

MODELS AND SYSTEMS OF GERIATRIC CARE

Developing a Stroke Unit Using the Acute Care for Elders Intervention and Model of Care

Kyle R. Allen, DO,^{*†} Susan E. Hazelett, MS, RN,^{*} Robert R. Palmer, MD, MPH,[‡]
David G. Jarjoura, PhD,[†] Glenda C. Wickstrom, MD,^{*†} Jan A. Weinhardt, MSN, RN, CS,^{*}
Robert Lada, MD,^{*} Carolyn M. Holder, MSN, RN, CS,^{*} and Steven R. Counsell, MD[§]

The Acute Care for Elders (ACE) model of care is a multicomponent intervention that improves outcomes for older patients hospitalized for acute medical illnesses. Likewise, stroke units improve outcomes for patients with acute stroke, yet the descriptions of their structure and approach to stroke management are heterogeneous. The purpose of this article is to describe how implementing the ACE model of care, using a continuous quality-improvement process, can serve as a foundation for a successful stroke unit aimed at improving stroke care. The ACE intervention (a prepared environment, interdisciplinary team management, patient-centered nursing care plans, early discharge planning, and review of medical care) was amplified in a community teaching hospital for stroke-specific care by creating a stroke interdisciplinary team, evidence-based stroke orders and protocols, and a redesigned environment. Administrative data show that the ACE model can be successfully adapted to create a disease-specific program for stroke patients, having the potential to improve the process of care and clinical stroke outcomes. *J Am Geriatr Soc* 51:1-8, 2003.

Key words: aged; hospital care; stroke unit; stroke; interdisciplinary team

Stroke is the leading cause of chronic disability and the third most common cause of death in the United States.¹ Seventy-five percent of all strokes occur in persons aged 65

From the ^{*}Division of Geriatric Medicine, Department of Medicine, Summa Health System, Akron, Ohio; [†]North-eastern Ohio Universities College of Medicine, Rootstown, Ohio; [‡]Section of Geriatric Medicine, The Cleveland Clinic Foundation, Cleveland, Ohio; and [§]Division of General Internal Medicine and Geriatrics, Indiana University School of Medicine, Indianapolis, Indiana.

This work was supported in part by the Summa Health System Foundation and Summa Health System Health Services Research and Education Institute. This work was presented in part at the 1998 and 2000 Annual Meetings of the American Geriatrics Society.

Address correspondence to Kyle R. Allen, DO, 75 Arch Street, Suite 301, Akron, OH 44304. E-mail: allenk@summa-health.org

and older.^{2,3} Technological advances in acute stroke treatment continue to evolve rapidly, but there are barriers that prevent adequate use of the new technologies, especially in the elderly population.^{4,5} Thus, innovative hospital-based interventions are needed to optimize outcomes and gain recovery for older stroke patients.

LITERATURE REVIEW

Acute care for elders (ACE) units and acute stroke units (SUs) have improved the clinical outcomes of hospitalization.⁶⁻¹⁰ ACE units improve older patients' functional status at discharge and reduce rates of discharge to nursing homes.^{6,10} SUs have been found to decrease mortality, length of stay (LOS), functional dependency, and institutionalization and increase discharge to home and quality of life compared with stroke care provided on general medical floors.¹¹ The organizational processes and components of a SU are vaguely described in the literature.¹¹ Indeed, heterogeneity in the description and organization of the different units reported in the literature hampered a systematic review and meta-analysis of SUs.¹¹ Additionally, there is no consensus regarding the essential elements that define a SU, making it difficult to generalize about the benefits of SU care.

Parallels between ACE units and SU in organization and process are not surprising because both models seek to improve functional outcomes of hospitalized individuals with complex medical and functional problems.⁶⁻¹¹ Moreover, stroke and its common complications can leave hospitalized older adults vulnerable to negative outcomes because of their diminished functional and physiological reserves.^{4,5,12} Thus, many of the key components of an ACE unit as described elsewhere are appropriate for the design of a SU.⁸ These include the creation of a prepared environment, use of patient-centered care, incorporation of nursing care plans for rehabilitation and prevention of disability, interdisciplinary team (IT) management, early planning for discharge home, and review of medical care to prevent iatrogenic illness. This paper provides a description of how a continuous-quality-improvement (CQI) methodology was used to implement a SU, using the ACE intervention as an organizational model.

