Published in final edited form as:

Am J Phys Med Rehabil. 2008 August ; 87(8): 637–641. doi:10.1097/PHM.0b013e31816ddf2f.

Do Clinical Rehabilitation Education Programs Really Improve Stroke-Related Knowledge?

Elizabeth R. Skidmore, PhD, OTR/L^{1,*}, Kris L. Koenig, M.B.A.², Michael C. Munin, M.D.³, Ellen M. Whyte, M.D.², Lynn O'Donnell, RN, CRRN⁴, Louis Penrod, M.D.³, and Eric J. Lenze, M.D.^{2,3}

¹Department of Occupational Therapy, School of Rehabilitation Sciences, University of Pittsburgh

²Department of Psychiatry, University of Pittsburgh School of Medicine

³Department of Physical Medicine & Rehabilitation, University of Pittsburgh School of Medicine

⁴University of Pittsburgh Medical Center Institute for Rehabilitation and Research, Pittsburgh, PA

Abstract

Objective—We evaluated the effectiveness of a clinical stroke education program for improving stroke-related health knowledge after inpatient rehabilitation in a “real world” setting.

Design—Thirty-four patients participated in an inpatient rehabilitation clinical stroke education program. Their stroke-related health knowledge in three key domains -- risk factors, warning signs, and appropriate actions to take if a stroke is suspected -- was evaluated at admission and 12 weeks later using a single-group pretest-posttest design. Pretest and posttest comparisons were conducted using Marginal Homogeneity and McNemar's Tests.

Results—Small non-significant improvements in stroke-related health knowledge were detected at posttest. Twelve weeks after the education program, 29% of participants were unable to name a single risk factor, 32% were unable to name a single warning sign, and 29% were unable to name appropriate emergency action in the event they suspected a stroke.

Conclusions—A substantial proportion of patients who completed our clinical stroke education program continued to have poor stroke-related health knowledge. We noted several limitations in our program that may have contributed to this outcome. Changes may be useful for improving the success of clinical stroke education programs, thereby reducing knowledge deficits.

Keywords

Stroke; Rehabilitation; Patient Education; Program Evaluation

Background

Ischemic stroke survivors are at high risk for a recurrent stroke. Thirteen percent of men and 22% of women ages 40 – 69 sustain an additional stroke within 5 years of the first one, and these rates increase after the age of 70.¹ Because many risk factors for stroke are modifiable (e.g., management of hypertension, smoking cessation), patient education is important to prevent recurrence. Additionally, severity of recurrent strokes can be reduced by prompt medical attention, which requires that patients know warning signs of stroke and the correct

*Address correspondence to Dr. Skidmore, 5012 Forbes Tower, Pittsburgh, PA 15260; telephone (412) 383-6617, fax (412)383-6613, skidmore@pitt.edu.

action to take if these warning signs occur (call 911 or go to an emergency room immediately).²

Previous studies have demonstrated that individuals in the general population, including individuals who have sustained stroke, have low levels of knowledge in these areas.^{2–12} Consistent with these findings, the Commission on Accreditation of Rehabilitation Facilities requires that accredited stroke specialty programs provide inpatient clinical education programs that focus on recurrence prevention.¹³ In order to ensure that these programs are in fact improving knowledge of risk factors, warning signs and emergency response to signs of stroke, it seems imperative that the effectiveness of such programs ought to be examined. While previous research has shown that interactive educational sessions provided during inpatient rehabilitation is efficacious at improving stroke-related health knowledge,¹⁴ this study was conducted almost 20 years ago. It is unknown whether these results can be duplicated in the current clinical environment of stroke rehabilitation. Accordingly, we sought to determine whether an inpatient rehabilitation clinical education program, consisting of didactic training, was effective in improving relevant knowledge.

