Factors That Influence the Stroke Care Team's Effectiveness in Reducing the Length of Hospital Stay

Loes M.T. Schouten, Marlies E.J.L. Hulscher, Reinier Akkermans, Jannes J.E. van Everdingen, Richard P.T.M. Grol and Robbert Huijsman

Stroke. 2008;39:2515-2521; originally published online July 10, 2008;
doi: 10.1161/STROKEAHA.107.510537
Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231

Print ISSN: 0039-2499. Online ISSN: 1524-4628

Factors That Influence the Stroke Care Team's Effectiveness in Reducing the Length of Hospital Stay

Loes M.T. Schouten, Msc; Marlies E.J.L. Hulscher, PhD; Reinier Akkermans, Msc; Jannes J.E. van Everdingen, MD, PhD; Richard P.T.M. Grol, PhD; Robbert Huijsman, PhD

Background and Purpose—The purpose of this study was to explore the effects of a quality improvement program for improving stroke care and the determinants of success at the team and hospital levels.

Method—For 16 months, 23 multidisciplinary stroke service teams participated in a quality improvement collaborative designed to set up stroke services and reduce the length of hospital stay (LOHS). We monitored the LOHS and the discharge delay during the project and measured indicators of well organized stroke services at baseline and after the intervention. A multiple and multilevel regression model was used to relate the outcome variables to the team and hospital characteristics. National LOHS figures served as reference data.

Results—Data regarding 4549 stroke patients were included in the analyses. The LOHS decreased significantly from 18.3 to 13.3 days. The mean LOHS varied substantially (9.2 to 20.9 days) after the intervention. Teams with higher team functioning scores showed lower LOHS scores and higher scores for the indicators of well organized stroke services. Team characteristics explain almost 40% of the variance in LOHS and 53% in the indicators of well organized stroke care.

Conclusion—Participation in a national quality improvement collaborative effected a significant decrease of the LOHS and a significant increase in the presence of key features of stroke services. Variation in ability to reduce the LOHS and increase key features of stroke services were related to team functioning. The data suggest that the composite of team functioning is pivotal in quality-of-care improvement and may need specific attention in any quality improvement program. **(*Stroke*. 2008;39:2515-2521.)**

Key Words: quality of health care ■ stroke management ■ outcomes ■ team functioning

Stroke is common, particularly among the elderly, and is associated with substantial morbidity and mortality. It is a leading and growing cause of death, long-term disability, and health care costs in Western societies.[1] Hospitalizations for stroke are among the most expensive,[2] and the length of hospital stay (LOHS) is the largest determinant of direct costs for stroke care.[3,4]

Robust data show the efficacy of specialized stroke services in improving outcomes of patients with stroke.[5] Even though the details of the organization of services may vary among institutions or in different parts of the country, or may reflect demographic or regional variables, there is convincing evidence that stroke services can reduce inpatient treatment delays and minimize the LOHS and costs.[5–13] Likely reasons for benefit include a more intensive approach to the management of medical complications and earlier and more focused multidisciplinary rehabilitation.[14,15]

Despite the evidence and attention in the literature and despite local initiatives, stroke services are still being criticized as haphazard and poorly tailored to patients' needs. Setting up stroke services has proven to be challenging. A recent survey in the Netherlands shows that stroke services are still poorly coordinated and the LOHS, for example, is less than optimal.[16–18] The number of "waits and delays" seems to be quite substantial. Many patients spent days in hospital without medical necessity, waiting for well organized multidisciplinary stroke rehabilitation in a nursing home or a rehabilitation center, or for professional home care. Van Straaten et al[18] estimated that about 35% of the average days of stay in hospital after stroke are without medical justification, leading to increased costs and possibly affecting patients' recovery. During the intervention hospitals were paid by means of prospective global budgets that were negotiated with the sickness funds and private insurers. The budgets cover operating costs plus capital costs for inventory and medical equipment. This prospective budgeting system is based on centralized price setting while simultaneously allowing for decentralized negotiations on volumes. Reducing the LOHS and discharge delay can lead to financial savings; the main benefit is to release capacity for an expansion in stroke caseload,

Received November 20, 2007; final revision received January 11, 2008; accepted January 29, 2008.

From the Dutch Institute for Healthcare Improvement (L.M.T.S., J.J.E.v.E.), Utrecht, The Netherlands; the Radboud University Nijmegen Medical Center (M.E.J.L.H., R.A., R.P.T.M.G.), IQ Healthcare, Nijmegen, The Netherlands; and Erasmus MC (R.H.), University Medical Center Rotterdam, Institute of Health Policy and Management, Rotterdam, The Netherlands.

