Health literacy and insurance are important aspects of healthcare, yet few studies assess the roles that each play in relation to strokes. The purpose of this study is to better understand the relationship that stroke health literacy and insurance coverage have on the development of post-stroke outcomes such as post-stroke depression and stroke severity. In this study, 47 patients receiving inpatient care for acute ischemic stroke were given a modified version of the Stroke Knowledge Test in order to assess their understanding of strokes. Stroke severity and depression levels were also measured using the National Institute of Health Stroke Scale (NIHSS) and Hamilton Rating Scale for Depression (HAMD–17), respectively. Additionally, patients were asked whether their insurance coverage influenced their decision to seek out healthcare for their acute stroke-like symptoms and whether their insurance coverage would influence their decision to continue taking any medications or treatments that were started due to their strokes. Among the patients screened, there was a trend towards lower stroke health literacy scores indicating a decreased understanding of strokes among patients who stated their insurance coverage would influence one or more of their healthcare decisions. There was also a trend towards increased HAMD–17 scores indicating higher depression levels in patients who answered that their insurance would influence both of these decisions. However, neither of these trends were significant. Through continued research, it is hoped that these trends will shed light on the roles that health literacy and insurance coverage have on post-stroke outcomes and will provide a more holistic understanding of patient decisions regarding healthcare.

Introduction

Strokes are a type of medical condition caused by the disruption of the blood supply to the brain and are one of the leading causes of death worldwide. Studies have shown that every year in the United States, almost 800,000 individuals have a stroke, and that nearly 25% of all strokes are in individuals who have had a previous stroke. Additionally, it has been found that the risk of stroke recurrence is around 30% in stroke survivors.

Broadly, strokes can be broken down into two main categories—ischemic and hemorrhagic. Ischemic strokes are characterized by clots resulting in obstructed blood flow, and account for roughly 60–80% of all strokes. However, hemorrhagic strokes also occur when a blood vessel in the brain ruptures, leading to bleeding in the brain, which account for the remaining 20–40%.

The widespread prevalence of strokes is a serious concern because this change in blood flow to the brain has been shown to result in a variety of serious physical, communicative and emotional disturbances, which can lead to morbidity and even death. Examples of these outcomes include partial paralysis, headache, problems producing and understanding speech, as well as emotional disturbances.

One example of an emotional disturbance following stroke is post-stroke depression, which is a type of depression that manifests in individuals following both ischemic and hemorrhagic strokes. Unfortunately, post-stroke depression develops in between 18–33% of stroke patients and may have serious effects on physical, cognitive, and emotional recovery following stroke. Further, when compounded with the normal stress associated with inpatient treatment of acute health concerns, incidence of post-stroke depression is found to
be significantly higher in acute stroke patients than patients later in recovery\(^6\). However, despite the prevalence of post-stroke depression and its potentially severe emotional and physical impacts on recovery, it is often underdiagnosed as these emotional disturbances may not be noticed in the busy inpatient setting\(^8\).

As strokes have been associated with these significant physical and emotional outcomes; stroke prevention techniques are an integral part of primary medical care. While strokes have been shown to be associated with multiple non-modifiable risk factors such as age, gender, and genetic background, there also exist a variety of modifiable risk factors that have been shown to play a significant role in stroke incidence. A few of these widely accepted risk factors that are able to be modified with intervention include hypertension, tobacco use, diabetes mellitus, obesity, physical inactivity, high cholesterol, and atrial fibrillation\(^14\).

Because so many of the risk factors for stroke are able to be modified with intervention, stroke education has become a significant aspect of preventative as well as post-stroke care. While the relationship between controlling risk factors and post-stroke outcomes varies based on the condition, some studies have found that controlling for things such as hypertension as well as atrial fibrillation decreases the risk of recurring stroke by nearly 50\(^%\)\(^21\). However, despite the importance of stroke education, one study found that nearly one third of patients with recurring stroke or transient ischemic attacks could not name a single risk factor for stroke\(^13\).

