

Inpatient Management of Acute Hypertension

Veronica F. Stevens

East Carolina University

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**Abstract**

One of every 4 patients admitted to U.S hospitals has hypertension. Few hypertension guidelines address the management of inpatient hypertension. The body of evidence suggests that management of hypertension in an inpatient setting may cause overtreatment with the potential for subsequent adverse events once the patient returns to their physiological baseline post-discharge. Patients often experience acute hypertensive episodes and remain hypertensive at discharge and follow up. Responsibilities of Advanced Practice Nurses in inpatient settings relative to hypertension include continuous monitoring and evaluation of vasoactive drugs, hypertensive crisis management and initiation of additional adjunct hypertensive therapy as needed. Further research is needed to provide consistent, detailed practice recommendations for treating acute severe hypertension. The purpose of this project was to determine treatment patterns for inpatient hypertension in a rural hospital. Rogers' diffusion of innovation theory provided a theoretical framework for the project. A retrospective review of 100 randomly selected records was conducted to determine what pharmacologic strategies were being used to treat severe acute hypertension, and if those practices were consistent with evidence. Data indicated inconsistency in management practices, though target blood pressures were close to goals set by the Eighth Joint National Committee. Clearer diagnostic guidelines and therapeutic recommendations may result in better control of hypertension in inpatient populations.

*Keywords:* acute severe hypertension, hypertensive crisis, hypertensive urgency

## Inpatient Management of Acute Hypertension

Acute care clinicians are often challenged to evaluate and treat inpatient hypertension in a variety of situations despite the paucity of data available to guide inpatient decisions (Rutecki, 2013). Patients often experience acute hypertensive episodes and remain hypertensive at discharge and follow up (Weder, 2011). Providers treat chronic hypertension in ambulatory settings based on evidence-based guidelines. These guidelines are systematically established recommendations developed to assist providers in selecting appropriate healthcare strategies that reduce blood pressure and minimize the risk of cardiovascular disease. However, few guidelines exist which address the management of inpatient hypertension (Weder and Erickson, 2010). The prevalence of uncontrolled hypertension is increasing despite advances in the therapeutic management of the disease (Chobanian, 2013). One of every 4 patients admitted to U.S hospitals has hypertension (Herzog et al., 2007). Patients often present for medical management of elevated blood pressure which may be categorized as hypertensive emergency, hypertensive urgency, or acutely elevated BP due to situational factors. It is important to distinguish these diagnoses from each other as appropriate treatment options vary greatly (Elliot, 2006).

The consequences of uncontrolled hypertension has been the focus of many evidence-based guidelines. However, existing guidelines provide recommendations chiefly for chronic hypertension that is managed in the outpatient setting. Few guidelines exist which include clinical practice recommendations for acute hypertension in inpatient settings (Weder and Erickson, 2010). There are areas of variation among current recommendations. The rate at which acutely elevated blood pressure should be lowered remains unclear and recommendations are restricted by the scarcity of high quality clinical evidence. The lack of evidence-based guidelines often leads to the use of inconsistent targets for blood pressure control extrapolated from

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guidelines intended for outpatient hypertension management (Pak, et al., 2014). Differences in management practices may increase the risk of harm to patients, taxing hospital resources for clinical practice recommendations. Research is needed to expand resources for clinical practice recommendations.

Severe asymptomatic hypertension (AH) is common and its presentation is contingent upon patients' underlying clinical condition. Acute hypertensive episodes are characterized by severe spikes in blood pressure that may lead to end-organ damage (Tulman, Stawicki, Papadimos, Murphy and Bergese, 2012). Acute hypertension has been linked to high rates of new organ damage, the need for intensive care unit treatment, and increased hospital readmission rates (Shorr et al., 2012). The syndrome has also been linked to increases in inpatient mortality (Shorr et al., 2012). Acute hypertension is frequently classified as hypertensive urgency or emergency and is rarely addressed by national treatment guidelines. The Seventh Joint Committee (JNC-7) defines hypertensive crisis as a systolic blood pressure (SBP) > than 180 mm Hg and/or a diastolic blood pressure (DBP)  $\geq$  120 mm Hg (Chobanian, et al., 2003). Hypertensive crises may be further designated into two categories based on the presence of target organ dysfunction. A diagnosis of hypertensive emergency is given if target organ damage is present. Hypertensive crisis without evidence of target organ damage is classified as hypertensive urgency or severe asymptomatic hypertension based on cardiovascular risk and patient history (Kessler and Joudeh, 2010). These designations profoundly impact treatment and prognosis, and are not addressed in JNC-8. Hypertensive emergencies require acute treatment with parenteral agents to minimize target organ damage. In these cases the goal of blood pressure reduction should not exceed 25% of the initial BP in 3-6 hours (Baumann, Cline, Pimenta, 2011).

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It is likely that many patients with chronic hypertension experience acutely elevated blood pressure while in the hospital (Weder, 2011). Tulman et al. (2012) concurs that acute hypertensive episodes occur more frequently in patients with chronic or pre-existing hypertension. Poorly justified treatments in these patients may be overly aggressive (Campbell et al., 2011). Many patients' homeostatic responses are contingent upon higher baseline blood pressures for adequate tissue oxygenation. Therefore, overly aggressive attempts to decrease blood pressure may cause unintentional hypotension and hypoperfusion of organs.

Sharma & Shrestha (2014) report that the incidence of hypertension is high (72%) in patients admitted to the hospital for diagnoses other than hypertension. Secondary factors contributing to acute BP increase include: anxiety, pain, bladder distension, narcotic and alcohol withdrawal, antihypertensive medication withdrawal, poorly controlled or undiagnosed hypertension, hypervolemia, medications, postoperative states, and central nervous system (CNS) disorders (Sharma & Shrestha, 2014). Acute hypertension without evidence of organ damage is unlikely to increase risks to patients. Evidence does not promote the immediate lowering of blood pressure in asymptomatic patients (Kessler and Joudeh, 2010). Hypertensive urgency does not automatically require aggressive treatment. These patients may be gradually stabilized with oral antihypertensive medications (Peacock, Angeles, Soto & Varon, 2009). Longer acting oral agents may be the more appropriate treatment (Rodriguez, Kumar & De Caro, 2010).

Many acute care providers believe that the control of inpatient hypertension is important and frequently warrants an adjustment or initiation of medication to achieve BP control (Axon et al., 2010). However, rapid lowering of the blood pressure is not usually necessary in the asymptomatic patient. There are no documented controlled studies which demonstrate improved

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long term outcomes resulting from the acute treatment of asymptomatic hypertension.

It is likely that these severely elevated blood pressures developed over a period of time rather than abruptly and treatment should be commensurate (Kessler & Joudeh, 2010).