Process of Implementing the SU Intervention

The SU at Summa Health System (SHS) Hospitals in Akron, Ohio, incorporates a biopsychosocial approach based upon ACE rather than the biomedical model entrenched in modern hospital care.^{4,5,7–9,12,13} The CQI methodology developed for ACE unit implementation^{7–9,13–15} and adapted for this SU is outlined below in the conceptual model's components: agree, build, commence, document, evaluate, and feedback.^{8,13} Each component is a sequential step in the process of organizing a clinical interdisciplinary team and creating a specialized environment for effective hospital care for older adults, including those with complex medical and neurological disease. These steps were followed in creating the SU at SHS.

Agree

This step involves identifying major stakeholders (e.g. administrators, department chairs, physicians, nursing administrators, and community advocates including stroke survivors and caregivers) and gaining their commitment to improve stroke care. Stakeholders should see the value of acute stroke care and secondary prevention delivered by a stroke interdisciplinary team within a SU. At SHS, the support for the SU was achieved in part because the stakeholders were aware of the prior success of the ACE Unit.¹⁰

Build

The build phase includes creation of the interdisciplinary team, development of SU protocols and an appropriate design of the SU. The SU interdisciplinary team process began at SHS as a Stroke Unit Clinical Focus Group (SUCFG) including nurses who would staff the new SU; clinical nurse specialists (CNSs); social workers; physical, occupational, and speech therapists; dietitians; pharmacists; and physician leaders (Table 1). The SUCFG met weekly for 3 months to develop the detailed protocols for the unit.

The SUCFG's purpose was to ensure that protocols were developed based on best available scientific evidence and that the full spectrum of patients' biopsychosocial needs were addressed. Literature reviews and input from local, regional, and national experts across specialties guided protocol creation.^{16–19} Protocols and guidelines, tailored to meet local and institutional characteristics of stroke care, received departmental approval from internal medicine and family medicine before implementation. Departments of medicine and nursing and residency training programs received in-service education regarding the new protocols' rationale; periodic reviews reinforced initial training in protocol use.

A geographically defined location was chosen for the SU. Originally, this had been a medical-surgery unit predominantly for neurology and neurosurgery patients. Thus, existing nursing staff had baseline familiarity with neurological disorders. Debate revolved around whether the unit should be specialized for neuro-intensive care or monitored beds, but after literature review and consensus it was decided to create a general, or noncritical care, SU and to continue to provide critical care services in a separate ICU area adjacent to the SU.^{16–19} Renovation costs were offset by philanthropic gifts for SU renovation.

Commence

The commence stage of the CQI process involves engaging the IT in daily team rounds and implementing SU protocols (discussed below).

Document

Problem areas of inefficiency or ineffectiveness are documented, for example, through chart audits and input of IT members. Documentation enhances evaluation of the SU and is used to provide feedback to the staff and team members.

Evaluate

The hospital administrative database provides a source of information to compare outcomes before and after SU establishment. Medicare data can also be obtained from, for instance, state hospital associations and hospital and healthcare rating companies and used for trend analysis of the process of care variables (e.g., LOS, diagnosis codes), population demographics, comorbidities, and stroke-specific inpatient mortality.

Feedback

Feedback to the stroke team identifies successes and shortcomings of the SU and suggests changes in care delivery. Feedback also enables hospital administrators to demonstrate progress and improved outcomes to the hospital board and community.

SETTING

SHS, affiliated with the North-eastern Ohio Universities College of Medicine, is a 1,300-bed nonprofit integrated healthcare system with three community teaching hospitals. Akron City Hospital is the 550-bed main campus hospital, location of the 31-bed SU. There are approximately 1,000 SHS discharges per year of patients who have suffered hemorrhagic or ischemic stroke or transient ischemic attack (TIA). The ACE unit¹⁰ serves as backup when the SU is full. Average age on the SU is 72; 58% are female, and about 14% are minorities. The predominant payer is Medicare (75% of payer mix (Medicare Health Maintenance Organization accounting for 18%)), with managed care paying 13%, Medicaid 7%, and commercial 5%.

SU staffing is no different from that of other general medical-surgical units, with the exception of a SU CNS and a geriatrician who serves as the SU interdisciplinary team medical director. The geriatrician medical director spent approximately 16 to 20 hours per week during the initial phase (Year 1) and was involved in the development, quality improvement, development of processes and protocols, evaluation and feedback to the stakeholders, team rounds, and administration. Subsequently, time commitment was only about 5 to 10 hours per week. The CNS spent about 34 hours per week (0.85 FTE) on development, implementation, documentation, evaluation, and frequent feedback to team and stakeholders during this initial phase. After the first year, the CNS time was 28 hours per week (0.7 FTE) to SU care and team management and the remaining time to stroke program planning and coordination for Summa's Center for Stroke Care, a multifaceted program for enhancing stroke care in the community and the health system.

