016) When summarizing several neuropsychiatric characteristics of the cohort, we found that out of those who reported depression, 62.07% did not receive recommended rehabilitation services, however 60% of those who reported no depression symptoms also did not receive rehabilitation.

We also summarized our cohort as those experiencing personal stress, as well as perception of stress on relationships. These characteristics revealed that of individuals reporting personal stress, 66.04% did not receive rehabilitation services. Stress that patients experience is likely to come from the life-changing event of a stroke, limited resources for help and support, as well as limited or no insurance coverage. Again, this supports prior data that suggest receiving rehabilitation and gaining physical and mental function could limit stress on patients by helping them care for themselves and return to their prior quality of life (Lökk & Delbari, 2010). Increasing a patient's independence could also have a positive effect on stress patients experience within their relationships. Having a functional impairment leads to many stroke survivors relying on their caregivers or family members to provide care and help for tasks that were once done independently. It is also well documented that many stroke survivors experience stress within their family or close relationships because the significant others are unable to relate to the life change the survivor is experiencing (Ostwald, Bernal, Cron, & Godwin, 2009).

Limitations

The sample size of participants in our cohort was small, and decreased with each set of inclusion criteria for analyses. Our sample was limited to patients who were referred rehabilitation services, which decreased the original sample size substantially due to the majority having minor stroke severity scores. In order to receive the 30-day call patients had to attended the clinic visit, which less than half who were not referred rehabilitation at discharge actually attended. Without the 30-day call, receipt of rehabilitation recommendations could not be assessed. Since the trial is ongoing, patients without the clinic visit and 30-day call will still be assessed at the 90-day call for functional outcomes for the COMPASS project.

Analysis of receiving recommended rehabilitation services for home health as well as outpatient required that participants received all services to which they were referred. Participants whose functional status changed may have influenced a change in home health rehabilitation to outpatient rehabilitation, which would have also put them in the category of not receiving all recommended services.

Ambulatory status at discharge was associated with receiving a rehabilitation referral; however, nearly 22% of the cohort did not have ambulatory statuses at discharge scores recorded. Missing discharge ambulatory statuses could account for participants not receiving a referral for rehabilitative care who show medical necessity for rehabilitation.

A final limitation in our study interpretation of a participant's geographic location. We let the location of the hospital where an individual received treatment, categorized as metropolitan or other, represent where the participant resided and in turn where they were referred care. We expected being in an urban area would imply greater access to rehabilitation services, however the issue is participants may not live in the same area as the hospital.

Future Research

Future directions of research that could build upon these findings are analyzing actual functional outcomes of stroke patients who received rehabilitation services versus those who did not. This study serves as a preliminary analysis to determine the status of COMPASS patients who attended clinic and received care plans, which is a focus of quality improvement for the remainder of the intervention enrollment period for the COMPASS trial.

CONCLUSION

Understanding the limitations and deficits of patients who have experienced a stroke are critical in developing a targeted rehabilitative care plan. Prior research has established that stroke patients are able to achieve pre-stroke quality of life and function through rehabilitation service supports; however, the factors that influence referral and receipt of recommended services for equitable health care are ill-defined. Our results demonstrate that ambulatory status influences referral to rehabilitation services, and that an association between racial minorities and receipt of outpatient therapy exists. Our study has also expressed the need for future studies and analyses to focus on actual functional outcome comparisons of patients who are receiving recommended rehabilitation compared to those not receiving the recommended rehabilitation services. This could be beneficial to the stroke population, as well as other health care systems, by helping to identify disparities that exist within stoke care and improving the methods behind receiving recommended services, with the possibility of improving functional outcomes and qualities of life for stroke survivors.

REFERENCES

Benjamin, A. E. (1986). State variations in home health expenditures and utilization under Medicare and Medicaid. *Home Health Care Services Quarterly*, *7*(1), 5–28. https://doi.org/10.1300/J027v07n01_02

Bogasky, S., Gage, B., Morley, M., Spain, P., & Ingber, M. (2009). Examining Post Acute Care Relationships in an Integrated Hospital System Final Report, March 2009.

Braveman, P. (2006). HEALTH DISPARITIES AND HEALTH EQUITY: Concepts and Measurement. *Annual Review of Public Health*, *27*(1), 167–194. https://doi.org/10.1146/annurev.publhealth.27.021405.102103

Buntin, M. B., Colla, C. H., Deb, P., Sood, N., & Escarce, J. J. (2010). Medicare spending and outcomes after postacute care for stroke and hip fracture. *Medical Care*, *48*(9), 776–84. https://doi.org/10.1097/MLR.0b013e3181e359df

Buntin, M. B., Garten, A. D., Paddock, S., Saliba, D., Totten, M., & Escarce, J. J. (2005). How much is postacute care use affected by its availability? *Health Services Research*, *40*(2), 413–434. https://doi.org/10.1111/j.1475-6773.2005.0i366.x

Chen, R., Crichton, S., McKevitt, C., Rudd, A. G., Sheldenkar, A., & Wolfe, C. D. A. (2015). Association Between Socioeconomic Deprivation and Functional Impairment After Stroke. *Stroke*, *46*(3).