Inadequate BP lowering may lead to confusion regarding the selection of antihypertensive medicine from the myriad of available agents. Longitudinal data continue to assert that controlling BP over time reduces the incidence, morbidity, mortality, and target organ damage while rapid BP lowering in asymptomatic patients has the potential to do harm (Tulman, 2012). Clearer diagnostic guidelines and therapeutic recommendations regarding when to treat elevated blood pressures may result in better control rates of both inpatient and outpatient hypertension (Axon, Cousineau & Egan, 2011).

### **Problem Statement and Rationale**

Few guidelines exist which address the management of inpatient hypertension (Weder and Erickson, 2010). Acute care providers often rely on outpatient guidelines which were not designed for the management of acute hypertension in the inpatient setting for management of hospitalized patients.

### **Process and Outcome Objectives**

The objective of this DNP project was to examine providers' management practices of acute hypertension in an inpatient setting. A retrospective electronic health record (EHR) review of approximately 100 records was conducted to examine existing management strategies at a rural community hospital. The project was conducted in a largely rural county in southeastern North Carolina where heart disease and cerebrovascular disease are among the top five causes of death. Feedback was disseminated to acute care providers and evidence-based recommendations were

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made for the establishment of a practice guideline for the treatment of acute hypertension. The following questions guided the project:

- What pharmacologic strategies do acute care providers use to treat acute episodes of inpatient hypertension?
- Does evidence support the use of these strategies?
- When should inpatients receive pharmacologic treatment for severe acute hypertension?

### **Theoretical Framework**

Dissemination science examines how evidence-based initiatives can best be translated into an interorganizational sector of potential adopters and implementers to generate effective results (Dearing, 2009). Roger's Diffusion of Innovations theory may be applied to organizational approaches that promote practice changes (Gale and Schaffer, 2009). Diffusion is the process through which an innovation is conveyed through certain channels over time among individuals in a social system (Rogers, 2003). The theory offers valuable insights into the process of social change by exploring qualities that make an innovation spread, understanding the needs of different user groups and understanding the importance of peer networks (Robinson, 2009). The focus of the theory is on changing products and behaviors so they better fit the needs of groups and individuals. Four main elements of the theory include innovation, communication channels, time, and social system (Sahin, 2006). An innovation is an idea, practice, or project that is perceived as new by an individual or other unit of adoption (Rogers, 2003, p. 12). An innovation may be old, but is a novelty for those who perceive it as new. Communication channels, the second element of the diffusion of innovations process, refers to the process in which participants share and create information to reach a mutual understanding (Rogers, 2003).

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The message originates from the source and is disseminated through a channel to a receiver.

Rogers further asserts that time is an essential aspect of adoption. Each phase encompasses an element of time. The last element in the diffusion process, social system, is set of interrelated units which employs joint problem solving to accomplish a common goal.

The innovation process involves five steps: knowledge, persuasion, decision, implementation, and confirmation (Rogers, 2003). In the knowledge stage, individuals seek information about the innovation after learning of its existence. He then progresses to the persuasion step during which the individual has a positive or negative attitude about the innovation. The opinions and beliefs of others affect the individual in his continued search for messages and evaluation of information. The individual chooses to reject or adopt the innovation at the decision stage. If the innovation is adopted it is then implemented. The implementer may need help from the change agent at this point to reduce uncertainty about the outcome. Finally, during the confirmation stage, the adopter looks for support for the decision.

A potential adopter is someone who must decide whether to invest resources into an innovation. The implementer is someone who will actually alter their behavior to put an innovation into practice (Rogers, 2003). Users rarely choose innovations in complex organizations. Implementers frequently oppose the intentions of adopters. The adopter usually has more formal authority than implementers and may not realize the extent or quality of the implementation or of the response by constituents to what is implemented (Rogers 2003). Rogers further explains attributes of innovations and their rate of adoption. Five characteristics of innovation are: relative advantage, compatibility with existing values and practices, simplicity and ease of use, trialability, and observable results. Relative advantage is the degree to which an

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innovation is perceived by users as better than the current idea. It is measured in terms important to the users such as social prestige, economic advantage, convenience or satisfaction. If the perceived relative advantage of an innovation is great, it will be adopted more rapidly.

Compatibility with existing values and practices is the degree to which the innovation is perceived as being consistent with needs, experiences and values of the potential adopters.

Incompatible ideas will not be adopted as quickly. Simplicity and ease of use is the degree to which an innovation is perceived as difficult to use and understand. Ideas that are simpler to understand will be more rapidly adopted. Trialability describes the degree to which an innovation has the flexibility to be experimented with. Trialable innovations appear less risky to potential adopters. Observable results enable individuals to visualize the results of an innovation, making it more likely to be adopted. Rogers (2003) asserts that these five qualities determine between 49 and 87 percent of the deviation in the adoption of innovations.

The success of an innovation depends on how well it meets the needs of individuals in a group. An effective approach is to partner with users in a process of continuous redefinition (Robinson, 2009). Reinvention of an innovation involves evolution to meet the needs of the users. The potential adopter's perceptions of the innovation's attributes of advantage, observability, complexity, and compatibility greatly impact the propensity toward adoption. The earliness of acceptance relative to others in adopting the innovation is of importance as well. Innovators are the fastest adopter groups. Early adopters are opinion leaders and self-conscious experimenters. The early majority are local observers, and the late majority wait for the majority's adoption of the innovation before adopting it themselves. Laggards are the slowest to change.

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Roger's theory is applicable to this project. The creation and adoption of a clinical practice guideline will require varying measures of change. Gale and Schaffer (2009) examined factors that affect the implementation or rejection of evidence-based changes. Top barriers to evidence-based practice change were insufficient time, lack of staff, and limited resources and supplies. Top reasons to adopt evidence-based practice were noted as having a personal interest in the change, avoidance of negative consequences to patients, and personal value of the practice changes. All team members must be enlisted for a clinical practice guideline to be effective. Creative strategies to engage team members must be utilized to increase the likelihood of adoption of a new practice guideline.

Acute care providers will be involved in each step of the process from data gathering to protocol development in hopes of generating a personal interest in and commitment to contributing to the guideline. Hopefully loyalty and ownership will be fostered. Capitalizing on group dynamics and individual characteristics will be essential. An innovator has already been identified in the group. This energetic, creative acute care provider has a passion for researching guidelines and protocols, and desires to practice according to evidence-based standards. He will be a great partner for promoting the design and adoption of a guideline. There are a few potential early adopters as well. They are respected by colleagues and are looking for activities that give them an advantage and competitive edge above peers. Early majority individuals will need proof of the benefits of a new strategy. The late majority will want to fit in. Promotion of the guideline as a social norm will be helpful with this group. The laggards will need to become familiar with the idea, exerting some control over how to operationalize it. The belief is that this group of acute care providers will find the development and use of a practice guideline attractive enough to participate in the process and adhere to changes.