Table 1. Stroke Unit Team Members Roles and Responsibilities

Role	Responsibilities
Medical director:	Conduct medical review of chart and medications; address significant or potential medical care problems.
Geriatrician	Assist in formulating team suggestions; communicate with primary care physician (PCP) and specialists. Provide medical direction and leadership for the interdisciplinary team. Provide education to the team regarding stroke care, clinical issues, and improving hospital outcomes.
Neurologist/neurosurgeon	Serve as primary consultant for emergency department patients with stroke/transient ischemic attack. Coordinate acute care for stroke; with primary/attending, determine appropriateness of aggressive intervention; implement interventions as indicated. Participate in interdisciplinary rounds when possible.
PCP	Coordinate overall medical management of patient. Participate in interdisciplinary rounds when possible.
Clinical nurse specialist: Master's prepared; certification in gerontological nursing or neurology	Guide and foster development of cohesive interdisciplinary team. Function as resource nurse; assist primary nurse in managing complex patients, clinical care issues. Serve as case manager to facilitate communication and integration among interdisciplinary team members (including PCP, specialists) to deliver high-quality patient-centered care. Organize and lead daily interdisciplinary team rounds. Provide staff education and National Institutes of Health (NIH) Stroke Scale certification. Provide ongoing education to staff on clinical care issues for stroke and older hospitalized adults. Perform assessments on targeted complex cases (e.g., mental status testing, depression screens, functional assessment).
Patient care coordinator: Registered nurse	Coordinate discharge plan as targeted by the interdisciplinary team. Facilitate referrals to appropriate resources (therapies, wound care, etc.) based on initial assessment. Assure that physician-ordered tests and procedures are planned and implemented in efficient, patient-centered manner.
Nursing: Registered nurses certified in the NIH Stroke Scale	Conduct Barthel and Modified Rankin Scales to determine patient's baseline function; assess for physical and occupational therapy needs. Conduct NIH Stroke Scale assessment daily to evaluate progression/improvement of stroke deficit. Provide stroke education to patients/families. Implement stroke plan of care.
Physical therapy: Licensed, registered physical therapist	Communicate team suggestions with appropriate physician. Evaluate, treat patients for ambulation, bed mobility, transfers, and gait. Work with large muscle groups to maintain or restore function, mobility. Determine patient's in-hospital physical therapy goals; recommend level of continued physical therapy in appropriate setting (skilled nursing facility (SNF) vs rehabilitation vs home physical therapy, etc.). Identify and address safety concerns with respect to mobility and transfers.
Occupational therapy: Licensed, registered occupational therapist	Evaluate and treat patient's functional abilities for self-care skills with goal of maximizing independence in skills (bathing, dressing, toileting, feeding). Assess visual, cognitive skills; provide compensatory strategies for safe, independent functioning. Assess occupational needs; provide maximizing skills. Determine patient's in-hospital occupational therapy goals; recommend level of continued occupational therapy in appropriate setting (SNF vs rehabilitation vs home occupational therapy, etc.).
Speech therapy: Licensed, registered speech pathologist	Evaluate and treat dysphagia; assess for signs of aspiration. Assess speech/language, cognition, memory recall, and thought coordination. Provide patient/family education. Provide recommendations for appropriate texture/consistency of food.

(continued)

Table 1. (Continued)

Role	Responsibilities
Nutrition services: Registered dietitian	Evaluate need for cookie swallow (video fluoroscopic dysphagia study) or short/long-term alternate nutrition (feeding tubes). Use speech pathology assessment to identify special nutritional needs of patients. Provide medical nutrition therapy (includes assessment of abnormal lab markers, weight changes, drug/nutrient interactions, conditions requiring dietary modification (e.g., cardiac, renal, diabetic mellitus)) for patients at high risk of malnutrition. Provide nutrition education as appropriate.
Social work: Licensed social worker, minimum; bachelor of arts in social work	Coordinate discharge plan as targeted by the interdisciplinary team (i.e., new nursing facility placements, acute rehabilitation, group home, assisted living). Initiate advanced directives, guardianship as appropriate. Initiate community supports, referrals as appropriate (e.g., community-based long-term care and Medicaid waiver case management services, Adult Protective Services, Lifeline, Mobile Meals).
Pharmacy: Licensed, registered pharmacist	*Assess for drug/drug interactions, food/drug interactions. Assess for polypharmacy and make appropriate suggestions. Assess for high-risk drugs that may impair cognition or function in older adults. Provide education as needed to promote medication compliance. Function as resource to nurses in clarifying dosages, drug uses, administration, etc. Provide education to all patients currently on or newly prescribed warfarin. Interface with attending physicians via notes/direct communication to improve drug prescribing and to avoid potential adverse drug interactions. Assess lab values that affect drug absorption/excretion; make recommendations as needed.
Pastoral care: Trained volunteer chaplains	Minister to spiritual, religious needs of patients and families, regardless of faith, tradition, or denomination; provide emotional supports, prayer, or spiritual counseling. Support Stroke Unit team, nursing staff via education and/or reflective listening for difficult cases or issues.