Cohen, M. D., Dilworth-Anderson, P., G Felix, A. C., Daniel Lee, S.-Y., Stearns, S. C., & Williams, S. W. (2010). THE EFFECT OF RACE ON REHABILITATION UTILIZATION AMONG STROKE PATIENTS IN NORTH CAROLINA. *Gillings School of Global Public Health (Health Policy and Management). Chapel Hill*.

Cormier, D. J., Frantz, M. A., Rand, E., & Stein, J. (2016). Physiatrist referral preferences for postacute stroke rehabilitation. *Medicine*, *95*(33), e4356. https://doi.org/10.1097/MD.0000000000004356

Cruz-Flores, S., Rabinstein, A., Biller, J., Elkind, M. S. V., Griffith, P., Gorelick, P. B., … Valderrama, A. L. (2011). Racial-Ethnic Disparities in Stroke Care: The American Experience. *Stroke*, *42*(7).

Dhamoon, M. S., Moon, Y. P., Paik, M. C., Boden-Albala, B., Rundek, T., Sacco, R. L., & Elkind, M. S. V. (2010). Quality of life declines after first ischemic stroke. The Northern Manhattan Study. *Neurology*, *75*(4), 328–34. https://doi.org/10.1212/WNL.0b013e3181ea9f03

Duncan, P. W., Lai, S. M., Bode, R. K., Perera, S., & DeRosa, J. (2003). Stroke Impact Scale-16: A brief assessment of physical function. *Neurology*, *60*, 291–296. https://doi.org/10.1212/01.WNL.0000041493.65665.D6

Ellis, C., & Egede, L. E. (2009). Racial/ethnic differences in poststroke rehabilitation utilization in the USA. *Expert Review of Cardiovascular Therapy*, *7*(4), 405–410. https://doi.org/10.1586/erc.09.6

Freburger, J. K., Li, D., Johnson, A. M., & Fraher, E. P. (2017). Physical and Occupational Therapy From the Acute to Community Setting After Stroke: Predictors of Use, Continuity of Care, and Timeliness of Care. *Archives of Physical Medicine and Rehabilitation*. https://doi.org/10.1016/j.apmr.2017.03.007

Gon?alves-Bradley, D. C., Iliffe, S., Doll, H. A., Broad, J., Gladman, J., Langhorne, P., … Shepperd, S. (2017). Early discharge hospital at home. In S. Shepperd (Ed.), *Cochrane Database of Systematic Reviews* (Vol. 6, p. CD000356). Chichester, UK: John Wiley &

Sons, Ltd. https://doi.org/10.1002/14651858.CD000356.pub4

Hackett, M. L., & Pickles, K. (2014). Part I: Frequency of Depression after Stroke: An Updated Systematic Review and Meta-Analysis of Observational Studies. *International Journal of Stroke*, *9*(8), 1017–1025. https://doi.org/10.1111/ijs.12357

Howard, G., Moy, C. S., Howard, V. J., McClure, L. A., Kleindorfer, D. O., Kissela, B. M., … Wadley, V. G. (2016). Where to Focus Efforts to Reduce the Black–White Disparity in Stroke Mortality. *Stroke*, *47*(7).

Johnson, W., Onuma, O., Owolabi, M., & Sachdev, S. (2016). Stroke: a global response is needed. *Bulletin of the World Health Organization*, *94*(9), 634–634A. https://doi.org/10.2471/BLT.16.181636

Langhorne, P., Widen-Holmqvist, L., Taylor, G., Murray, G., Askim, T., Dennis, M., … Wolfe, C. (2007). Early supported discharge after stroke. *Journal of Rehabilitation Medicine*. https://doi.org/10.2340/16501977-0042

Lökk, J., & Delbari, A. (2010). Management of depression in elderly stroke patients. *Neuropsychiatric Disease and Treatment*, *6*, 539. https://doi.org/10.2147/ndt.s7637

McNaughton, H., Feigin, V., Kerse, N., Barber, P. A., Weatherall, M., Bennett, D., … Anderson, C. (2011). Ethnicity and Functional Outcome After Stroke. *Stroke*, *42*(4).

Mozaffarian, D., Benjamin, E. J., Go, A. S., Arnett, D. K., Blaha, M. J., Cushman, M., … Turner, M. B. (2015). Heart Disease and Stroke Statistics—2016 Update. *Circulation*.