While health education is of particular importance across all aspects of healthcare, knowledge of the symptoms of strokes specifically is integral in reducing both the risk of stroke onset as well as effectively treating acute stroke. One reason for this is the medication intravenous tissue plasminogen activator (tPA), which is a key component of caring for acute strokes. tPA is a medication that can be used to effectively reverse the effects of an ischemic stroke if given within a short window of stroke onset\(^12\). Thus, stroke education is paramount in ensuring patients are able to identify symptoms and seek out subsequent treatment in the event of acute stroke. This can be evidenced through one study which found that stroke education programs led to decreased prehospital delay for patients experiencing acute stroke–like symptoms\(^15\). Additionally, other studies have found that decreased health literacy was associated with increased stroke severity and increased length of stay in the hospital\(^16\). Despite the clear importance that stroke education has on preventative and post-stroke care, it is impossible to consider without also addressing the role that insurance coverage and access to healthcare play in these decisions and outcomes. In the United States, it is estimated that 8.5\% of Americans lack insurance coverage\(^17\) and that the average cost of hospitalization when stroke was a primary or secondary diagnosis was $20,396 ± $23,256\(^19\). Additionally, with the cost of simple checkups with a primary care physician sometimes over $100, the promotion of stroke education and subsequent treatment of risk factors may be unattainable for many Americans.

Unfortunately, this may have serious outcomes. One study found that uninsured patients with hypertension, high cholesterol, or diabetes mellitus were less likely to take medications prior to stroke, use an ambulance to travel to the hospital, or arrive early after onset of acute stroke–like symptoms. It was also found that these patients were more likely to die of their condition and survivors were less likely to attend in–patient rehab than their insured counterparts\(^10\). Further, another study based in China found that uninsured individuals less than 65 years of age had an earlier mean age of stroke onset and were three times more likely to die of stroke than insured individuals\(^3\). Thus, it is clear that stroke education and healthcare access are both integral for understanding stroke prevention and mitigating negative post-stroke outcomes.

While there has been significant research
about stroke health literacy and insurance coverage in general, few studies have assessed their roles in the development of post-stroke outcomes such as stroke severity and post-stroke depression. This project seeks to better understand this relationship in the hopes of developing a more holistic understanding of patients’ physical and emotional health following acute strokes.

**Methods**

This comprehensive cross-sectional study was completed on the inpatient stroke service of WVU Medicine’s Ruby Memorial Hospital beginning in April of 2019. Patients on the inpatient stroke service able to verbally respond to questions were identified by the members of the stroke team and were subsequently asked if they would be interested completing the verbal survey.

Here, 47 patients with radiographic evidence of acute ischemic stroke were given a short verbal survey assessing whether their insurance coverage played a role in their decision to seek out healthcare for their acute stroke-like symptoms and whether their insurance coverage would play a role in their decision to continue taking any medications or treatments that were started due to their stroke. Of these 47 patients, 23 were male and ages ranged from 20-90 with a median age of 65.

Thirty-eight of these patients also agreed to taking a modified version of the previously validated Stroke Knowledge Test as well as six true or false questions to assess their understanding of strokes. Every patient also was screened for depression using the Hamilton Rating Scale for Depression (HAM-D-17), which is a survey using a numerical scale to assess severity of depression.

Patients with a score of 0-7 were not considered depressed, whereas scores of 8-13 indicated mild depression, scores of 14-18 indicated moderate depression, scores of 19-22 indicated severe depression, and scores greater than or equal to 23 indicated very severe depression.

Additionally, stroke severity was assessed using the National Institute of Health Stroke Scale (NIHSS) with higher scores indicating increased stroke severity (NINDS Know Stroke Campaign - NIH Stroke Scale, 2019). Data was analyzed using T-Test, and hedges’ g effect sizes, a variation of Cohen’s d that corrects for small sample sizes, were calculated using a standardized mean.

Additionally, patients were asked to report the trust they had in the healthcare system on a scale ranging from no trust to complete trust. Institutional Review Board (IRB) approval was obtained due to the nature of the study and all participants verbally consented prior to participation (IRB Protocol Number: 1904517369).

**Results**

Among patients, the median HAMD-17 score was found to be 7, which generally indicates mild depression, with a range between 0 and 17. Further, the median score on the Stroke Knowledge Test was found to be 61.18% with a range between 27 and 86.36%.