SU Intervention and Protocols

All patients who present to the emergency department with stroke symptoms undergo a “brain attack” protocol to ensure initiation of appropriate treatments.^{16–19} All patients who receive invasive procedures or thrombolytics for acute stroke are admitted to the critical care unit located on the same floor as the SU and transferred to the SU when stable. After patients arrive on the SU they are admitted to primary care or stroke neurology with standard orders for stroke or TIA management (Figure 1).

Admission Stroke/TIA Care Orders

Admission stroke/TIA care orders include:

- mandatory comanagement of patients by their primary care physician and a stroke neurologist
- laboratory tests for lipids, serum chemistries, electrocardiogram, hemogram, stool for occult blood if heparin is used, micro blood sugar twice daily for 2 days
- diagnostic testing alternatives (e.g. magnetic resonance imaging, computed tomography, echocardiogram)
- blood pressure treatment parameters and guidelines with available medication dosage guidelines and alternatives

- standardized antiplatelet/anticoagulation therapy
- no use of sedatives or narcotics unless approved by a neurologist
- standardized deep venous thrombosis prophylaxis treatments

Patients undergo a thorough assessment by SU nurses that includes the National Institute of Health Stroke Scale (NIHSS),²⁰ for which all SU nurses are certified. The primary nurse presents new patients to the stroke team during daily IT stroke rounds. A new patient presentation requires 5 to 10 minutes and encompasses the chief complaint/reason for admission, past medical history, past and current medications, functional status before admission, current functional/neurological status as measured by the NIHSS,²⁰ Barthel Index,²¹ and Modified Rankin Score.²²

After presentation, the IT makes suggestions concerning assessment findings, medication issues, and addressing needs for therapy, psychosocial support, and potential postdischarge care. Suggestions are conveyed to the neurologist and primary care physician via the Stroke Unit Interdisciplinary Team Suggestion Sheet, which is promi-

Date Time **BLACK BOXES MANDATORY ON ALL PATIENTS, CHECK ANY OTHER BOXES THAT APPLY, ADD ADDITIONAL INFORMATION AS APPROPRIATE.**

1. Admit/Transfer to: Stroke Unit Telemetry _____
 Admit to the service of Dr. _____
 Consult Primary Care Physician (unless PCP is admitting physician) Dr. _____
 Consult Stroke Neurologist (unless neurologist is admitting physician) Dr. _____
 Obtain old records

2. Preliminary Diagnosis: _____ Ischemic Stroke

3. Diet: NPO except dysphagia screen and/or evaluation
 Advance diet/texture/consistency per Speech Therapy recommendation
 Diet Type: _____

4. Activity: Up with assistance _____

5. Therapy:
 Speech Therapy for dysphagia, speech/language, & cognition screen. Evaluate & treat positive screen.
 Speech Therapy for speech/language and cognition screen. Evaluate and treat positive screen.
 Occupational Therapy evaluation/treatment. Physical Therapy evaluation/treatment.

6. Nursing:
 Barthel Index and Modified Rankin scores on admission and prior to discharge
 Physical and/or Occupational Therapy evaluation/treatment if Barthel Index < 100
 NIH stroke scale daily **and prn with acute changes.** Notify BAT for acute changes
 Vital Signs and Neuro checks q2h x 12 hours, then q shift if stable
 Notify physician if systolic BP >210 or <100 OR
 (Specify vs): _____
 Notify physician if diastolic BP >115 OR
 (Specify vs): _____
 Strict I&O Weight on admission

7. Respiratory:
 O₂ @ _____ L/min to keep SpO₂ = 92%. Monitor SpO₂ q 8 h prn while on V O₂

8. Diagnostics:
 Basic Metabolic Panel Hemogram Lipid Profile
 Stool for occult blood daily **if on any heparin therapy.**
 Micro blood sugar at 6 a.m. and 4 p.m. daily x 2. Notify physician if MBS* is = _____ or = _____ .
 12-lead Electrocardiogram
 Transcranial Doppler (Physician to read _____)
 Carotid Doppler (Physician to read _____)
 Electroencephalogram (Physician to read _____)
 Computerized Tomography scan of head
 Magnetic Resonance Imaging of brain
 Magnetic Resonance Angiography of Circle of Willis with gadolinium contrast
 Magnetic Resonance Angiography of common carotid arteries
 2D Echocardiogram with Doppler, R/O:

9. IV Fluids:
 IV ½ Normal Saline at _____ ml/hr Prn lock

10. DVT Prophylaxis:
 Heparin 5,000 Units SQ every 12 hours if weight is <200 lbs. **or** every 8 hours if weight is >200 lbs.
(If not on heparin protocol or low molecular weight heparin)
 Pneumatic Calf Compressors

11. Medications:
 No narcotics or sedatives unless cleared by Stroke Neurologist
 Dalteparin 100 Units per kilogram (maximum 10,000 Units) SQ every 12 hours
 Heparin per protocol. **Do not give bolus.**
 Warfarin (Coumadin) _____ mg po. Daily dose to be called by physician.
 Aspirin 325 mg po daily
 OR Dipyridamole/Aspirin (Aggrenox) extended release 1 po bid
 Clopidogrel (Plavix) 75 mg po daily

Physician's Signature:

Figure 1. Admission stroke care orders. NPO = nothing by mouth; NIH = National Institutes of Health; prn = as needed; SpO₂ = blood oxygen saturation; BAT = brain attack team; MBS = micro blood sugars; IV = intravenous; SQ = subcutaneous; DVT = deep vein thrombosis; PO = by mouth; Neuro = neurologist; BP = blood pressure; I & O = intake and output; 2D = two dimensional; R/O = rule out; bid = twice daily.

nently displayed on the patient's chart. The team prepares a preliminary discharge plan and selects a target discharge date. The CNS further evaluates complex cases and monitors execution of the care plan.

Stroke Care Tools

Standardized protocols were developed in a similar manner by researching the literature; obtaining input from IT members; gaining input and acceptance by medical staff and nursing departments; providing in-service education to nursing, medical, and house staff; and broadly communicating use of protocols at the time of their implementation. Feedback was solicited often and revisions made, especially during the first months of use.

Dysphagia Admission Screen

Aspiration pneumonia is one of the most common and lethal complications of stroke.^{23,24} Thus, in collaboration with the IT and stroke neurologists, speech therapists devised a screening protocol for aspiration risk that is administered to all stroke patients within 24 hours of admission. Until screened, patients receive nothing by mouth (NPO). Based upon assessment, decisions may be made to change the patient's diet texture, continue NPO, implement oral feeding alternatives, or evaluate further using video fluoroscopic dysphagia studies. Use of the dysphagia screening protocol for patients with TIAs is decided on a case-by-case basis. SU nurses receive education to monitor for dysphagia risk and apply appropriate interventions.

National Institutes of Health Stroke Scale

The nursing staff received education and certification in use of the NIHSS, a stroke severity measure validated for use by nonneurologists.²⁰

Barthel Index and Modified Rankin Scales

Standing orders specify the frequency of assessment for the Barthel Index²¹ and Modified Rankin Scales,²² which are measures of function and stroke severity. Physical and occupational therapy are automatically consulted for evaluation and treatment based upon outcomes of these measures.

Blood Pressure Management Guidelines

Peristroke blood pressure management is a controversial quality issue.¹⁷⁻¹⁹ Guidelines were circulated to medical and nursing staff, presented at house staff meetings, and posted near SU patient charts. Nursing staff received the same information as physicians, along with a challenge to remind physicians not to overtreat blood pressure.

Deep Venous Thromboembolism Prevention Guidelines

Guidelines developed to diagnose, treat, and prevent deep venous thromboembolism were circulated to the medical staff and posted near SU patient charts. These include descriptions of the most-appropriate prophylaxis to be used for various clinical settings and patient conditions.^{17,18}

Antiplatelet/Anticoagulation Guidelines

Similar to guideline development described above, an evidence-based approach was taken for antiplatelet use.²⁵ Also, the SU pharmacist routinely educates patients and families when warfarin anticoagulation is prescribed.

Patient Education Materials

The SU interdisciplinary team identified needs of patients and families for stroke knowledge. Educational topics include the importance of recognizing stroke warning symptoms and signs as an emergency and accessing emergency medical services if symptoms occur.²⁶ A 15-minute video, viewable any time during the hospital stay, addresses recognizing stroke warning signs and need for emergency intervention. A Stroke Care Pathway* booklet explains common tests and procedures that patients may expect during hospitalization. A Stroke Awareness sheet is given to each patient with discharge instructions to reinforce this information. Emphasis is given to educating patients about how to reduce their risk of subsequent stroke through modification of their risk factors (hypertension, diabetes mellitus, and hyperlipidemia) and lifestyle habits (smoking cessation, exercise, and limiting alcohol use).