Naylor, M. D., Aiken, L. H., Kurtzman, E. T., Olds, D. M., & Hirschman, K. B. (2011). The care span: The importance of transitional care in achieving health reform. *Health Affairs*, *30*(4), 746–754. https://doi.org/10.1377/hlthaff.2011.0041

Ostwald, S. K., Bernal, M. P., Cron, S. G., & Godwin, K. M. (2009). Stress experienced by stroke survivors and spousal caregivers during the first year after discharge from inpatient rehabilitation. *Topics in Stroke Rehabilitation*, *16*(2), 93–104. https://doi.org/10.1310/tsr1602-93

Ovbiagele, B., Goldstein, L. B., Higashida, R. T., Howard, V. J., Johnston, S. C., Khavjou, O. A., … Trogdon, J. G. (2013). Forecasting the Future of Stroke in the United States. *Stroke*, *44*(8). Retrieved from http://stroke.ahajournals.org/content/44/8/2361.long

Paolucci, S. (2008). Epidemiology and treatment of post-stroke depression. *Neuropsychiatric Disease and Treatment*, *4*(1), 145–54. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/18728805

Pollock, A., Baer, G., Campbell, P., Choo, P. L., Forster, A., Morris, J., … Langhorne, P. (2014a). Physical Rehabilitation Approaches for the Recovery of Function and Mobility After Stroke. *Stroke*, *45*(10). Retrieved from http://stroke.ahajournals.org/content/45/10/e202

Pollock, A., Baer, G., Campbell, P., Choo, P. L., Forster, A., Morris, J., … Langhorne, P. (2014b). Physical rehabilitation approaches for the recovery of function and mobility following stroke. In A. Pollock (Ed.), *Cochrane Database of Systematic Reviews*. Chichester, UK: John Wiley & Sons, Ltd. https://doi.org/10.1002/14651858.CD001920.pub3

Prvu Bettger, J., McCoy, L., Smith, E. E., Fonarow, G. C., Schwamm, L. H., & Peterson, E. D. (2015). Contemporary trends and predictors of postacute service use and routine discharge home after stroke. *Journal of the American Heart Association*, *4*(2). https://doi.org/10.1161/JAHA.114.001038

Sandel, M. E., Wang, H., Terdiman, J., Hoffman, J. M., Ciol, M. A., Sidney, S., … Chan, L. (2009). Disparities in stroke rehabilitation: results of a study in an integrated health system in northern California. *PM & R : The Journal of Injury, Function, and Rehabilitation*, *1*(1), 29–40. https://doi.org/10.1016/j.pmrj.2008.10.012

Shen, J. J., & Washington, E. L. (2007). Disparities in Outcomes Among Patients With Stroke Associated With Insurance Status. *Stroke*, *38*(3).

Stein, J., Bettger, J. P., Sicklick, A., Hedeman, R., Magdon-Ismail, Z., & Schwamm, L. H. (2015). Use of a standardized assessment to predict rehabilitation care after acute stroke. *Archives of Physical Medicine and Rehabilitation*, *96*(2), 210–217. https://doi.org/10.1016/j.apmr.2014.07.403

Towfighi, A., Ovbiagele, B., El Husseini, N., Hackett, M. L., Jorge, R. E., Kissela, B. M., … Williams, L. S. (2016). Poststroke Depression: A Scientific Statement for Healthcare Professionals From the American Heart Association/American Stroke Association. *Stroke*. Retrieved from http://stroke.ahajournals.org/content/early/2016/12/08/STR.0000000000000113

Veerbeek, J. M., van Wegen, E., van Peppen, R., van der Wees, P. J., Hendriks, E., Rietberg, M., & Kwakkel, G. (2014). What is the evidence for physical therapy poststroke? A systematic review and meta-analysis. *PloS One*, *9*(2), e87987. https://doi.org/10.1371/journal.pone.0087987

Watkins, C., Daniels, L., Jack, C., Dickinson, H., & Van Den Broek, M. (n.d.). Accuracy of a single question in screening for depression in a cohort of patients after stroke: comparative study. Retrieved from http://www.bmj.com/content/bmj/323/7322/1159.full.pdf

Winstein, C. J., Stein, J., Arena, R., Bates, B., Cherney, L. R., Cramer, S. C., … Zorowitz, R. D.

(2016). *Guidelines for Adult Stroke Rehabilitation and Recovery: A Guideline for Healthcare Professionals from the American Heart Association/American Stroke Association*. *Stroke* (Vol. 47). https://doi.org/10.1161/STR.0000000000000098

APPENDIX

Table 1: Summary of Cohort Data Extract Date: May 3, 2017

Criteria	N	%
Enrolled and Did Not Withdraw	1695	100.0%
Referred to Rehab at Discharge	604	35.6%
Not Referred to Rehab at Discharge	1091	64.4%
Completed Clinic Visit [1]	659	38.9%
Not Referred to Rehab at Discharge	399	23.5%
Referred to Rehab at Clinic Visit and Not Discharge	52	3.1%
Completed 30-Day Call and Clinic Visit [1]	369	21.8%
w/Documented Rehab Recommendations	176	10.3%
w/Documented Home Health Rehab Recommendations	114	6.7%
w/Documented Outpatient Rehab Recommendations	79	4.6%