Methods

The present study was a single-group pretest-posttest design conducted as part of a clinical quality assurance project and was conducted in accordance with the ethical standards of the Institutional Review Board. Patients consecutively admitted to an inpatient rehabilitation hospital with diagnosis of ischemic stroke (within the prior 30 days) were recruited between October 2003 and March 2005. Participants who consented and who demonstrated an absence of severe aphasia or cognitive impairment (i.e., able to answer questions reliably) were interviewed by a trained research associate with health interview and education expertise who developed and validated the interview. Interviews were conducted in the hospital upon admission to the study and by telephone 12 weeks later. The timing for the follow-up interviews was selected to represent an optimal time span to assess knowledge retention without risk of loss to follow-up.

Participants were asked about three key domains of stroke-related health knowledge in each interview. First, they were asked to name as many risk factors for stroke as they could; second, they were asked to name as many warning signs for stroke as they could; third, they were asked what they would do first if they thought they or someone else were having a stroke. The questions were worded based on a module in the Behavioral Risk Factor Survey used by Reeves et al.⁹ Participants were prompted to give complete answers. Information provided by the American Heart Association¹⁵ was used to determine whether or not answers were correct.

The inpatient stroke education program was designed to address main objectives of stroke rehabilitation education, as outlined in Denby et al¹⁶ and consisted of three weekly one hour education sessions: “what happened to me?,” “life in rehabilitation,” and “life after rehabilitation.” In the “what happened to me?” class, stroke risk factors and warning signs were taught by case managers and nursing staff. “Life in rehabilitation” was taught by physical therapists and addressed the purpose of therapy sessions. “Life after rehabilitation” was taught by occupational therapists and addressed home modifications and safety issues after stroke. Handouts were provided at each educational session, and verbal discussion was strongly encouraged. Programs similar to this administered in inpatient rehabilitation have been shown to be efficacious for improving knowledge.¹⁴

The number of correct responses to each of the three domains provided during the baseline and follow-up interviews were examined with descriptive statistics. Pretest and posttest

comparisons of risk factors and warning signs were examined using the Marginal Homogeneity Test, and pretest and posttest comparisons of emergency actions named were examined using the McNemar's Test (SPSS for Windows, Version 14.0, 2005).

Results

We approached 323 patients admitted to the inpatient rehabilitation hospital; 130 patients consented and met inclusion criteria. Because this study was designed to examine the effectiveness of the clinical education program, only those participants who were discharged home, participated in at least one education session in the hospital, and completed both the baseline and follow-up interview were included in this analysis ($n=34$). There were many reasons for the large attrition in our study. Several patients completed the baseline interview, but did not attend any education classes ($n=67$). Reasons for missed classes included medical illness, scheduling conflicts, short length of stay and refusals. Other reasons for attrition were admission to inpatient facility (i.e., acute care hospital, skilled nursing facility) or deceased at follow-up ($n=13$), refusal to participate in follow-up interview ($n=3$), and loss to follow-up ($n=13$). When comparing subjects who completed the study to those who only participated in the baseline interview ($n=96$), there were no differences between groups in terms of demographic statistics, stroke location or baseline stroke knowledge. However, participants who did not complete the study had a significantly shorter rehabilitation length of stay (Table 1).

Thirty-four participants were interviewed before and after the stroke education program. The mean age of the sample was 70.3 (SD 12.8); 59% were male, 71% Caucasian (29% African-American), and 56% were married. Mean education was 12.4 years (SD 2.5). Length of stay in rehabilitation was mean 21.1 days (SD 8.7). Stroke location, determined by chart review, was: 10 cortical; 15 subcortical; 2 cortical/subcortical, 4 brainstem, and 3 unknown.

Of note, only 9/34 participants (25%) attended all three sessions of the stroke education program; however, 28/34 (82%) participants attended Session 1, which addressed the knowledge examined in this analysis. Number of sessions attended, or attendance of Part 1 of the program, was not significantly associated with any knowledge items at baseline or at 12 week follow-up (data not shown).