Correspondence to Loes M.T. Schouten, Dutch Institute for Healthcare Improvement, P.O. Box 20064, 3502 LB Utrecht, The Netherlands. E-mail l.schouten@cbo.nl

Stroke **is available at http://stroke.ahajournals.org** **DOI: 10.1161/STROKEAHA.107.510537**

and it may provide a means of addressing the predicted increase in need for stroke care within the existing hospital capacity.

A voluntary, national, quality-improvement program was initiated for exploring effective ways of improving care for stroke patients in the Netherlands. This quality improvement collaborative (QIC) was designed to bring together and assist health-care organizations in using the best available evidence for setting up stroke services and reducing the LOHS. However, the evidence of the impact of QICs is inconclusive: studies show varying results in the participants' outcomes.[19] Moreover, the team's role and the role of the organizational characteristics in the effectiveness of QICs are largely unknown. Study results suggest that a set of internal team characteristics such as team size, experience in working together, team stability, team composition, and the presence or absence of a team leader are likely to be important.[20–22] Heuschmann[23] has found that the LOHS is influenced by hospital characteristics as well as by patient characteristics, such as the number of patients treated. Increasing our knowledge of the impact of teams and organization in successful quality improvement is particularly important, given the fact that changes can only be translated into positive outcomes if the processes at the levels of the team and organization are optimal.

In this paper, we assess the effectiveness of a QIC designed to set up stroke services and reduce the LOHS in stroke care, and we pay particular attention to the influence of team and hospital characteristics on successful improvement. The results should shed new light on effectiveness and the determinants of success of quality improvement efforts in stroke care.

Methods

Design

The stroke service collaborative involved two sequential phases. Stroke collaborative I (October 2002 to February 2004) included nine stroke services, and stroke collaborative II (March 2003 to July 2004) included 14 stroke services. We assessed the impact of this quality program in an observational study that monitored the LOHS and the discharge delay and measured the indicators of well organized stroke services. National LOHS figure were used as reference data.

Participants

In the spring of 2002, letters of invitation were sent to all 69 geographically distinct stroke services in the Netherlands to inform provider teams about the project and to invite them to participate. In addition, 2 invitational meetings were organized to inform services about the overall goals and structure of the project. More than 30 stroke services volunteered to participate. To be eligible, the services had to demonstrate leadership commitment. To participate, the services had to pay a €15 000 fee to cover project costs. Twenty-three stroke services were selected. Seven stroke services were not accepted or withdrew because of organizational problems or funding difficulties. The participating services consisted of volunteers who received no compensation.

Collaborative Quality-Improvement Intervention

The 23 stroke services were requested to form a multidisciplinary improvement team composed of medical, nursing, and therapy staff from hospitals, nursing homes, rehabilitation organizations, and home care in the region. Most teams had 5 or 6 members, though a few were larger, and all included at least neurologists, stroke nurses, and allied health professionals. At the start of the project, teams were asked to collect baseline data and report the main bottlenecks in their current stroke service. During the project, 4 conferences (including 1 kick-off meeting) were organized to inform the participating teams about the best available evidence concerning well organized stroke care and the best way to implement it. At the kick-off meeting, the teams were provided with a toolkit with information about the key features of well organized stroke services, national and international guidelines, and the application of quality improvement. Each conference included additional instruction in quality-improvement techniques and sessions that focused on specific aspects of stroke services. A systematic approach was encouraged: the teams had to choose clear and measurable improvement aims, collect data, and plan interventions to improve care. Regarding the best available evidence, teams were directed to focus on key indicators of well organized stroke services (Table 2) to improve stroke care and reduce the LOHS. Nevertheless, depending on service-specific routines or bottlenecks the teams were free to choose aims. The teams were supported by a national expert team that specializes in stroke care. In the periods between the conferences, the teams recruited other providers from their respective organizations to participate in the implementation of improvement interventions. Coaching and support were provided through the conferences, as were site visits from the expert team, an active e-mail list, and periodic performance feedback based on expert review of the monthly progress reports of the teams. Collaboration and sharing between participating stroke services were explicitly encouraged. Regularly scheduled workshops at the conferences were organized to provide opportunities of presenting improvement plans and progress and of discussing on-going issues.