[1] Excludes patients who did not provide consent for research at the clinic visi

Table 2: Summary of Demographics Characteristics for Enrolled Patients Who Did Not Withdraw

Data Extract Date: May 3, 2017

		N	%
Age Category	<65	686	40.5%
	>=65	1009	59.5%
Sex	Male	890	52.5%
	Female	805	47.5%
Ethnicity	Hispanic	31	1.8%
	Non-Hispanic	1657	97.8%
	Unknown	7	0.4%
Race	White	1327	78.3%
	African American	310	18.3%
	American Indian/Native AL	11	0.6%
	Asian	5	0.3%
	Native HA/Pacific Islander	1	0.1%
	Multi-race	7	0.4%
	Other	24	1.4%
	Unknown	10	0.6%
Hospital Location	Metropolitan	1030	60.8%
	Other	665	39.2%
Diagnosis	Ischemic Stroke	1025	60.5%
	ICH	72	4.2%
	Ischemic Stroke withHemorrhage	7	0.4%
	Stroke, NOS	40	2.4%
	TIA	551	32.5%
Ambulatory Status at Admission	Independent	1601	94.5%
	With assistance	58	3.4%
	Unable to ambulate	23	1.4%
	Missing	13	0.8%
Ambulatory Status at Discharge	Independent	1185	69.9%
	With assistance	116	6.8%
	Unable to ambulate	12	0.7%
	Missing	382	22.5%

Table 2: Summary of Demographics Characteristics for Enrolled Patients Who Did Not Withdraw

Data Extract Date: May 3, 2017

		N	%
NIH Stroke Score Category	0	451	26.6%
	1	283	16.7%
	2	185	10.9%
	3 to 4	203	12.0%
	5 to 7	123	7.3%
	>7	101	6.0%
	Missing	349	20.6%
Medicare Insurance[1]	No	694	40.9%
	Yes	990	58.4%
	Missing	11	0.6%
Medicaid Insurance[1]	No	1529	90.2%
	Yes	155	9.1%
	Missing	11	0.6%
Private Insurance[1]	No	1153	68.0%
	Yes	531	31.3%
	Missing	11	0.6%
VA/Champus Insurance[1]	No	1631	96.2%
	Yes	53	3.1%
	Missing	11	0.6%
Self-Pay/No Insurance[1]	No	1530	90.3%
	Yes	154	9.1%
	Missing	11	0.6%

Table 3a: Analysis of Discharge Rehab Referral Status
Data Extract Date: May 3, 2017

					Odds Ratio[1]		
Characteristic	**Value**	**N**	**Referred to Rehab at Discharge n(%)**	**Not Referred to Rehab at Discharge n(%)**	**Unadjusted (95% CI) [2]**	**Adjusted (95% CI) [3]**	**p-value [4]**
Age (years)	<65	686	216 (31.49%)	470 (68.51%)	1.36 (1.10,1.68)	1.81 (1.42,2.31)	<0.0001*
	>=65	1009	388 (38.45%)	621 (61.55%)			
Gender	Male	890	292 (32.81%)	598 (67.19%)	1.30 (1.06,1.59)	1.40 (1.10,1.76)	0.0052
	Female	805	312 (38.76%)	493 (61.24%)			
Ethnicity	Non-Hispanic	1657	598 (36.09%)	1059 (63.91%)	0.34 (0.10,0.91)	0.26 (0.09,0.77)	0.0152
	Hispanic	31	5 (16.13%)	26 (83.87%)			
Race	White	1333	467 (35.03%)	866 (64.97%)	1.15 (0.90,1.48)	1.10 (0.83,1.47)	0.5099
	Non-white	352	135 (38.35%)	217 (61.65%)			
Hospital Location	Metropolitan	1030	426 (41.36%)	604 (58.64%)	0.52 (0.42,0.64)	0.53 (0.26,1.05)	0.0672
	Other	665	178 (26.77%)	487 (73.23%)			
NIH Stroke Score[5]	0 - No Stroke Symptoms	451	98 (21.73%)	353 (78.27%)			
	1-4 - Minor	671	278 (41.43%)	393 (58.57%)	2.55 (1.93,3.38)	2.65 (2.01,3.49)	<0.0001*
	5-42 - Moderate to Severe	224	132 (58.93%)	92 (41.07%)	5.15 (3.60,7.43)	5.61 (3.90,8.06)	<0.0001*
	Missing	349	96 (27.51%)	253 (72.49%)			

Table 3a: Analysis of Discharge Rehab Referral Status
Data Extract Date: May 3, 2017