Figure 1 shows baseline and 12-week follow-up results for the 34 participants in terms of knowledge of risk factors and warning signs. Improvements in knowledge from baseline to follow-up were small and non-significant. At baseline, 17/34 (50%) of participants were unable to identify any risk factors for stroke, while at follow-up 10/34 (29%) were unable to identify any risk factors (Exact $p=0.13$ for pre-post comparison). Of the 24 who could identify a risk factor at follow-up, 12 (35%) identified only 1, 7 (21%) identified 2, and 5 (15%) identified 3 risk factors. Similarly, 17/34 (50%) of participants were unable to identify a single warning sign for stroke at baseline; 11/34 (32%) of participants were unable to identify a single warning sign for stroke at follow-up (Exact $p=0.42$). Of the 23 who could identify a warning sign at follow-up, 18 (53%) identified only 1, 2 (6%) identified 2, and 3 (9%) identified 3 or more risk factors.

In terms of knowledge of correct action to take in case of suspected stroke, 21/34 (62%) of participants reported a correct action (i.e., call 911 or go to an emergency room), versus incorrect action (e.g., rest, call primary care doctor), at baseline. At follow-up, 24/34 (71%) reported a correct action, a non-significant improvement (Exact $p=0.58$).

Discussion

Our study found that participation in this inpatient rehabilitation clinical education program was not effective for improving stroke-related health knowledge of ischemic stroke survivors. Small and non-significant improvements in stroke knowledge, in terms of risk factors (including modifiable risk factors such as hypertension or smoking), warning signs, and appropriate action to take in case of suspected stroke, were noted 12 weeks after participation in the clinical stroke education program. Substantial proportions of participants, approximately one-third of the sample, continued to have deficits in these fairly basic knowledge items. Given the high risk of stroke recurrence, these deficits are concerning. Stroke survivors, who are at high risk for recurrence, are arguably the group who should be most informed about prevention of recurrent stroke (by recognizing and managing modifiable risk factors) and reduction of stroke severity (by early recognition of warning signs and prompt emergency action, to provide maximal benefit from thrombolytic therapies or other stroke care).

There are several possible explanations for our findings. First, even participants who completed the study did not receive the full education program due to illness, scheduling conflicts, short inpatient length of stay or refusals. Due to the paucity of studies examining inpatient clinical education programs, it is difficult to say whether or not these rates and reasons for attrition generalize to other programs. However, the findings from the present study do suggest some potentially important barriers to the validity of inpatient clinical education programs that bear consideration in clinical practice. Second, educational material was not repeated or reinforced, and hence may have led to inefficient learning. Third, stroke education was not individualized, that is; it did not address each patient's specific needs (e.g., hypertension or diabetes management). Fourth, the program did not take participants' neurological deficits into account: those with cognitive impairments which may affect learning or understanding of didactics received the same type of education as those without any impairment.

Study findings should be interpreted with caution due to several design limitations. Data were collected as part of a clinical quality assurance project to assess the validity of a standard clinical stroke education program, and therefore few *a priori* controls were placed in the study design. As a result, data represent a small sample, even further reduced by a significant attrition of participants from baseline to follow-up interview. Even among study completers, attendance at all stroke education sessions was poor. With these limitations, it is difficult to detect small improvements in knowledge (though such small improvements, e.g., knowing 1 warning sign instead of none, arguably are not the target outcomes of clinical education programs).

Notwithstanding these limitations, the study findings have implications for clinical didactics-based stroke education programs conducted during inpatient rehabilitation.¹⁸ Given the complexity of factors that reduce available time for clinical inpatient rehabilitation education programs, it is not unreasonable to suggest that new approaches to stroke education may be needed. First, clinical education programs may benefit from enhanced access to and usability of educational information after inpatient rehabilitation. Several studies have examined the effectiveness of providing information to stroke patients and their caregivers, in the form of booklets, to improve stroke knowledge, with some success,^{19–22} and another study found efficacy of group classes extending from the inpatient stay into 6 weeks of outpatient therapy.²³ More recently, it has been suggested that computer-based products could provide a better mechanism for education during rehabilitation as well as after discharge.²⁴ Second, clinical education programs should incorporate immediate assessment of knowledge acquisition and retention (e.g., via post-