### **Research Based Evidence**

A search was conducted via databases of OVID, CINAHL, PubMed and MEDLINE. Search terms included “hypertension”, “hypertensive crisis”, “acute hypertension”, “inpatient hypertension”, “severe hypertension”, “severe acute hypertension”, “hypertensive urgency”, and “hypertensive emergency”. The original search yielded 1,108 articles. Information was then limited to adults and the following topics were excluded: pregnancy, liver failure, uremic syndrome, gastrectomy, ischemic stroke, lupus, gastrointestinal complications, pediatrics, aortic occlusion, telemedicine, exercise, hemodialysis, streptokinase, heart failure, tumors and culture. Resources were limited to the English language and covered a time period of January 2010 to the present.

Two hundred abstracts were reviewed. Fifty full text articles were reviewed. Bibliographies and resource websites of the fifty retrieved articles were examined. Resources included 9 systemic reviews, 3 random control trials, 2 correlational studies, 3 cross-sectional studies, 17 exploratory studies, 11 descriptive studies, 4 reports and 1 case study. Forty-three sources of relevance were used to obtain content relevant to the inpatient management of acute hypertension.

### **Acute Hypertensive Episodes**

Many patients with chronic hypertension experience acute hypertensive episodes. Tulman, Stawicki, Papadimos, Murphy, and Bergese (2012) define acute hypertensive episodes (AHE) as “severe spikes in blood pressure that may precipitate end organ damage” (p. 375). AHEs may occur as isolated events and are more likely to occur in patients with pre-existing chronic hypertension. Failure to identify and treat AHE immediately predisposes the patient to end-organ damage. Repeated episodes of acute hypertension may result in vascular endothelial

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injury (Kuppasani and Reddi, 2010). Increasing blood pressure leads to vasoconstriction and further endothelial damage. Vasoconstriction and thrombosis may lead to diminished blood flow, hypoperfusion, and ischemia of organs. If the chain of events is not interrupted autoregulatory function becomes ineffective. Autoregulation is essential to maintaining perfusion of vital organs. Blood flow must be decreased strategically to avoid hypoperfusion. Therefore, antihypertensive agents must be carefully selected (Kessler and Joudeh, 2010). Acute care providers must be aware of effective treatment approaches relative to the management of hypertensive crises. The eyes, kidneys, brain and heart are most vulnerable to end-organ damage related to hypertensive emergencies (Belsha, 2011). Other commonly associated conditions include acute left ventricular failure with pulmonary edema, acute myocardial infarction, acute aortic dissection, acute renal failure, eclampsia, and ischemic and hemorrhagic stroke (Kuppasana and Reddi, 2010). Symptoms of organ damage include: chest pain, back pain, seizures, papilledema, exudates and altered consciousness. Prompt treatment is required to prevent catastrophic complications.

The Seventh Joint Committee (JNC-7) defines hypertensive crisis as a systolic blood pressure (SBP) > than 180 mm Hg and/or a diastolic blood pressure (DBP) > 120 mm Hg (Chobanian, et al., 2003). Hypertensive crises may be further designated into two categories based on the presence of target organ dysfunction. A diagnosis of hypertensive emergency is given if target organ damage is present. Hypertensive crisis without evidence of target organ damage is classified as hypertensive urgency or severe asymptomatic hypertension based on cardiovascular risk and patient history (Kessler and Joudeh, 2010). These designations profoundly impact treatment and prognosis, and are not addressed in JNC-8. Hypertensive emergencies require acute treatment with parenteral agents to minimize target organ damage. In

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these cases the goal of blood pressure reduction should not exceed 25% of the initial BP in 3-6 hours (Baumann, Cline, Pimenta, 2011). Many patients' homeostatic responses are contingent upon higher baseline blood pressures for adequate tissue oxygenation. Therefore overly aggressive attempts to decrease blood pressure may cause unintentional hypotension and hypoperfusion of organs.

Additionally, there are patients without a previous diagnosis of hypertension who experience situations such as anxiety and pain that generate transient acute hypertension. Sharma & Shrestha (2014) reported that the incidence of hypertension is high (72%) in patients admitted to the hospital for reasons other than hypertension. Secondary factors contributing to acute BP increase include: anxiety, pain, bladder distension, alcohol and narcotic withdrawal, antihypertensive medication withdrawal, poorly controlled or undiagnosed hypertension, hypervolemia, postoperative state, medications and central nervous system (CNS) disorders. Acute hypertension without organ damage is unlikely to increase risks to patients. Evidence does not promote the immediate lowering of blood pressure in asymptomatic patients (Kessler and Joudeh, 2010). It is suggested that these patients may be managed safely with oral antihypertensive medications. Providers need to distinguish hypertensive emergency from severe asymptomatic hypertension so that safe, appropriate treatment may be administered (Kessler and Joudeh, 2010).

Patients who present with acutely elevated blood pressures can have one of three diagnoses. These diagnoses must be distinguished in order to determine appropriate treatment. Hypertensive emergency presents with signs and symptoms of ongoing acute target organ damage. Blood pressure in hypertensive emergency should be reduced within minutes using an intravenous antihypertensive agent (Tulman, et al., 2012). The patient with elevated BP without

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evidence of end organ damage, however, may have outpatient management and reassessment (Chobanian, 2013). The patient with hypertensive crisis presents a dilemma. Clear, evidence-based guidelines for the initiation of testing to distinguish patients experiencing hypertensive urgency from hypertensive emergency do not exist. Comprehensive history and physical examination to assess for end-organ damage are sometimes omitted due to limited time and resources. Patients may be questioned about symptoms indicative of end organ damage such as chest pain, dyspnea and focal neurologic symptoms. In the absence of those symptoms and compelling evidence the patient may be discharged home without further inpatient evaluation. Research efforts should be made which emphasize the development of standardized functional diagnostic criteria specifically for hypertension in the inpatient setting. These criteria could assist in distinguishing nonemergent from emergent blood pressures and determine best practices for managing all elevated blood pressures.

### **Hypertensive Urgency vs. Emergency**

Appropriate identification and treatment of hypertension continues to be an issue in health care (Polly, Paciullo & Hatfield, 2011). Patients who receive appropriate primary care can often avoid complications of chronic hypertension such as heart failure, aneurysm, myocardial infarction, stroke, and renal failure. The same complications are associated with acute severe spikes in blood pressure though they rarely receive emphasis. Patients often present to emergency departments with severe hypertension, which is labeled as hypertensive crisis. This designation is further divided into hypertensive emergencies or hypertensive urgencies based on the presence of target organ damage (TOD). Accurate identification, evaluation, and management of these conditions is imperative in the emergency department (Polly, Paciullo &

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Hatfield, 2011). Many conditions place patients at risk for hypertensive crisis. The syndrome often arises from primary hypertension, and could be generated by nonadherence to

antihypertensive regimens, untreated hypertension, and abrupt withdrawal from medications (Flanigan & Vitberg, 2006). Other conditions such as renovascular disease, thyroid storm, trauma, or adrenal dysfunction may contribute to severely elevated blood pressures.