					Odds Ratio[1]		
Characteristic	**Value**	**N**	**Referred to Rehab at Discharge n(%)**	**Not Referred to Rehab at Discharge n(%)**	**Unadjusted (95% CI) [2]**	**Adjusted (95% CI) [3]**	**p-value [4]**
Ambulatory Status at Admission[6]	Independent	1601	553 (34.54%)	1048 (65.46%)	2.49 (1.55,4.03)	1.78 (1.02,3.13)	0.0429
	With assistance	58	35 (60.34%)	23 (39.66%)			
	Unable to ambulate	23	11 (47.83%)	12 (52.17%)			
	Unknown	13	5 (38.46%)	8 (61.54%)			
Ambulatory Status at Discharge[6]	Independent	1185	442 (37.30%)	743 (62.70%)	8.57 (5.23,14.60)	8.81 (4.45,17.43)	<0.0001*
	With assistance	116	99 (85.34%)	17 (14.66%)			
	Unable to ambulate	12	8 (66.67%)	4 (33.33%)			
	Unknown	382	55 (14.40%)	327 (85.60%)			
Medicare Insurance[7]	No	694	211 (30.40%)	483 (69.60%)	1.48 (1.20,1.83)	1.48 (1.07,2.06)	0.0177
	Yes	990	389 (39.29%)	601 (60.71%)			
Medicaid Insurance[7]	No	1529	530 (34.66%)	999 (65.34%)	1.55 (1.09,2.19)	1.70 (1.13,2.55)	0.0106
	Yes	155	70 (45.16%)	85 (54.84%)			
Private Insurance[7]	No	1153	444 (38.51%)	709 (61.49%)	0.66 (0.53,0.83)	0.89 (0.68,1.17)	0.4077
	Yes	531	156 (29.38%)	375 (70.62%)			

Table 3a: Analysis of Discharge Rehab Referral Status
Data Extract Date: May 3, 2017

					Odds Ratio[1]		
Characteristic	**Value**	**N**	**Referred to Rehab at Discharge n(%)**	**Not Referred to Rehab at Discharge n(%)**	**Unadjusted (95% CI) [2]**	**Adjusted (95% CI) [3]**	**p-value [4]**
VA/Champus Insurance[7]	No	1631	579 (35.50%)	1052 (64.50%)	1.19 (0.65,2.15)	1.14 (0.59,2.18)	0.7027
	Yes	53	21 (39.62%)	32 (60.38%)			
Self-Pay/No Insurance[7]	No	1530	556 (36.34%)	974 (63.66%)	0.70 (0.47,1.02)	0.63 (0.40,1.01)	0.0546
	Yes	154	44 (28.57%)	110 (71.43%)			

Table 3b: Analysis of Clinic Visit Rehab Referral Status for Patients not Referred at Discharge
Data Extract Date: May 3, 2017

					Odds Ratio[1]		
Characteristic	**Value**	**N**	**Referred to Rehab at Clinic Visit n(%)**	**Not Referred to Rehab at Clinic Visit n(%)**	**Unadjusted (95% CI) [2]**	**Adjusted (95% CI) [3]**	**p-value [4]**
Age (years)	<65	188	25 (13.30%)	163 (86.70%)	0.96 (0.51,1.79)	0.78 (0.40,1.49)	0.4466
	>=65	211	27 (12.80%)	184 (87.20%)			
Gender	Male	223	30 (13.45%)	193 (86.55%)	0.92 (0.48,1.72)	0.92 (0.48,1.78)	0.8133
	Female	176	22 (12.50%)	154 (87.50%)			
Ethnicity	Non-Hispanic	387	51 (13.18%)	336 (86.82%)	0.94 (0.02,7.58)	0.75 (0.09,6.52)	0.7981
	Hispanic	8	1 (12.50%)	7 (87.50%)			
Race	White	314	40 (12.74%)	274 (87.26%)	1.14 (0.52,2.36)	1.00 (0.46,2.21)	0.9941
	Non-white	84	12 (14.29%)	72 (85.71%)			
Hospital Location	Metropolitan	255	35 (13.73%)	220 (86.27%)	0.84 (0.42,1.62)	0.59 (0.22,1.57)	0.2871
	Other	144	17 (11.81%)	127 (88.19%)			
NIH Stroke Score[5]	0 - No Stroke Symptoms	156	11 (7.05%)	145 (92.95%)			
	1-4 - Minor	156	28 (17.95%)	128 (82.05%)	2.87 (1.32,6.67)	2.86 (1.37,5.99)	0.0052
	5-42 - Moderate to Severe	27	4 (14.81%)	23 (85.19%)	2.28 (0.49,8.57)	2.17 (0.63,7.45)	0.2179
	Missing	60	9 (15.00%)	51 (85.00%)			

Table 3b: Analysis of Clinic Visit Rehab Referral Status for Patients not Referred at Discharge
Data Extract Date: May 3, 2017