Assuring Successful SU Implementation

Several methods were used to document progress in implementing SU protocols. A patient log, maintained by the CNS, captured information on nurses' use of stroke-care standing orders, number and type of team suggestions made and implemented, and types of therapy services used (such as dysphagia screens). A team-rounds attendance record tracked individuals' participation in patient evaluations. Audits were developed to monitor nurses' completion of the Barthel Index, Rankin Scale, and NIHSS scale; use of nursing protocols; and team suggestion implementation.

Over the course of the first 12 months of SU implementation the above-described patient logs, attendance sheets, and chart audits were used as process measures and the hospital administrative database was analyzed to assess progress with the implementation of the process of care on the SU. Providing this evaluative feedback to the SU team and staff enhanced compliance with stroke protocols.

OUTCOMES

The hospital's administrative and Medicare databases provided information to evaluate the SU. These data sources helped to evaluate trends in the process of care and quality outcomes, but in the initial period, it was helpful to look at a pre- and postcomparison to account for any major factors that could affect the data (e.g., change in populations, demographics, acuity, payer changes). Administrative data collected in 1996 were compared with 1997, the year after the creation of the SU (Table 2). Patients included in the analysis had principal diagnostic codes for ischemic stroke and TIA, excluding hemorrhagic stroke, based on stroke specific codes of the *International Classification of Diseases, Ninth Revision, Clinical Modification*.²⁷ Patients before and after SU creation had similar average age (72 years) and sex (58% female). Patients post-SU had a shorter average LOS than those pre-SU (4.6 days

Table 2. Comparison of Stroke and TIA Patient Outcomes: Pre-Stroke Unit (SU) (1996) versus Post-SU (1997) Using ICD-9 Diagnostic Codes for Ischemic Stroke and TIA

Demographic	One Year Pre-SU (n = 622)	One Year Post-SU (n = 544)	P-value
Age	72	72	1.000
Female, %	58	58	1.000
Pneumonia, n (%)			.68 [§]
Aspiration pneumonia	21 (3)	16 (3)	
Other pneumonia	7 (1)	9 (2)	
No pneumonia	594 (96)	519 (95)	
Deaths (in hospital), n (%)	16 (3)	7 (1)	.11 [§]
Length of stay, days, mean	4.6	3.8	<.0001 [¶]
Discharge Destination, n (%)			<.0001 [#]
Nursing home	97 (15)	61 (11)	
Rehabilitation	89 (14)	91 (15)	
Home health	32 (5)	56 (10)	
Other	83 (15)	9 (2)	
Home*	313 (50)	335 (62)	
Readmissions, n (%)			<.0001 ^{**}
= 10 days	30 (5)	37 (7)	
11–30 days [†]	61 (10)	37 (7)	
> 30 days < 1 year	416 (67)	248 (46)	
None (during 1 year) [‡]	115 (18)	222 (41)	

Note: International Classification of Diseases, Ninth Revision (ICD-9)³⁸ principal diagnostic codes for ischemic stroke and transient ischemic attack (i.e., 433.*, 434.*, 435.*, 436.*) and excluded hemorrhagic codes.

* For the simple two-category comparison of discharge to home versus the other four categories ($\chi^2 df = 1$), the post-SU was significantly superior ($P < .001$).

† For the simple comparison of <30 day versus >30 day or none ($\chi^2 df = 1$), post-SU was not significantly superior.

‡ For the simple comparison of no readmission versus readmission within 1 year ($\chi^2 df = 1$), post-SU was significantly superior ($P < .0001$).

§ P-value based on chi-square test with $df = 2$.

¶ P-value based on chi-square test with $df = 1$.

P-value based on Student *t* test.

** P-value based on chi-square test with $df = 4$.

** P-value based on chi-square test with $df = 3$.

pre-SU vs 3.8 days post-SU; $P < 0.0001$) and were more often discharged home (50% pre-SU vs 62% post-SU; $P < 0.0001$) and less often readmitted during the following year (82% pre-SU and 59% post-SU; $P < 0.0001$). Hemorrhagic strokes were omitted from these initial evaluations because of delays in developing and implementing hemorrhagic stroke protocols.