Outcome Measures

Length of Hospital Stay and Discharge Delay

The teams used the total length of hospital stay (LOHS) as the primary outcome measure because of the paramount importance of seamless care for stroke patients. The teams collected data for all patients who suffered a cerebrovascular accident and who were admitted to hospital during the intervention. The LOHS was calculated from the admission and discharge data of consecutive stroke patients who were admitted during the QIC intervention. To collect data on LOHS the participating teams created their own registries as electronic medical records are lacking in most hospitals. The teams were provided with verbal and written instructions, and each team received a prepared registration format for collecting the data. The period of measurement varied from site to site, depending on the start and end data of the registry. The data registered included the patient's birth date, dates of admission and discharge, length of stay, and date of finishing medical treatment. National LOHS data (www.prismant.nl) were used to compare the effect of the QIC with national secular trends in the LOHS of stroke patients.

The teams also measured the discharge delay (eg, time spent in hospital for nonmedical reasons) attributable to waiting times for a place in a nursing home, a rehabilitation clinic, or for installations, alterations, and help in the patient's own home. The delay in discharge was calculated from discharge data and the date of finishing medical treatment.

Process Measures

Indicators of Well Organized Stroke Services

An expert group defined a core set of 15 indicators for well organized stroke services in the Netherlands on the basis of national and international stroke guidelines and a Dutch series of stroke service experiments.[17] The teams participating in the QIC were directed to work toward these 15 indicators (2 of which consist of 3 elements) addressing structures and processes of good stroke care (Table 2). These indicators, which are described in the international literature,[9,24] include a multidisciplinary team of medical, nursing, and therapy staff with the necessary skills and interest in stroke or rehabilitation who coordinate their work through regular multidisciplinary meetings.

We developed a questionnaire to determine whether the stroke services met the criteria of the15 indicators of well organized stroke services. The participating teams were asked to complete the questionnaire at the beginning and the end of the collaborative. The proportion of teams who met the criteria (yes/no) for each indicator at baseline and follow-up periods, as well as mean sum scores (varying from 0 to 19), were calculated.

Determinants at the Team and Hospital Levels

Team Characteristics

We hypothesized that more effective teams would achieve better results in improving care for patients with stroke. We derived 8 key characteristics that influence team effectiveness: team composition, team collaboration, stability, time allotted to the various tasks, the presence of a team leader, clinical leadership of a specialist, and knowledge of and experience with quality improvement and senior leadership support.[25–27] For the purpose of assessing these characteristics, individual team members were asked to complete an 8-item questionnaire (yes/no) at the last conference. Factor analysis showed the 8 items clustered into 3 scales: team functioning (reflecting 6 items: team composition, team collaboration, stability, time allotted for the various tasks, the presence of a team leader, and clinical leadership of a specialist), senior leadership support (1 item), and knowledge of and experience with quality improvement (1 item). Individual measures were aggregated to the team level. We used mean scores per team (varying from 0 to1).

Hospital Characteristics

We collected data for 3 other measures related to the hospital: number of hospital beds, number of stroke patients treated annually, and the teaching status of the hospital. We hypothesized that a hospital with more beds or more patients treated would be associated with a lower LOHS. Moreover, we hypothesized that hospitals with a teaching affiliation might enhance a specific learning environment and the organization's capacity to learn and adopt innovation, which would result in a lower LOHS.[28]

Data Analysis

We evaluated the impact of the project by aggregating and displaying the LOHS and discharge delay data in 7 distinct quartiles from the fourth quartile of 2002 up to the second quartile of 2004, which represent the start and end of the intervention period. To explore the impact of the project on the indicators of well organized stroke services, baseline data and end-of-project survey data were compared. Multilevel LOHS analysis and multiple regression analysis of indicators of well organized stroke services were used to determine whether postintervention differences in LOHS and indicators of well organized stroke services were attributable to differences in team and hospital characteristics or could be explained by them. Important and well known predictors of LOHS at the patient level, such as stroke severity and advanced age, are beyond the scope of this study. The data were analyzed in a multilevel model to account for the clustering of patients within hospitals. Scores at the team and hospital levels were computed and used as independent variables in regression equations for each of the effect measures, taken baseline scores in account.

Results

Site Characteristics

The 23 stroke services participating in this study represent 33% of all 69 stroke services in the Netherlands. The mean number of beds was 749 (range 242 to 1368). The mean number of stroke patients treated was 291 (range 116 to 618). Fifty-two percent of the hospitals had a teaching affiliation.