					Odds Ratio[1]		
Characteristic	**Value**	**N**	**Referred to Rehab at Clinic Visit n(%)**	**Not Referred to Rehab at Clinic Visit n(%)**	**Unadjusted (95% CI) [2]**	**Adjusted (95% CI) [3]**	**p-value [4]**
Ambulatory Status at Admission[6]	Independent	386	49 (12.69%)	337 (87.31%)	2.58 (0.43,11.18)	1.06 (0.12,9.04)	0.9580
	With assistance	4	0 (0.00%)	4 (100.0%)			
	Unable to ambulate	7	3 (42.86%)	4 (57.14%)			
	Unknown	2	0 (0.00%)	2 (100.0%)			
Ambulatory Status at Discharge[6]	Independent	269	42 (15.61%)	227 (84.39%)	2.16 (0.20,13.70)	0.00 (0.00,I)	0.9871
	With assistance	5	0 (0.00%)	5 (100.0%)			
	Unable to ambulate	2	2 (100.0%)	0 (0.00%)			
	Unknown	123	8 (6.50%)	115 (93.50%)			
Medicare Insurance[7]	No	197	26 (13.20%)	171 (86.80%)	0.94 (0.50,1.78)	0.79 (0.30,2.02)	0.6174
	Yes	199	25 (12.56%)	174 (87.44%)			
Medicaid Insurance[7]	No	368	44 (11.96%)	324 (88.04%)	2.45 (0.83,6.42)	2.63 (0.94,7.36)	0.0664
	Yes	28	7 (25.00%)	21 (75.00%)			
Private Insurance[7]	No	246	36 (14.63%)	210 (85.37%)	0.65 (0.32,1.27)	0.66 (0.31,1.38)	0.2659
	Yes	150	15 (10.00%)	135 (90.00%)			

Table 3b: Analysis of Clinic Visit Rehab Referral Status for Patients not Referred at Discharge
Data Extract Date: May 3, 2017

					Odds Ratio[1]		
Characteristic	**Value**	**N**	**Referred to Rehab at Clinic Visit n(%)**	**Not Referred to Rehab at Clinic Visit n(%)**	**Unadjusted (95% CI) [2]**	**Adjusted (95% CI) [3]**	**p-value [4]**
VA/Champus Insurance[7]	No	386	51 (13.21%)	335 (86.79%)			
	Yes	10	0 (0.00%)	10 (100.0%)			
Self-Pay/No Insurance[7]	No	355	44 (12.39%)	311 (87.61%)	1.46 (0.51,3.61)	1.15 (0.41,3.24)	0.7921
	Yes	41	7 (17.07%)	34 (82.93%)			

Table 4a: Analysis of Receipt of All Recommended Home Health Care
Data Extract Date: May 3, 2017

					Odds Ratio[1]		
Characteristic	**Value**	**N**	**Received Home Health Care n(%)**	**Did Not Receive Home Health Services n(%)**	**Unadjusted (95% CI) [2]**	**Adjusted (95% CI) [3]**	**p-value [4]**
Age (years)	<65	34	15 (44.12%)	19 (55.88%)	0.96 (0.40,2.35)	1.09 (0.44,2.72)	0.8517
	>=65	81	35 (43.21%)	46 (56.79%)			
Gender	Male	43	17 (39.53%)	26 (60.47%)	1.29 (0.56,3.01)	1.74 (0.75,4.03)	0.1945
	Female	72	33 (45.83%)	39 (54.17%)			
Ethnicity	Non-Hispanic	114	50 (43.86%)	64 (56.14%)	Not Estimable	Not Estimable	Not Estimable
	Hispanic	1	0 (0.00%)	1 (100.0%)			
Race	White	92	40 (43.48%)	52 (56.52%)	1.00 (0.35,2.76)	1.10 (0.39,3.08)	0.8535
	Non-white	23	10 (43.48%)	13 (56.52%)			
Hospital Location	Metropolitan	69	22 (31.88%)	47 (68.12%)	3.32 (1.42,7.81)	3.50 (0.88,13.91)	0.0750
	Other	46	28 (60.87%)	18 (39.13%)			
NIH Stroke Score[5]	0 - No Stroke Symptoms	14	5 (35.71%)	9 (64.29%)			
	1-4 - Minor	63	26 (41.27%)	37 (58.73%)	1.26 (0.33,5.37)	1.36 (0.40,4.68)	0.6257
	5-42 - Moderate to Severe	27	14 (51.85%)	13 (48.15%)	1.91 (0.43,9.32)	2.20 (0.54,8.94)	0.2698
	Missing	11	5 (45.45%)	6 (54.55%)			

Table 4a: Analysis of Receipt of All Recommended Home Health Care
Data Extract Date: May 3, 2017