SHS obtained the Medicare database through its relationship with the Ohio Hospital Association and through Healthgrades.com, a healthcare and hospital quality-rating company. SHS Medicare stroke-specific inpatient mortality rates were determined for 1995–2000. The rate pre-SU (1995–96) was 11.4% and post-SU (1997–2000) 8.4%. This difference was significant ($P = .02$) and showed a favorable downward trend in inpatient stroke mortality over the SU implementation period.

These trends are important in light of the increase in the average age and acuity of the patients during the 3 years post-SU. Thrombolytic use (2–3% use for ischemic stroke at SHS) and acute stroke interventions have changed little over this period. Furthermore, LOS was shorter in the post-SU period despite changes in the Medicare Prospective Payment System that may have discouraged early transfer of stroke patients to other institutional posthospital facilities (e.g., skilled nursing units, acute rehabilitation). Surveys of nurses' perceptions of the unit pre- and post-SU implementation showed increased job satisfaction and a sense of pride associated with working on the SU. Post-SU

surveys have been above average for patient and family satisfaction with SU hospital and nursing care.

FUTURE DIRECTIONS

SU care improves survival and functional outcomes for patients with acute stroke treated in acute SU compared with those treated in general wards, as documented by the meta-analyses of 19 randomized trials.¹¹ Randomized trials for SU using an ACE model have not been conducted. Studies are needed to identify the elements of SU and ACE operations and processes that make a difference in patient care outcomes.²⁸

Many of the benefits of a comprehensive SU plan of care may be lost once a patient is discharged from the SU. Although the staff on the SU emphasized secondary prevention through education and an organized approach to discharge planning, it was found that patients readmitted for stroke often failed to treat their symptoms as an emergency and that their secondary prevention targets were not optimally controlled. Thus, a pilot study was undertaken involving 96 stroke patients randomized to receive a care management intervention to improve poststroke recovery and secondary stroke prevention or usual poststroke care. The intervention provided a poststroke care manager who focused on linking the SU plan of care to subsequent outpatient care and providing education to patients and caregivers on how to optimize stroke recovery

and secondary prevention. The initial results were in favor of the intervention group compared with the usual poststroke care for improving secondary prevention and stroke knowledge and decreasing poststroke complications.²⁹ A larger funded trial is in progress.

The cost-effectiveness of SU care remains to be determined. Analysis of two ACE units has estimated that hospital costs were not increased because of savings from LOS reductions that offset the CNS and medical director costs.^{10,30}

CONCLUSION

A SU was implemented using a CQI methodology as established for ACE units achieved with the “ABC” process of implementation.^{7,13} The ACE model offers a practical and effective foundation that is transportable to a SU, but studies are needed to evaluate the effectiveness of this SU model in community hospitals, especially where new stroke technologies may not be available and where this model may offer a more practical means of improving stroke outcomes for an increasing population of older adults.

Copies of Stroke Tools, Stroke Education Materials, and Stroke Unit Interdisciplinary Team Suggestions are available from author upon request.

ACKNOWLEDGMENTS

The authors wish to express appreciation to Don Jackovitz, Trish Enos, and Luise Potter (Quality Review Management, SHS) for assistance in obtaining administrative data and to Judy Agner, Michele Gareri, Sally Nash, and the SHS medical library staff for support in preparing this manuscript.

The authors wish to acknowledge the Stroke Steering Committee, the staff of Akron City Hospital's Stroke Unit, and the IT members for their dedication and commitment to make this project successful.