All 23 stroke services established improvement teams, participated in the learning sessions, and completed the collaborative. The improvement aims of the teams varied, depending on service-specific routines or bottlenecks. Within the study period, 17 of the 23 (74%) stroke service teams focused their improvement aim on reducing the LOHS and discharge delay (Table 1). The teams set about 6 or 7 improvement aims on average (range 4 to 9).

Table 1. Overview of Improvement Aims and Numbers of Teams Working on Them (n=23 Teams)

Features to be Improved	No. of Teams (%)
Length of stay/discharge delay	17 (74)
Sharing provider information	17 (74)
Post discharge care delivery	13 (56)
Thrombolytic treatment	12 (52)
Use of protocols	10 (43)
Monitoring and management	09 (39)
Patient education	06 (30)
Relevant education of provider/nurse	04 (17)

Effect Measures

Length of Hospital Stay and Discharge Delay

Figure 1 shows the length of stay per hospital. Seventeen stroke services (representing 23 hospitals; 74%) submitted LOHS data (n=4549 patients). The start and end data of the registries differed per stroke service, and there was considerable heterogeneity in the number of patients registered per site, varying from 84 to 581 patients. A total of 4549 patients were included in the study. The mean age of the patients was 70.3 years (SD 13.6). Stroke services did not collect information about major confounding factors such as gender, stroke severity, or functional status. At the start of the intervention, the LOHS ranged from 1 to 121 days. At the end of the intervention, the LOHS ranged from 1 to 54 days. There was heterogeneity in the mean LOHS per site, varying from 10.6 to 33.7 days at baseline versus 9.2 to 20.9 days at the end of the intervention.

Comparing outcome measures at the start and end of the intervention (1st quartile of 2003 and the 2nd quartile of 2004), the total LOHS diminished significantly from 18.3 to 13.3 days (27% reduction; Figure 2) in the study services, whereas all the other hospitals in the Netherlands (n=81) showed only a 5.7% reduction (19.2 versus 18.1 day) in the same period (Figure 2).

Figure 2 also shows the mean discharge delay information. The correlation between the LOHS and the discharge delay turned out to be 0.73 ($P<0.0001$). We obtained discharge delay data from 3612 patients at 15 sites (representing 19 hospitals; 65%). Comparing outcome measures between the start and the end of the intervention (1st quartile of 2003 and the 2nd quartile of 2004), the discharge delay diminished significantly from 5.9 to 1.7 days (a 71% reduction) in the study services. The discharge delay ranged from 0 to 100 days at the start and from 3 to 38 days at the end of the intervention. There was heterogeneity in the mean discharge delay per site, varying from 0 to 23 days at baseline versus 0 to 12 days after the intervention.