					Odds Ratio[1]		
Characteristic	**Value**	**N**	**Received Home Health Care n(%)**	**Did Not Receive Home Health Services n(%)**	**Unadjusted (95% CI) [2]**	**Adjusted (95% CI) [3]**	**p-value [4]**
Ambulatory Status at Admission[6]	Independent	106	47 (44.34%)	59 (55.66%)	0.63 (0.10,3.14)	0.43 (0.08,2.42)	0.3391
	With assistance	7	2 (28.57%)	5 (71.43%)			
	Unable to ambulate	2	1 (50.00%)	1 (50.00%)			
Ambulatory Status at Discharge[6]	Independent	84	38 (45.24%)	46 (54.76%)	0.66 (0.18,2.18)	0.73 (0.15,3.68)	0.7049
	With assistance	15	5 (33.33%)	10 (66.67%)			
	Unable to ambulate	2	1 (50.00%)	1 (50.00%)			
	Unknown	14	6 (42.86%)	8 (57.14%)			
Medicare Insurance[7]	No	32	14 (43.75%)	18 (56.25%)	0.98 (0.40,2.45)	0.93 (0.29,2.91)	0.8947
	Yes	83	36 (43.37%)	47 (56.63%)			
Medicaid Insurance[7]	No	100	42 (42.00%)	58 (58.00%)	1.58 (0.46,5.53)	1.35 (0.40,4.52)	0.6253
	Yes	15	8 (53.33%)	7 (46.67%)			
Private Insurance[7]	No	91	42 (46.15%)	49 (53.85%)	0.58 (0.20,1.63)	0.58 (0.20,1.67)	0.3141
	Yes	24	8 (33.33%)	16 (66.67%)			

Table 4a: Analysis of Receipt of All Recommended Home Health Care
Data Extract Date: May 3, 2017

					Odds Ratio[1]		
Characteristic	**Value**	**N**	**Received Home Health Care n(%)**	**Did Not Receive Home Health Services n(%)**	**Unadjusted (95% CI) [2]**	**Adjusted (95% CI) [3]**	**p-value [4]**
VA/Champus Insurance[7]	No	113	48 (42.48%)	65 (57.52%)	Not Estimable	Not Estimable	Not Estimable
	Yes	2	2 (100.0%)	0 (0.00%)			
Self-Pay/No Insurance[7]	No	110	48 (43.64%)	62 (56.36%)	0.86 (0.07,7.84)	0.85 (0.12,6.14)	0.8684
	Yes	5	2 (40.00%)	3 (60.00%)			

Table 4b: Analysis of Receipt of All Recommended Outpatient Care
Data Extract Date: May 3, 2017

					Odds Ratio[1]		
Characteristic	**Value**	**N**	**Received Outpatient Care n(%)**	**Did Not Receive Outpatient Services n(%)**	**Unadjusted (95% CI) [2]**	**Adjusted (95% CI) [3]**	**p-value [4]**
Age (years)	<65	44	15 (34.09%)	29 (65.91%)	1.00 (0.37,2.70)	0.92 (0.34,2.46)	0.8674
	>=65	41	14 (34.15%)	27 (65.85%)			
Gender	Male	47	15 (31.91%)	32 (68.09%)	1.24 (0.46,3.36)	1.05 (0.39,2.79)	0.9282
	Female	38	14 (36.84%)	24 (63.16%)			
Ethnicity	Non-Hispanic	83	29 (34.94%)	54 (65.06%)	Not Estimable	Not Estimable	Not Estimable
	Hispanic	1	0 (0.00%)	1 (100.0%)			
Race	White	64	25 (39.06%)	39 (60.94%)	0.28 (0.05,1.11)	0.22 (0.05,0.95)	0.0428
	Non-white	20	3 (15.00%)	17 (85.00%)			
Hospital Location	Metropolitan	64	19 (29.69%)	45 (70.31%)	2.15 (0.69,6.63)	3.64 (0.98,13.43)	0.0527
	Other	21	10 (47.62%)	11 (52.38%)			
NIH Stroke Score[5]	0 - No Stroke Symptoms	21	5 (23.81%)	16 (76.19%)			
	1-4 - Minor	42	17 (40.48%)	25 (59.52%)	2.15 (0.60,8.97)	2.14 (0.65,7.06)	0.2104
	5-42 - Moderate to Severe	12	4 (33.33%)	8 (66.67%)	1.58 (0.24,9.85)	1.59 (0.33,7.62)	0.5614
	Missing	10	3 (30.00%)	7 (70.00%)			

Table 4b: Analysis of Receipt of All Recommended Outpatient Care
Data Extract Date: May 3, 2017