A thorough history is the initial step in evaluating patients who present with severely elevated blood pressures. Evaluation should include ascertaining a history of hypertension, BP control measures, preexisting organ damage such as kidney disease or CHF, and adherence to medication regimen (Polly, Paciullo & Hatfield, 2011). Blood pressures must be verified in both arms with a cuff of the proper size. The physical examination should emphasize evaluation of target organs for damage. The heart and lungs should be evaluated for adventitious heart and lung sounds. Fundoscopic and neurologic examinations should be performed. Additional evaluation should include blood urea nitrogen, creatinine, complete blood count, electrolytes, chest radiograph and urinalysis. A treatment plan may be developed after a distinction is made between urgency and emergency.

Hypertensive urgency can be addressed using oral antihypertensives. The goal is the reduction of blood pressure, and is relative to the baseline measurements. BP should be reduced to baseline values over 24 to 48 hours (Marik & Varon, 2007). Pharmacologic agents may be used to decrease heart rate and/or systemic vascular resistance. Tissue perfusion is maintained through vasoconstriction or vasodilation. This homeostatic mechanism functions only if acute changes are less than 20-25%. Exceeding these parameters may result in ischemia, precipitating consequences such as stroke, myocardial infarction, and death. Therefore, blood pressure should

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be reduced slowly for patients with hypertensive urgency.

Hypertensive emergencies require a more aggressive approach to prevent target organ damage (Polly, Paciullo & Hatfield, 2011). The acuity level of these patients requires the monitoring and a nurse-patient ratio that is provided in an intensive care or cardiac care unit. The focus of treatment in hypertensive emergencies is a reduction of the BP by 15 to 25% within the first hour (Marik & Varon, 2007). Blood pressure may be further reduced once the patient is stabilized to a goal of 160 mmHg for the systolic blood pressure and 100-110 mmHg for the diastolic blood pressure. According to JNC7 recommendations this reduction should take place over a 2-6 hour period (Chobanian et al., 2003). Intravenous antihypertensive therapy should be replaced with oral medications during the final reduction period. An agent should be used with a rapid onset, short duration, and easy titration. It should be well tolerated with minimal adverse effects.

Severe, acute elevations in BP may require only oral therapy and gradual reduction in BP over 24 to 48 hours. Patients may present with evidence of TOD needing emergent BP reduction with intravenous antihypertensive agents. Accurate assessment and evaluation is essential to successful treatment and positive patient outcomes.

Elliot (2006) asserts that patients presenting with acutely elevated blood pressures often have compelling symptoms which may result in poor prognoses if left unattended. The individual with hypertensive emergency manifests with signs and symptoms of acute ongoing target organ damage, and blood pressure should be reduced within minutes using an intravenous drug administered in an intensive care unit. At the other end of the spectrum is the person with a very elevated blood pressure without target-organ damage. This individual has a 70% likelihood of

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having poorly treated stage 2 hypertension. This patient presentation is not an emergency and does not require immediate treatment. A referral to a provider for ongoing management of chronic hypertension is appropriate as management is complex.

Hypertensive urgency is often diagnosed when the provider deems it unsafe to discharge the patient without reducing the blood pressure. These patients have very elevated blood pressures without chronic target organ damage that is not ongoing or acute. There is limited evidence supporting the reduction of blood pressure in this setting. Most authorities concur that blood pressure may be reduced at a slower pace within hours to days with follow up and oral medications (Shayne, 2009).

Types of hypertensive emergencies include cardiac hypertensive emergencies such as myocardial infarction and pulmonary edema, hemorrhage, aortic dissection, obstetric hypertensive emergencies, hypertensive emergencies caused by catecholamine excess, renal hypertensive emergencies and neurologic hypertensive emergencies. Treatment options depend on the type of emergency and the patient (Elliot, 2006).

Kessler and Joudeh (2010) discussed the treatment of severe, asymptomatic hypertension. Severely elevated blood pressure may be defined as a systolic BP of 160 or greater, or a diastolic BP of 110 mmHg or greater. It can be further designated as severe asymptomatic hypertension or hypertensive emergency. Severe asymptomatic hypertension is severely elevated hypertension without signs and symptoms of end organ damage. Hypertensive emergency manifests when signs and symptoms of end organ damage occurs. Hypertensive emergency usually occurs when the diastolic blood pressure is greater than 120 mmHg. Severe asymptomatic hypertension may be further classified into severe uncontrolled hypertension or hypertensive urgency based on cardiovascular risk and history. Hypertensive urgency is noted when the following risk factors

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exist: history of unstable angina, congestive heart failure, or renal failure. These risk factors are absent in severe uncontrolled hypertension. Asymptomatic hypertension does not warrant a rapid reduction in BP. No controlled studies exist which demonstrate improved patient outcomes with treatment of this syndrome (Kessler and Joudeh, 2010). It is unlikely that SAH develops rapidly. Rapid reduction of SAH may result in a significant decrease in perfusion to the brain with resultant ischemia and infarction. Treatment should be initiated with a maintenance dose of oral medication. Follow up is recommended in 1-7 days.

### **Inpatient Severe Acute Hypertension Admissions**

According to the Agency for Healthcare, Research and Quality (AHRQ) over 20 million emergency department visits involve hypertension each year (Owens and Mutter, 2010). Much of the literature focuses on the epidemiology of chronic hypertension. However, fewer studies address severe acute hypertension (AH). The syndrome receives little attention in national treatment guidelines. Few discussions have taken place regarding the relationship between severe acute hypertension and outcomes in hospitalized patients (Shorr, et al., 2012). Hospitalists need a better understanding of the relationship between severe AH and mortality and morbidity. Shorr, et al. (2012) conducted a retrospective cohort study of 1,290,804 adults admitted between 2005 and 2007 to 114 acute care hospitals. Severe AH was defined as having at least 1 systolic BP >180 mmHg. Data were obtained from clinical research databases. Patients were grouped according to their maximum blood pressures in the emergency department. Outcome measures included in-hospital mortality, length of stay (LOS) and need for mechanical ventilation on admission day. Groups were stratified into 9 major disease categories based on organ systems. Hospital mortality was 3.6% (n=46,033) with 13.3% experiencing severe AH. Fifty-nine percent

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of patients had at least 1 BP measurement of  $\geq 140$  mmHG during their stay in the ED, including 13.8% with SBP  $> 180$  mmHg.

Circulatory, endocrine and urinary systems were associated with the highest prevalence of severe AH at 29%, 16%, 14.5% and 13.5% respectively. Relationships between SBP and mortality risk was revealed by univariate analysis. The relationship was most pronounced for nervous system diseases for which a 10 mmHG increase in SBP from 180 to  $> 220$  mmHG was 6.5%, 8.1%, 10.0%, 12.0% and 19.7% (trending  $P < 0.0001$ ). Severe AH was not noted to be a predictor of independent mortality in other disease categories. Univariate analysis revealed a relationship between LOS and AH for almost all disease categories in survivors (trending  $P < 0.0001$ ). Initial severe blood pressure elevations at the ED were independently correlated with mortality. Severe BP elevations at the ED were also independently associated with an increased need for mechanical ventilation on admission and prolonged LOS across various disease processes. Incremental increases in SBP above 180 mmHG were associated with a stepwise increase in the risk for death. Further study is needed to determine the best method of management for these patients, and to determine the impact of optimal management of severe AH upon admission on generating positive outcomes. Consequently, severe AH may exacerbate both chronic and acute conditions. These exacerbations may complicate disease management and result in longer hospital stays.