session testing), coupled with reinforcement of information as needed. This may be accomplished through a variety of written or interactive platforms. This may also be accomplished by combining didactic clinical education with self-management skill training in the context of rehabilitation therapy sessions to facilitate application of stroke knowledge in personal care management activities. Third, clinical education programs should have an inherent flexibility to meet the specific educational needs of individual patients, accounting for differences in educational levels and stroke-related deficits. However, even with these modifications, such educational programs would need to be tested to determine whether they improved educational outcomes (e.g., retention of stroke-related health knowledge) among stroke patients, as well as their caregivers.

In summary, there is limited evidence that clinical inpatient stroke education programs are effective at improving stroke-related knowledge,¹⁷ and yet inpatient rehabilitation facilities continue to provide these programs. As discussed, there may be many potential barriers to the effectiveness of these clinical stroke education programs, and therefore modifications to existing educational practices may be needed.

Acknowledgments

SOURCES OF SUPPORT: The research was funded by the NIMH and investigator-initiated grants from Pfizer and Johnson & Johnson. The sponsors had no role in study design, collection, analysis, interpretation of data, or writing/submission of this or other reports.

FINANCIAL DISCLOSURES: Dr. Lenze has received grant/research support from Forest, Pfizer, and Johnson & Johnson. Dr. Munin has received grant/research support from Allergan. Ms. Koenig, Drs. Whyte, Munin, and Lenze have received consulting fees from Fox Learning Systems, Inc.

References

1. Rosamond W, Flegal K, Friday G, et al. for the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics--2007 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation*. 2007; 115:e69–e171. [PubMed: 17194875]
2. Kothari R, Jauch E, Broderick J, et al. Acute stroke: delays to presentation and emergency department evaluation. *Ann Emerg Med*. 1999; 33:3–8. [PubMed: 9867880]
3. Samsa GP, Cohen SJ, Goldstein LB, et al. Knowledge of risk among patients at increased risk for stroke. *Stroke*. 1997; 28:916–921. [PubMed: 9158625]
4. Kothari R, Sauerbeck L, Jauch E, et al. Patients' awareness of stroke signs, symptoms, and risk factors. *Stroke*. 1997; 28:1871–1875. [PubMed: 9341687]
5. Yoon SS, Heller RF, Levi C, et al. Knowledge of stroke risk factors, warning symptoms, and treatment among an Australian urban population. *Stroke*. 2001; 32:1926–1930. [PubMed: 11486127]
6. Greenlund KJ, Neff LJ, Zheng ZJ, et al. Low public recognition of major stroke symptoms. *Am J Prev Med*. 2003; 25:315–319. [PubMed: 14580633]
7. Parahoo K, Thompson K, Cooper M, et al. Stroke: awareness of the signs, symptoms, and risk factors- a population based survey. *Cerebrovasc Dis*. 2003; 16:134–140. [PubMed: 12792171]
8. Williams LS, Bruno A, Rousch D, et al. Stroke patients' knowledge of stroke: influence on time to presentation. *Stroke*. 1997; 28:912–915. [PubMed: 9158624]
9. Reeves MJ, Hogan JG, Rafferty AP. Knowledge of stroke risk factors and warning signs among Michigan adults. *Neurology*. 2002; 59:1547–1552. [PubMed: 12451195]
10. Ramsden VR, Shuaib A, Reeder BA, et al. Risk factor awareness: a randomized telephone survey of public knowledge. *Can J Public Health*. 1994; 85:S57–S60. [PubMed: 7804953]
11. Pancioli AM, Broderick J, Kothari R, et al. Public perception of stroke warning signs and knowledge of potential risk factors. *JAMA*. 1998; 279:1288–1292. [PubMed: 9565010]