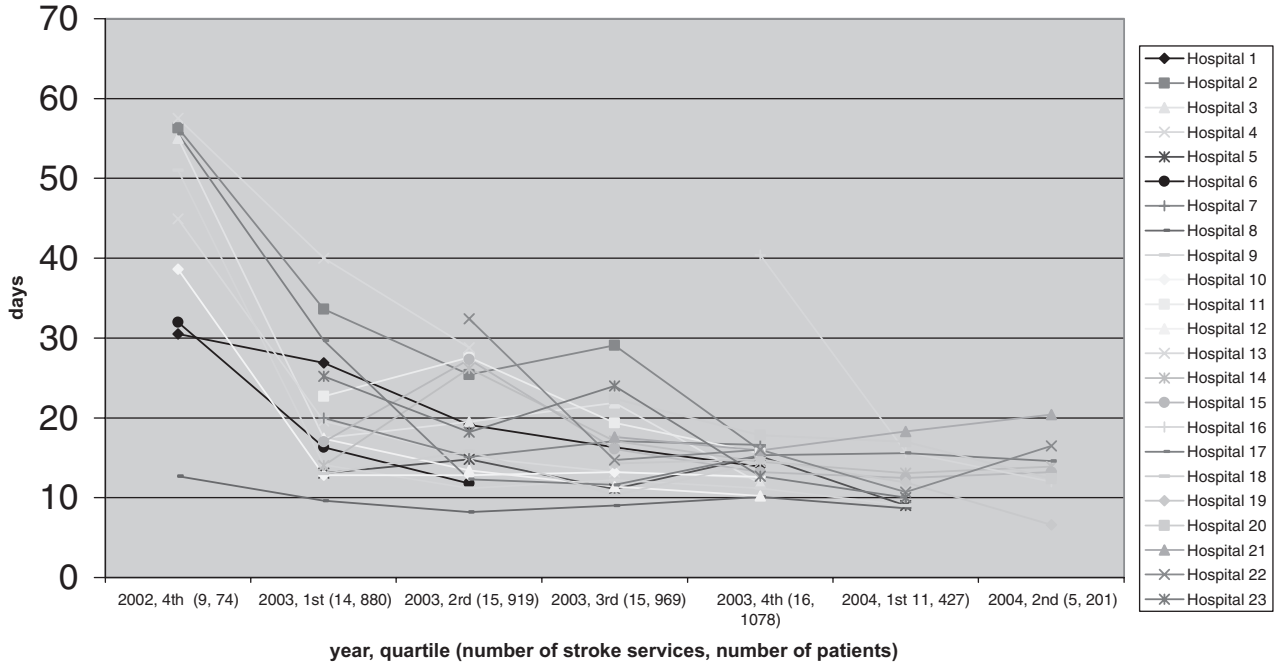

Figure 1. Reduction in length of hospital stay per hospital.

Indicators of Well Organized Stroke Services

Table 2 shows the baseline and postintervention scores (total number of key features of stroke services) for the 15 indicators. We obtained survey scores from 21 sites (91%). During the study, the teams were able to substantially improve guaranteed admittance for patients with stroke, postdischarge care delivery, sharing of provider information, patient education, and performance monitoring. The sum scores improved significantly, by 27%, during participation (from 11 to 14).

Determinants of Success

The survey data were obtained from 73 team members of the stroke services participating in the project. Table 3 shows the team and hospital characteristics. As already mentioned, the teams did not assess patient characteristics.

Length of Hospital Stay

The LOHS was significantly shorter for hospitals whose teams reported higher scores for team functioning. The effect of team functioning scores on LOHS was −5.37 (95% CI −9.89, −0.85). An improvement of 0.2 points (on a scale of 0 to 1) in team functioning resulted in an extra reduction of the LOHS of 1 day. Multiple multilevel regression analysis showed that our model (taking baseline scores into account) explained 38.4% of the variance of the LOHS at the hospital and team levels.

Indicators of Well Organized Stroke Services

The team characteristics were also significantly associated with indicators of well organized stroke care. Teams reporting higher scores for team functioning showed higher scores on the indicators reflecting well organized stroke services. The effect of team functioning scores on the indicators of well organized stroke services was 4.19 (95% CI 0.51, 7.89). Teams with a score for team functioning higher by 0.2 points (on a scale of 0 to 1) had a sum score that was 1 point higher for these key features. Higher scores for the indicators of well organized stroke

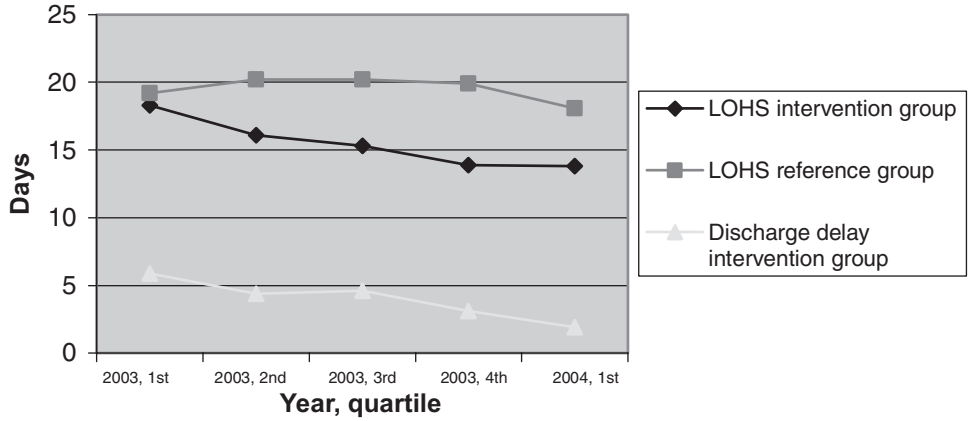

Figure 2. Reduction in length of hospital stay and discharge delay.