### **Inpatient Hypertension**

Hypertension continues to be a highly prevalent problem in our nation affecting 29% of adults (NHANES). The overall control rate for patients who are treated for hypertension remains at approximately 44%. Approximately 30% of patients are not aware of their hypertension, and

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a substantial group are aware of the diagnosis and choose not to receive treatment (Axon, Cousineau, Egan, 2011). Strategies to improve the screening, management and control of hypertension have focused on the outpatient setting in the past. However, one of every 4 patients admitted to U.S hospitals has hypertension (Herzog, 2007). The potential to improve hypertension management exists by focusing on hospitalized patients (Axon, Cousineau, Egan, 2011). Patients in the hospital setting with persistently elevated blood pressures without mitigating factors will probably continue to have high blood pressures in the outpatient setting. Current consensus guidelines fail to adequately address inpatient hypertension. Lack of consistent guidelines may result in suboptimal management which may result in readmission and death.

Axon, Cousineau and Egan, (2010) conducted a systematic review of hypertension prevalence and care patterns among adults that had a primary focus of hypertension diagnosis and treatment or reported estimates of hypertension prevalence in the inpatient setting. A review was conducted of English language studies published later than 1976 and included MEDLINE indexed randomized control trials (RCT), observational studies and meta-analyses. RCTs were excluded that did not focus on hypertension. The initial search strategy yielded 826 articles. Results indicated a 50-75% prevalence of hypertension in general medical-surgical and cardiology patients. Blood pressures typically remained elevated in patients with uncontrolled hypertension at discharge. At discharge only 23.2% of the cohort had a blood pressure <140/90 mmHg. Studies examining prescribing practices at discharge did not indicate the tendency toward intensifying therapy in patients with uncontrolled hypertension. Intensification was reported in only 53.1%. Failure to prescribe antihypertensive medications at the time of discharge was the single most accurate predictor of nontreatment at 6 to 18 month follow up

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despite other follow-up visits where BP medications might have been titrated. Failure to manage observed inpatient hypertension was a predictor of medication use and disease outcomes in patients with risk factors. One cohort reported that only 35% of hypertensive urgency or emergency patients had a 90 day follow up visit for hypertension. Thirty-seven percent were readmitted and 11% died within 90 days. The researchers noted that opportunities for accurate diagnosis of hypertension and subsequent initiation or modification of treatment were frequently missed. Study limitations included the paucity of published research documenting hypertension prevalence, and the fact that the definition of hypertension varied between studies. Further, existing consensus guidelines did not address inpatient diagnosis and management of hypertension. More specific therapeutic and diagnostic guidelines prompting detection and treatment of inpatient hypertension would enhance transition between inpatient and outpatient settings (Axon, Cousineau and Egan, 2011).

### **Readmissions**

Disease-specific data is available for chronic diseases such as pneumonia, chronic obstructive pulmonary disease and heart failure. However, limited data exists for patients with severe acute hypertension. The Studying the Treatment of Acute hypertension (STAT) initiative is a clinical registry of hospital patients with acute severe hypertension comprised of 25 institutions. The registry employs consistent data, definitions and case identification. The STAT study collected follow-up information on patients' outcomes and characterized contemporary treatment outcomes. This multi-centered survey ascertained routine management practices and outcomes for patients with SAH treated in critical care and nonoperative settings with intravenous antihypertensive therapy. Gore, et al. (2010) conducted an observational, cross-sectional study to identify clinical predictors of 90-day rehospitalization. Data were collected

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from 25 hospitals from across the nation. Adult men and women who presented to the hospital with SAH (BP >180 mm Hg systolic and >110 mm Hg diastolic) and were treated in nonoperative intensive care or emergency department settings with intravenous antihypertensive agents were included. Practice patterns were documented. Inclusion criteria consisted of patients receiving at least 2 boluses of intravenous antihypertensive therapy or having been given a continuous antihypertensive infusion within 24 hours of arrival to the hospital. Patients receiving topical, oral or sublingual medications were excluded. Patients in the perioperative and peripartum periods were excluded as well. Readmission follow-up data were reviewed for 92% (1,009) of patients discharged home alive, and for 90% (1,313) of the 1,458 patients discharged alive to other facilities. Hypertension was responsible for readmission in 29% of cases. Readmission rates were the greatest during the first 3 weeks after discharge. Forty-four percent of patients readmitted for SAH returned within 2 weeks. Patients readmitted with hypertension took longer to experience a 10% reduction in systolic blood pressure compared to those readmitted for other reasons. Those rehospitalized for hypertension had more drugs prescribed at discharge. These patients also experienced higher levels of creatinine and brain natriuretic peptide levels. Patients with hypertension as an admitting diagnosis were 94% more likely to be readmitted for hypertension than patients without hypertension as a diagnosis. Nearly one third of patients discharged after hospitalization with SAH were rehospitalized within 90 days. Recurrent SAH readmissions tended to occur in less than a month after discharge, and accounted for 29% of readmissions. Transition between hospital and ambulatory care settings was a critical, modifiable risk factor. There were several study limitations noted. Potential for selection bias existed as only patients selected by providers to receive initial intravenous therapy were included. Researchers were unable to achieve 100% follow-up which may have led to

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misrepresentation of true readmission rates in the study cohort. Appropriate intervention and monitoring is needed during initial episodes of SAH. Additionally, arrangement for outpatient follow up is needed within the first few days of discharge.

### **Attitudes and Practices of Providers**

Very few clinical practice guidelines give treatment recommendations for acute hypertensive episodes except for in specific illnesses such as stroke and pregnancy. Guidelines for the management of hypertension have historically focused on the outpatient setting. Evidence demonstrates that the prevalence of hypertension in the inpatient setting is rising (Conan, Perruchoud, et al.). Experts agree on principles for treating various hypertensive emergency syndromes. However, no consensus recommendation exists on the management of nonacute elevated blood pressure in the inpatient setting. JNC 8 does not specifically discuss inpatient hypertension, and its use in the hospital setting has not been established. Recognition and management of hypertension in the inpatient setting has been less than optimal. A minimal amount of published information has been disseminated which addresses the knowledge and practices of inpatient providers in the management of elevated BP. Axon, et al. (2011) conducted a cross-sectional survey of resident physicians in internal medicine (IM), family medicine (FM) and surgery concerning elevated BP in the inpatient setting. Survey questions targeted diagnosis, management, and care transitions for inpatients with elevated BP. Participants were selected from two university based medical centers and one community based hospital. Residents were invited to complete questionnaires by pen and paper format or via online survey. Survey responses were anonymous. Respondents were given \$5.00 coupons for completing the survey forms. Survey results were combined and analyzed. Groups were compared according to their training program. Between-group differences were tested using chi-square or Fisher exact tests.