12. Koenig K, Whyte EM, Munin MC, et al. Stroke-related knowledge and health behaviors among post-stroke patients in inpatient rehabilitation. *Arch Phys Med Rehabil*. In press.
13. CARF International. *Medical Rehabilitation Standards Manual*. Tucson, Arizona: Author; 2007.
14. Evans RL, Matlock AL, Bishop DS, et al. Family intervention after stroke: does counselling or education help? *Stroke*. 1988; 19:1243–1249. [PubMed: 3176084]
15. American Stroke Association. Stroke warning signs. 2003 Available from: <http://www.americanheart.org/presenter.jhtml?identifier=4742>.
16. Denby F, Harvey RL. An educational intervention for stroke rehabilitation patients and their families: healthy living after stroke. *Top Stroke Rehabil*. 2003; 9:34–45. [PubMed: 14523698]
17. Forster A, Smith J, Young J, et al. Information provision for stroke patients and their caregivers. *Cochrane Database of Systematic Reviews*. 2007
18. Easton KL, Zemen DM, Kwiatkowski S. Developing and implementing a stroke education series for patients and families. *Rehabil Nurs*. 1994; 19:348–351. [PubMed: 7855402]
19. Lomer M, McLellan DL. Informing hospital patients and their relatives about stroke. *Clin Rehabil*. 1987; 1:33–37.
20. Pain HSB, McLellan DL. The use of individualised booklets after a stroke. *Clin Rehabil*. 1990; 4:265–272.
21. Lorenc L, Sturmey P, Brittain H. Evaluation of a meta-cognitive strategy to improve the information gained from a stroke information pack. *Stress Medicine*. 1992; 8:111–112.
22. Mant J, Carter J, Wade DT, Winner S. The impact of an information pack on patients with stroke and their carers: a randomized controlled trial. *Clin Rehabil*. 1998; 12:465–476. [PubMed: 9869250]
23. Rodgers H, Atkinson C, Bond S, et al. Randomised controlled trial of a comprehensive stroke education program for patients and caregivers. *Stroke*. 1999; 30:2585–2591. [PubMed: 10582982]
24. McEwen S, Szurek K, Polatajko HJ, Rappolt S. Rehabilitation Education Program for Stroke (REPS): learning and practice outcomes. *J Continuing Educ*. 2005; 25:105–115.

Figure 1. Changes in the number of risk factors identified

Figure Legend: Exact $p=0.13$ for pre-post comparison of risk factors named

Figure 2. Changes in the number of warning signs for stroke identified

Figure Legend: Exact $p=0.42$ for pre-post comparison of warning signs named

Figure 3. Changes in responses to early signs of a stroke

Figure Legend: Exact $p=0.58$ for pre-post comparison of emergency actions named

Table 1

Baseline stroke-related health knowledge completers and non-completers of inpatient rehabilitation education program

	Completers (n=34)	Non-Completers (n=96)	
Age (years)	70.3 (12.8)	69.5 (14.7)	$p=.76$
Male (%)	59%	57%	$p=.11$
Race			$p=.45$
Caucasian (%)	71%	77%	
African American (%)	29%	23%	
Married (%)	56%	46%	$p=.31$
Education (years)	12.4 (2.5)	12.8 (3.0)	$p=.52$
Rehabilitation LOS (days)	21.1 (8.7)	14.5 (9.2)	$p=.00$
Stroke Location			$p=.66$
Cortical (%)	29%	40%	
Subcortical (%)	56%	51%	
Cortical/Subcortical (%)	6%	3%	
Unknown (%)	9%	6%	
Baseline Stroke Knowledge			
Risk Factors (% 0 factors)	50%	52%	$p=.84$
Warning Signs (% 0 signs)	50%	52%	$p=.92$
Emergency Actions (% incorrect)	62%	67%	$p=.31$

Note. Differences between groups tested with t tests (continuous variables) and χ^2 tests (categorical variables).