REFERENCES

- Sacco R, Benjamin E, Broderick J et al. Risk factors. *Stroke* 1997;28:1507–1517.
- National Center for Health Statistics. Advanced Report of the Final Mortality Statistics (PHS Publication no. 93–1120). 1993;42(Suppl.):62.
- American Heart Association. 2001 Heart and Stroke Statistical Update. Dallas, TX: American Heart Association, 2000.
- Wolinsky F, Gurney J, Wan G et al. The sequelae of hospitalization for ischemic stroke among older adults. *J Am Geriatr Soc* 1998;46:577–582.
- Kaste M, Palmakih, Sarna S. Where and how should elderly stroke patients be treated? A randomized controlled trial. *Stroke* 1995;26:249–253.
- Landefeld C, Palmer R, Kresevic D et al. A randomized trial of care in a hospital medical unit especially designed to improve the functional outcomes of acutely ill older patients. *N Engl J Med* 1995;332:1338–1344.
- Palmer R, Counsell S, Landefeld C. Clinical intervention trials: The ACE unit. *Clin Geriatr Med* 1998;14:831–849.
- Palmer R, Landefeld C, Kresevic D et al. A medical unit for the acute care of the elderly. *J Am Geriatr Soc* 1994;42:545–552.
- Kresevic D, Holder C. Interdisciplinary Care. *Clin Geriatr Med* 1998;14:787–798.
- Counsell S, Holder C, Liebenauer L et al. Effects of a multi-component intervention on functional outcomes and process of care in hospitalized older patients: A randomized controlled trial of acute care for elders (ACE) in a community hospital. *J Am Geriatr Soc* 2000;48:1572–1581.
- Stroke Unit Trialists' Collaboration. Collaborative systematic review of the randomized trials of organized inpatient (stroke unit) care after stroke. *BMJ* 1997;314:1151–1159.
- Sager M, Rudberg M. Functional decline associated with hospitalization for acute illness. *Clin Geriatr Med* 1998;14:669–679.
- Covinsky K, Palmer R, Kresevic D et al. Improving functional outcomes in older patients: Lessons from an acute care for elders unit. *Jt Comm J Qual Improv* 1998;24:63–67.
- Kresevic DM, Counsell SR et al. A patient-centered model of acute care of elders. *Nurs Clin North Am* 1998;33:515–527.
- Counsell S, Holder C, Liebenauer L et al. The ACE Manual. Meeting the Challenge of Providing Quality and Cost-Effective Hospital Care to Older Adults. Akron, OH: Summa Health System, 1998.
- Alberts M, Hademenos G, Latchaw R et al. Recommendations for the establishment of primary stroke centers. *JAMA* 2000;283:3102–3109.
- Adams HP Jr, Brott TG, Crowell RM et al. Guidelines for the management of patients with acute ischemic stroke. A statement for healthcare professionals from a special writing group of the Stroke Council, American Heart Association. *Circulation* 1994;90:1588–1601.
- Smucker WD, Disabato JA, Krishen AE. Systematic approach to the diagnosis and initial management of stroke. *Am Fam Physician* 1995;52:225–234.
- Brott T, Reed RL. Intensive care for acute stroke in the community hospital setting. The first 24 hours. *Stroke* 1989;20:694–697.
- Goldstein L, Samsa G. Reliability of the National Institutes of Health stroke scale extension to non-neurologists in the context of a clinical trial. *Stroke* 1997;28:307–310.
- Mahoney F, Barthel D. Functional evaluation: The Barthel Index. *Md Med J* 1965;14:61–65.
- Rankin L. Cerebral vascular accidents in patients over the age of 60. *Scott Med J* 1957;2:200–215.
- Agency for Health Care Policy and Research. Diagnosis and treatment of swallowing disorders (dysphagia) in acute-care stroke patients. Summary, Evidence Report/Technology Assessment: Number 8, March 1999. [on-line] Agency for Health Care Policy and Research, Rockville, MD. Available at <http://www.ahcpr.gov/clinic/dysphsum.htm> Accessed 2001.
- Odderson IR, Keaton JC, McKenna BS. Swallow management in patients on an acute stroke pathway: Quality is cost effective. *Arch Phys Med Rehabil* 1995;76:1130–1133.
- Antiplatelet Trialists Collaboration. Collaborative review of randomized trials of antiplatelet therapy-I: Prevention of death, myocardial infarction, and stroke by prolonged antiplatelet therapy in various categories of patients. *BMJ* 1994;8:81–106.
- Pancioli A, Broderick J, Kothari R et al. Public perception of stroke warning signs and knowledge of potential risk factors. *JAMA* 1998; 279:1288–1292.
- International Classification of Diseases, 9th Revision, Clinical Modifications, 6th Ed., Vols. 1, 2, and 3. Los Angeles: Practice Management Information Corporation, 2000.
- Indredavik B, Bakke RPT, Slordahl SA et al. Treatment in a combined acute and rehabilitation stroke unit: Which aspects are most important? *Stroke* 1999;30:917–923.
- Allen K, Hazelett S, Jarjoura D et al. Effectiveness of a post-discharge care management model for stroke and transient ischemic attack: A randomized trial. *J Stroke Cerebrovasc Dis* 2002;11:88–98.
- Covinsky K, King J, Quinn L et al. Do acute care for elders units increase hospital costs? A cost analysis using the hospital perspective. *J Am Geriatr Soc* 1997;45:729–734.



Author Query Form

Journal **JGS**

Article **51521**

1. Disk Usage :-

Disk not provided

Disk used

Additional Work done:

Disk not used

Disk is corrupt

Unknown file format

Virus found

2. Queries :-

While preparing this paper/manuscript for typesetting, the following queries have arisen.

Query No.	Description	Author Response
Q1	AQ: Foot note link () not provided in the table body please check.	