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SAS statistical software package was used to perform analysis. Eighty percent of respondents rated the control of BP as 4 or 5 out of five in importance. No significant differences existed between specialties regarding the importance attributed to inpatient BP control, correlation of elevated BP with medication timing, frequency of manually rechecking of BP in patients with elevations, and frequency of changing BP medications. Most respondents reported that they based their management on current JNC 7 guidelines. There were notable differences in responses to this question. Ninety-seven percent of FM and 70% of IM residents stated they used guidelines. Only 19% of surgery residents reported using guidelines ( $P<.001$ ). No group was likely to change BP medication at  $<140/90$  mmHG. The threshold for medication changes was higher for FM or IM residents. Sixty-five percent of FM and 64% of IM residents would change medications at a diastolic BP  $\geq 100$  mmHg., but only 23% of surgical residents would do so ( $P<.001$ ). Participants were asked to choose how they would deal with asymptomatic, moderately elevated BP in an inpatient. Forty-four percent indicated that they would treat with an intravenous or oral agent, while 56% indicated that they would not treat the patient with an antihypertensive. Fifty-nine percent of IM and FM residents said they would not consult a specialist, while 14% of surgeons stated they would do so ( $P<.001$ ). Ninety-one percent of respondents agreed that the final antihypertensive regimen adopted during hospitalization should be the discharge regimen. Seventy-one percent indicated that 1 to 2 weeks after discharge would be an appropriate follow-up interval. Internal medicine residents (16%) chose follow-up intervals of greater than 2 weeks. Sixty-six percent of respondents stated they would treat and document newly diagnosed BP to include prescribing new medication at discharge. However, only 7.8 % stated they would contact a primary care provider for collaboration regarding titrating medications on a complex heart failure patient with uncontrolled BP. Respondents rated the

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management of inpatient hypertension as having high priority. Most indicated use of current guidelines despite their lack of applicability to acute care. However, responses indicated that patients would need to have a BP greater than 160/100 mmHG prior to the initiation of medication changes rather than then 140/90 suggested by JNC 7. Ambiguity was noted on proper management of transiently elevated BP. Forty-four percent indicated that they would treat acutely elevated BP in asymptomatic patients.

Inpatient hospitalization gives providers an opportunity to recognize and address uncontrolled hypertension. Providers could alert outpatient physicians that problems exist with BP control (Axon, et al., 2010). Diagnostic uncertainty affects the provider's ability to make effective decisions about medication regimens at the time of discharge. Further, a proliferation of hospitalists has contributed to discontinuity of care between inpatient and outpatient settings. Limitations existed in the study. A convenience sample of resident physicians was used. This sample may not be reflective of the knowledge and practice habits of all providers. Future research should focus on the development of specific management criteria for hypertension in the inpatient setting. Best practices should be ascertained for the management of nonemergent, elevated BP. Guidelines could minimize variations in care that could negatively impact patient outcomes.

### **Review and Appraisal of Guidelines**

Few clinical practice guidelines provide suggestions for the management of acute hypertensive episodes outside of the context of specific conditions such as stroke and pregnancy (Pak, et al. 2014). A systematic review was performed to identify guidelines which address acute hypertension. Guidelines were appraised using the Appraisal of Guidelines for Research and Evaluation (AGREE II) quality assessment tool. Literature on hypertension in pregnancy,

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secondary hypertension, preeclampsia/eclampsia, aortic dissection, stroke and pheochromocytoma was excluded. A MEDLINE search was conducted on guidelines published between January 1, 2003 and June 15, 2014. Guidelines derived from other guidelines were excluded. Three reference guidelines were identified after reviewing titles and abstracts from selected articles and include: “Clinical Policy: Critical Issues in the Evaluation and Management of Adult Patients in the Emergency Department with Asymptomatic Elevated Blood Pressure” from the American College of Emergency Physicians (ACEP), “Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure”), and “2013 ESH/ESC Guidelines for the Management of Arterial Hypertension from the European Society of Hypertension (ESH) and the European Society of Cardiology (ESC).

Hypertension guidelines from JNC 7 recommended treating hypertensive emergencies by reducing mean arterial pressure by  $\leq 25\%$  in the first hour, then to 160/100-110 mmHg within 2-6 hours. The guideline recommended further gradual reduction within the next 24-48 hours. JNC 7 listed parenteral drugs for treatment of hypertensive emergency. The 2014 report from members appointed to the Eighth National Committee is more limited in scope and does not address acute hypertension (Pak, et al., 2014). The 2013 guidelines for the management of arterial hypertension from the ESH and The ESC defined hypertensive emergency as SBP > 120 mmHG or DBP > 120 mmHg with associated impending or worsening organ dysfunction. These guidelines recommended reducing BP by < 25% within the first hours followed by judicious reduction (number of hours not specified). Medications recommended for lowering blood pressure in the ESH/ESC guidelines were the same as those suggested for treating malignant hypertension as designated by ESH/ESC guidelines as a hypertensive emergency associated with ischemic organ dysfunction. ESH/ESC guidelines stated that recommendations were limited

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because of a lack of randomized controlled trials comparing aggressive regimes to conservative regimens in reducing blood pressure. The National Institute of Health and Care Excellence explicitly excluded acute hypertension in emergency settings or accelerated hypertension. The review addressed 2 critical questions: 1) In patients with asymptomatic markedly elevated blood pressures, does ED medical intervention reduce rates of adverse outcomes? 2) In Inpatients admitted to the ED with asymptomatic elevated blood pressure, does screening for target organ injury reduce rates of adverse outcomes? No high or moderate quality recommendations resulted (see Figure 1). Several low quality recommendations resulted. AGREE II assessment yielded mean domain percentage and overall assessment scores (1-7) as follows: ESH/ESC: 56%, 4.5, ACEP: 67%, 5.5, and NHLBI: 73%, 5.5. Researchers asserted that identification of only 3 guidelines attests to the scarcity of clinical practice recommendations on the subject of acute hypertension (Weder, 2011). Overall assessment results indicated that NHLBI and ESH/ESC guidelines were of high quality and provided comparable recommendations for managing asymptomatic acute hypertensive episodes and hypertensive emergencies. However, the guidelines lacked specific recommendations for acutely elevated asymptomatic blood pressure in patients hospitalized for other causes. The speed at which acutely elevated blood pressure should be reduced is equivocal and recommendations are limited by the paucity of high-quality evidence. Rapid reduction of BP has shown no benefits. In the asymptomatic patient, the general recommendation by JNC 7 is to gradually lower the BP over hours to days to minimize risks associated with rapid reduction or interference with autoregulatory mechanism that maintain perfusion. No evidence exists which demonstrates the benefit of antihypertensive management in patients hospitalized for diagnoses other than hypertension. Despite numerous guidelines for chronic hypertension, acute hypertension is neglected in the literature. Acute severe hypertension

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has high rates of mortality and morbidity. The lack of evidence based direction leads to the adoption of ambiguous blood pressure targets from guidelines intended for outpatient management. Practice differences may negatively impact patient outcomes and burden hospital resources (Pak, et al. 2014). Further research is needed to provide more detailed information for clinical practice guidelines.