					Odds Ratio[1]		
Characteristic	**Value**	**N**	**Received Outpatient Care n(%)**	**Did Not Receive Outpatient Services n(%)**	**Unadjusted (95% CI) [2]**	**Adjusted (95% CI) [3]**	**p-value [4]**
Ambulatory Status at Admission[6]	Independent	82	29 (35.37%)	53 (64.63%)	Not Estimable	Not Estimable	Not Estimable
	With assistance	1	0 (0.00%)	1 (100.0%)			
	Unable to ambulate	1	0 (0.00%)	1 (100.0%)			
	Unknown	1	0 (0.00%)	1 (100.0%)			
Ambulatory Status at Discharge[6]	Independent	72	24 (33.33%)	48 (66.67%)	1.00 (0.08,7.56)	1.06 (0.16,7.03)	0.9514
	With assistance	6	2 (33.33%)	4 (66.67%)			
	Unknown	7	3 (42.86%)	4 (57.14%)			
Medicare Insurance[7]	No	46	15 (32.61%)	31 (67.39%)	1.21 (0.44,3.27)	1.32 (0.39,4.48)	0.6586
	Yes	38	14 (36.84%)	24 (63.16%)			
Medicaid Insurance[7]	No	79	27 (34.18%)	52 (65.82%)	1.28 (0.10,11.89)	1.10 (0.16,7.44)	0.9248
	Yes	5	2 (40.00%)	3 (60.00%)			
Private Insurance[7]	No	53	16 (30.19%)	37 (69.81%)	1.67 (0.60,4.63)	1.55 (0.55,4.39)	0.4078
	Yes	31	13 (41.94%)	18 (58.06%)			

Table 4b: Analysis of Receipt of All Recommended Outpatient Care
Data Extract Date: May 3, 2017

					Odds Ratio[1]		
Characteristic	**Value**	**N**	**Received Outpatient Care n(%)**	**Did Not Receive Outpatient Services n(%)**	**Unadjusted (95% CI) [2]**	**Adjusted (95% CI) [3]**	**p-value [4]**
VA/Champus Insurance[7]	No	81	29 (35.80%)	52 (64.20%)	Not Estimable	Not Estimable	Not Estimable
	Yes	3	0 (0.00%)	3 (100.0%)			
Self-Pay/No Insurance[7]	No	72	27 (37.50%)	45 (62.50%)	0.33 (0.03,1.76)	0.31 (0.06,1.76)	0.1877
	Yes	12	2 (16.67%)	10 (83.33%)			

Table 5 : Summary of Select Characteristics Identified at the Clinic Visit for Patients Receiving Home Health Rehabilitation Recommendations
Data Extract Date: May 3, 2017

Characteristic	Response	N(%)
Fall Risk	Yes	64 (42.95%)
	No	85 (57.05%)
ADL Limitations	Yes	57 (38.26%)
	No	92 (61.74%)
IADL Limitations	Yes	48 (32.21%)
	No	101 (67.79%)
Physical Mobility and Safety	Yes	100 (67.11%)
	No	49 (32.89%)
Communication Deficits	Yes	24 (16.11%)
	No	125 (83.89%)

Table 6*: Summary of Select Characteristics Identified at the Clinic Visit*

by Receipt Status of All Recommended Rehabilitation Data Extract Date: May 3, 2017

Characteristic	Response	Received Rehab Services N(%)	Did Not Receive Rehab Services N(%)
Depression	Yes	22 (37.93%)	36 (62.07%)
	No	45 (39.13%)	70 (60.87%)
Stress	Yes	18 (33.96%)	35 (66.04%)
	No	49 (40.83%)	71 (59.17%)
Stress on Relationships	Yes	6 (60.00%)	4 (40.00%)
	No	61 (37.42%)	102 (62.58%)
Lack of Transportation	Yes	1 (100.0%)	0 (0.00%)
	No	66 (38.37%)	106 (61.63%)

CURRICULUM VITAE

Kristen N. Penland

Education

Master of Science: Health Disparities in Neuroscience-related Disorders
August 2017
Wake Forest University, Winston-Salem, NC

Bachelor of Science: Exercise Science
May 2012
Appalachian State University, Boone, NC

Experience

Clinical Research Coordinator, DJL Clinical Research, PLLC., Charlotte, NC
2017-Present

- Identified and enrolled eligible patients into appropriate clinical trials.
- Maintained accurate patient records in compliance with company SOP and FDA standards.
- Conducted subject visits according to protocol.
- Preformed quality assurance checks on patient and regulatory binders.
- Communicated with project team management in regards to queries and adverse events in timely manner.

Wellness Coordinator, Homestead Hills Senior Living, Winston-Salem, NC
2015-2015

- Managed and instructed aquatic and land based wellness program.
- Developed wellness classes for Memory Care Facility.
- Developed participation and retention strategies.

Rehab Aide, CarePartners Rehabilitation Hospital, Asheville, NC
2013-2015

- Assisted in patient therapy.
- Co-managed and developed aquatic wellness program.
- Tracked individual patient plan of care.

Certifications

- CITI- Human Research Biomedical Investigators
- CITI- Good Clinical Practice (GCP)
- CITI- International Conference on Harmonization (ICH)