Additionally, 68.09% (n=32) of patients reported that their insurance coverage influenced their decision to either seek out healthcare for acute stroke-like symptoms or their decision to continue taking any medications or treatments that were started due to their strokes. Further, 44.68% (n=21) of patients reported that their insurance would influence both decisions (Figure 1).

**Figure 1: Role of Insurance Coverage in Health Decisions of Acute Stroke Patients**
system reported their insurance coverage would influence the healthcare decisions highlighted in the methods section. This is contrasted to 72.7%, 87.5%, and 57.15% among those who reported strong, moderate, and somewhat degrees of trust, respectively. There were no evident trends relating trust in the healthcare system with scores on the Stroke Knowledge Test or HAMD-17 scores.

In terms of the stroke health literacy scores, though there was a trend towards increased HAMD-17 scores for patients with literacy scores above the 50th percentile, this trend was not statistically significant ($M=6.74$ vs $M=7.66$, $p=0.6706$, Hedges’ $g=0.14$). Additionally, there was a trend towards increased NIHSS in patients below the median literacy score, though this trend was also not statistically significant ($M=4.29$ vs $M=6.59$, $p=0.1361$, Hedges’ $g=0.38$). Finally, though there was a trend towards decreased stroke health literacy scores for patients who reported that their insurance coverage either influenced their decision to seek out healthcare for their acute stroke–like symptoms or would influence their decision to continue taking medications or treatments that were started due to their strokes, this trend was not significant ($M=64.03$ vs $M=58.43$, $p=0.2856$, Hedges’ $g=0.38$).

**Discussion**

Though this project did not lead to statistically significant results, it has shed light on interesting trends regarding post–stroke outcomes in relation to stroke health literacy and insurance coverage, which can be used to better understand the reasoning behind patients’ healthcare decisions. Further, the findings regarding the general incidence of depressive symptoms among inpatient stroke survivors highlights the importance of integrating mental healthcare in the treatment of acute stroke.

The results of the insurance questionnaire indicate that insurance coverage may be a significant barrier to care for patients with acute ischemic strokes in rural West Virginia,
and are important in understanding patients’ decisions to seek out care for acute stroke and to participate in follow-up care. Further, the association between responses to the insurance questionnaire and depression levels highlights the impact that social and environmental factors such as accessible health insurance may have on mental health. However, it was interesting to find that there was no significant relationship between response to the insurance questionnaire and stroke severity or literacy scores. Future data must be collected in order to better understand the true scope of the impact that these trends may have on local health outcomes.

Additionally, the relatively low median score on the Stroke Knowledge Test among inpatient stroke survivors indicates the necessity of increased stroke education in this population. Further, the trend towards lower NIHSS in patients with higher stroke health literacy scores indicates the potential importance of health literacy on stroke severity and leads to questions about the way that stroke education programs may impact such post-stroke outcomes. Future research will need to be completed in order to fully understand this relationship.

Finally, though there were no relationships identified between trust in the healthcare system and insurance coverage, stroke literacy, or post-stroke outcomes, the demographic information regarding patients’ trust in the healthcare system overall may serve as a tool to better understand patients holistically. This may provide valuable insight in terms of better understanding patients’ interactions with healthcare providers as well as their interactions with the healthcare system as a whole.

Despite the interesting trends that were identified through this research, this study did have various limitations that must be considered when assessing its results. Examples include the cross-sectional nature of this data as well as the relatively small sample size (n=47). Additionally, sampling bias is another limitation of this study, as only patients with acute stroke able to verbally respond to questions were considered. As aphasia is a relatively common side effect of stroke, this decision excluded a population of stroke survivors which may have influenced the data. Further, the decision to only screen inpatient stroke survivors may have influenced HAMD-17 scores due to the prevalence of environmental stressors in the hospital setting as well as the relatively short time between stroke onset and the administration of the survey.

Because this study currently has a limited sample size, it is hoped that with time and an increased sample, the trends that were identified may become significant results. However, though these trends were not statistically significant, many of these findings may still have valuable implications in healthcare, especially in terms of understanding the reasons why patients make the decisions that they do regarding their health. It is hoped that these findings may facilitate the development of a more holistic perspective among healthcare providers regarding both the importance of mental health considerations in the acute care setting as well as the role that insurance coverage may play on patient decision making during acute stroke.

Competing Interests

The author declares no competing interests.

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