### **Synthesis of the Evidence**

Patients presenting with acutely elevated blood pressures can have one of three diagnoses. Diagnoses must be distinguished in order to determine appropriate treatment (Elliot, 2006). Clear, evidence-based guidelines for the initiation of testing to distinguish patients experiencing hypertensive urgency from hypertensive emergency do not exist (Pak, et al., 2014). Though numerous guidelines for chronic hypertension are available, acute hypertension is neglected in the literature. Differences in management practices among acute care providers may increase the risk of harm to patients, taxing hospital resources and negatively impacting health care systems. Further research is needed to provide more detailed information for clinical practice guidelines.

Asymptomatic hypertension does not warrant a rapid reduction in blood pressure (Weder and Erickson, 2010). No controlled studies exist which demonstrate improved patient outcomes with treatment of SAH. Diagnostic uncertainty affects providers' ability to make effective decisions about medication regimens at the time of discharge of patients with uncontrolled hypertension. Future research should be inclusive of all types of acute health care providers and focus on the development of specific management criteria. Further study is needed to determine the best method for management of severe AH and prevent complications in disease management that may result in longer hospital stays.

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Readmission rates of patients with SAH are impacted by inpatient treatment. Patients with SAH are often rehospitalized less than a month after discharge. Transition between hospital and ambulatory care setting is a modifiable risk factor for hospital readmission. Appropriate intervention and monitoring is needed during initial episodes, and follow up within the first few days of discharge is essential. Further study is needed of patients discharged after experiencing SAH to include a wider variety of participants.

This project sought to determine treatment practices of inpatient hypertension among a group of acute care providers at a rural hospital. Data will be used to assist these providers in adopting a practice guideline which embraces evidence-based management of inpatient hypertension.

### **Methodology**

A convenience sample was used for random selection of patients with a diagnosis of hypertension at a rural hospital in eastern North Carolina. A list of patients in the hospital with hypertension from January to June of 2015 was generated by the medical records department. Every 10<sup>th</sup> record was selected for review. Records were reviewed from June to July 2015. A retrospective chart review of 100 electronic medical records was conducted, with inclusion criteria of patients between age 18 and 89 with a systolic blood pressure above 180 and/or a diastolic BP above 90. The facility did not have a formal review board, so a letter of support was provided. An IRB application was submitted to East Carolina University for review, and the project was deemed exempt.

The records review took place in a secure area of the medical records department. A room with a password protected computer was provided for EHR review, and no identifying information was maintained. Charts were reviewed for the following information: admitting

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diagnosis, existing diagnosis of diabetes, renal disease, or liver disease, body mass index, cardiac disease, neurological disease, age, gender, admission antihypertensive, antihypertensive initiated during hospitalization, medications added to regimen, changes in medication regimen, specific agents used, admitting blood pressure, highest BP, discharge BP, length of stay, and discharge disposition.

The primary focus was the prevalence and management of severe acute hypertension as defined by at least one SBP measurement greater than 180 mmHG. Descriptive statistics were used to gain insight into practice patterns relative to acute episodes of hypertension in the inpatient setting. Management strategies were noted, including pharmacologic agents. The resultant data was reported to the hospital risk manager and quality officer. A report was provided for inpatient health care providers.

### **Results**

One hundred charts were reviewed, and forty patient records met inclusion criteria. These forty adults were admitted to the facility or seen in the emergency department from January 1 to June 30 of 2015. Subjects included 16 males and 24 females who ranged in age from 28-86. The median age was 65 years, and BMI ranged from 17-60. The patients were admitted with the following diagnoses with hypertension as a comorbidity: diabetes mellitus II (23), renal disease (13), cardiac disease (16), respiratory disease (9), and neurological disease (5).

Admission blood pressures ranged from 212/127 – 127/70 with a mean SBP of 158.9 and a mean DBP of 93.8. The highest blood pressures during inpatient stay ranged from 252/70 – 206/120 with a mean SBP of 168.7 and a mean DBP of 102.1. Discharge blood pressures ranged from 170/90 – 116/57 with a mean SBP of 142.8 and a mean DBP of 79.45. The average length

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of stay was 4.2 days. Thirty-six patients were discharged home. Two patients were discharged to the nursing home, and 2 were transferred to a tertiary care center.

Thirty patients came into the hospital on antihypertensive medications. Six patients were diagnosed with hypertension at the hospital, and medications initiated. Eleven had their medications changed while they were hospitalized. Twenty-three patients were placed back on their previous treatment regimen. The following medications were used in the inpatient setting: 9 patients received ace-inhibitors, 3 received angiotensin receptor blockers, 15 received beta blockers, 12 received calcium channel blockers, 13 were on diuretics, 4 received nitrates and 4 received arterial vasodilators.

Eight patients (20%) had an admitting blood pressure  $>180$ . Seven (17.5%) had severe acute hypertension, and 21 (52.5%) were classified as having hypertensive emergency. Patients with severe acute hypertension had the following diagnoses: cellulitis, opiate overdose, urinary tract infection, asthma, pneumonia, abdominal pain, and chest pain.

Drugs used for treating patients with severe acute hypertension were: Hydralazine, Clonidine, Metoprolol and Furosemide (Figure 4). One patient's blood pressure decreased from 188/87 to 146/68 over 5 days. Another had a decrease from 186/119 – 137/98 over 2 days. A third had a decrease from 161/103- 122/68 over 2 days. Another patient had a decrease from 172/101 – 148/98 in 3 days. Another had a decrease from 170/117 – 167/99 over 4 days. Another had a decrease from 159/117 – 168/97 in 1 day. Another had a decrease from 201/120 to 148/81 in 2 days.

Practice patterns for the treatment of severe asymptomatic hypertension varied but were conservative and appropriate. Over half of patients with a prior diagnosis of hypertension who were on antihypertensive medications resumed their pre-hospital medications. Severe

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asymptomatic hypertension was treated in all except one case. JNC-8 has target blood pressures for specific age group. Providers were at or near JNC-8 target blood pressure goals at discharge for patients with severe asymptomatic hypertension (Figure 3). Blood pressures were reduced over several days with oral medications and subsequent recommendations for outpatient follow-up. Recommended add-on drugs, calcium channel blockers, diuretics and beta blockers were utilized alone or in combination with each other for management. Providers selected treatments that were the same or similar to pre-admission medications. Patients were then referred back to their primary care providers for further management.

### **Discussion**

Limitations of this scholarly project include the relatively small sample size that was used. The small size of the facility could be viewed as another limitation. The group of providers was small and homogenous. The providers were predominately physicians. There was one acute care Nurse Practitioner and one Physician Assistant in the group. Results may not be generalizable to larger, less homogeneous groups of providers.

Management of severe asymptomatic hypertension was appropriate but inconsistent among providers. An algorithm for the management of hospital hypertension with goals of treatment and preferred pharmacologic agents would facilitate consistency and provide guidance for providers. Further research and examination of current evidence are needed to expand limited resources for clinical practice guidelines and recommendations. Future studies might focus on the treatment of all types of hypertensive crises. Larger sample sizes might be used, and an examination of possible relationships between variable could be considered. Also providers could be surveyed regarding their management practices using case studies or questionnaires. Survey questions could target diagnosis, management, and care transitions for inpatients with

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elevated BP. Finally, data could be used to develop current, evidence-based clinical practice guidelines.

In conclusion, severe elevations in BP may range from benign levels which require a gradual reduction with oral agents over a 24-48 hour period to critical levels associated with target organ damage requiring emergent reduction of blood pressure with intravenous antihypertensives. Evidence does not promote the immediate lowering of blood pressure in asymptomatic patients. Few guidelines exist that specify treatment of the varied presentations of inpatient hypertension. Lack of consistent guidelines may result in suboptimal management which may result in readmission and death.

Herzog et al. (2007) proposed a novel pathway for the management of hypertension for hospitalized patients which includes an initial assessment to determine if hypertension is urgent or emergent. A thorough history and physical reveal signs and symptoms that suggest target organ damage. Patients with symptoms suggestive of organ damage need a chest x-ray and electrocardiogram to assist in excluding hypertensive emergency. Algorithms for treating all types of inpatient hypertension are critical to positive patient outcomes.

Axon, Turner & Buckley (2015) describe a practical approach to managing asymptomatic elevated blood pressure in the inpatient setting. The pathway recommends the treatment of acute conditions such as chronic kidney disease, ischemic heart disease, and congestive heart failure according to available guidelines. Patients without emergent conditions require an assessment to identify and treat incidental factors that elevate blood pressure (Axon, Turner & Buckley, 2015). According to the pathway, once emergent conditions are ruled out, other contributing factors should be addressed such as pain, nausea, withdrawal states, and rebound hypertension from medications. Providers are cautioned against overtreatment of blood pressure as long acting

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medications may not reach therapeutic levels for days or weeks. Direct communication between hospitalists and primary care providers are recommended.

These pathways are recommended as resources for the creation and adoption of current, evidence-based clinical practice guidelines and might promote consistency in management practices and provide guidance for providers.

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Figure 1:

Pak, K.J., Hu, T., Fee, C, Wang, R., Smith, M., Bazzano, L.A. (2014). Acute hypertension review and appraisal of guidelines. *The Ochner Journal*, 14, 655-663.

<b>SORT: KEY RECOMMENDATIONS FOR PRACTICE</b>		
<b>Clinical recommendation</b>	<b>Evidence rating</b>	<b>References</b>
Severe asymptomatic hypertension should be distinguished from hypertensive emergency, the classified as hypertensive urgency or severe uncontrolled hypertension	C	Flanigan & Vitberg, 2006 Marik & Varon, 2007 Shayne, 2009
In patients with severe asymptomatic hypertension, those with more cardiovascular risk factors should be evaluated and treated more aggressively than those with fewer risk factors	C	Chobanian, A.V., Bakris, G.L., Black, H.R., Cushman, W.C., Green, L.A., Izzo, J.L., Jones, D.W., Materson, B.J., Oparil, S., Wright, J.T., Rocella, E.J., The National High Blood Pressure Education Program Coordinating Committee (2003).
Initiating treatment for asymptomatic hypertension in patients previously diagnosed with hypertension is optional with appropriate follow-up. However, in patients with a systolic blood pressure of 200 mm Hg or greater, or diastolic blood pressure of 120 mm Hg or greater, oral medication should be initiated before discharge	C	Chobanian, A.V., Bakris, G.L., Black, H.R., Cushman, W.C., Green, L.A., Izzo, J.L., Jones, D.W., Materson, B.J., Oparil, S., Wright, J.T., Rocella, E.J., The National High Blood Pressure Education Program Coordinating Committee (2003). Shayne, 2009 Marik & Varon, 2007 Flanigan & Vitberg, 2006
Blood pressure should not be expected to decrease to desired levels during the initial visit for severe asymptomatic hypertension. Blood pressure should instead be reduced gradually with repeated follow-up visits.	C	Chobanian, A.V., Bakris, G.L., Black, H.R., Cushman, W.C., Green, L.A., Izzo, J.L., Jones, D.W., Materson, B.J., Oparil, S., Wright, J.T., Rocella, E.J., The National High Blood Pressure Education Program Coordinating Committee (2003). Shayne, 2009 Marik & Varon, 2007 Flanigan & Vitberg, 2006
A=consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C= consensus, disease-oriented evidence, usual practice, expert opinion, or case series.		

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Figure 2: Letter of Support



607 Beaman Street (28328), Post Office Drawer 260, Clinton, NC 28329-0260  
Telephone: (910) 592-8511, Fax (910) 590-2321

February 25, 2015

ECU Institutional Review Board

To Whom It May Concern:

We have received a request from DNP student Veronica Stevens for clinical practice at our facility. She would like to partner with our institution for a DNP scholarly project.

After review of the request we grant permission for Ms. Stevens to complete her work here. She has satisfied orientation requirements and has received clearances from our human resources department. She has assured us that sensitive information will be handled in a way that preserves patient privacy and is consistent with the policies and procedures here at Sampson Regional Medical Center. Please contact us if further information is needed regarding this letter of support.

Sincerely,

A handwritten signature in black ink, appearing to read 'Shawn Howerton', is written over a light blue horizontal line.

Shawn Howerton, MD  
CMO/CEO

Figure 3: Discharge Blood Pressures for Severe Asymptomatic Hypertension

	<b>AGE</b>	<b>DISCHARGE BP</b>	<b>JNC – 8 GOAL</b>
Patient 1	28	136/74	140/90
Patient 2	42	137/98	140/90
Patient 3	45	148/91	140/90
Patient 4	80	132/70	150/90
Patient 5	66	148/98	150/90
Patient 6	66	122/68	150/90
Patient 7	70	148/81	150/90

Figure 4: Medications and Admitting Blood Pressures

	<b>Medications</b>	<b>Admitting Blood Pressure</b>
Patient 1	• Hydralazine	170/142
Patient 2	• Amlodipine + Clonidine	186/119
Patient 3	• Hydralazine + Lisinopril + Amlodipine	161/103
Patient 4	• Hydralazine	172/101
Patient 5	• <u>Metoprolol</u> + Hydralazine	201/120
Patient 6	• Metoprolol	188/110
Patient 7	• Lasix	165/92

## Running head: INPATIENT MANAGEMENT OF ACUTE HYPERTENSION

Figure 5: Approach to non emergent elevated blood pressure in the inpatient setting  
Axon, Turner & Buckley, 2015