Table 2. Indicators of Well Organized Stroke Services (21 Stroke Services)

Indicator	No. of Stroke Services at Baseline	No. of Stroke Services After the Intervention
Guaranteed admittance	13	20
Use of protocols	21	21
Observation of consciousness	20	21
Observation of functional health status of patient	18	20
Relevant education of provider/nurse	19	20
Multidisciplinary consultation (minimally once a week) at hospital	21	21
Hospital sharing provider information (content) with		
Nursing home	14	21
Rehabilitation clinic	13	16
Home care	10	19
Hospital sharing provider information (in time) with		
Nursing home	14	21
Rehabilitation clinic	12	17
Home care	10	20
Patient education	2	11
Transmural patient file	3	6
Monitoring of performance	1	10
Measuring patient satisfaction	9	9
Measuring satisfaction of health-care provider	7	5
Post discharge care delivery	11	18
Case management at the stroke-service level	4	9

services were also associated with lower scores for knowledge and experience in quality improvement. The effect of knowledge and experience scores on the indicators was −3.34 (95% CI −5.307, −1.375). The results of multiple regression analysis (taking baseline scores into account) showed that our model explained 52.5% of the variance of the key features of the stroke services.

Discussion

This article describes the effectiveness of a voluntary, regional, multiorganizational QIC based on the Breakthrough Series. It also determines the degree to which successful improvement of stroke care in this QIC was associated with characteristics at the team and hospital levels.

Table 3. Hospital and Team Characteristics of the 23 Participating Stroke Services

Characteristics of Participating Stroke Services	Mean (SD)	Range
Determinants at the hospital level		
No. of beds	749 (335)	242–1368
No. of stroke patients treated per year	291 (158)	116–618
Teaching affiliation (yes)	52%	
Determinants at the team level		
Team effectiveness	0.77 (0.24)	(0.06–1.00)
Knowledge and experience in quality improvement	0.66 (0.37)	(0.00–1.00)
Senior leadership support	0.74 (0.34)	(0.00–1.00)

The results show that the participating stroke services achieved significant reductions of the LOHS and discharge delay (27% and 71%, respectively) and a significant increase (27%) in the presence of key indicators of well organized stroke services, whereas the remaining hospitals (from nonparticipating stroke services) decreased the LOHS by only 5.7%. The majority of the bed days saved seem to be a result of the reduction in waits and delays, given the reduction of 71% in discharge delay and the correlation of 0.73 between LOHS and discharge delay. These findings supports our assumption that the results equate with an improvement in the quality of care.

To understand the variations among the 23 stroke services, we explored factors at the hospital and team levels. Analysis shows that the factor of team functioning was significantly associated with success. Higher scores on self-reported characteristics reflecting team functioning were significantly associated with a shorter LOHS and higher scores for key indicators reflecting well organized stroke services. Our results highlight the importance of several team characteristics, such as composition, collaboration, stability, time allotted for the various tasks, having a team leader, and specialist clinical leadership. Although studies differ in how they measure team functioning, our findings confirm the conclusions of previous studies, which indicate that good teamwork is an integral part of providing high-quality patient care.[20,21,29–32] Our results indicate that the team characteris-

tics are also an important determinant of success in quality-improvement strategies. It seems likely that good team functioning form an important vehicle for innovation and quality improvement. However, quality-improvement efforts are often made without any examination of the team characteristics. Awareness of specific team requirements may be a first step toward improving care. Increasing our knowledge of how to develop or encourage good team functioning in quality-improvement initiatives may be a crucial step in redesigning health care. Because almost 40% of the participating teams in our study had team effectiveness scores below 0.7 (range 0 to 1), there seems to be room for improvement.

The negative relationship between "knowledge and experience in quality improvement" and indicators of well organized stroke services is somewhat intriguing. It may be that stroke services with lower scores for knowledge and experience were more amenable to the quality-improvement techniques offered in the collaborative. However, other mechanisms cannot be discounted.

Although the results are promising, there are limitations to our ability to generalize from this effort. First, the participating teams self-reported the data, and we could not validate or verify their registration. Second, stroke services provided information about their LOHSs. The available data sources did not provide information for checking important and well known predictors of LOHS at the patient level, such as stroke severity. For these reasons, our results do not provide a comprehensive model for predicting the LOHS. Rather, this study examined the role of team and hospital characteristics, and checked the baseline scores for the LOHS and indicators for well organized stroke care, but did not take into account other factors that affect the LOHS. Multiple and multilevel regression analysis showed that team characteristics in our model explain almost 40% of the variance in LOHS and 53% in the indicators of well organized stroke care. Although the lack of patient characteristics in this model is an important limitation that must be acknowledged, our findings provide important guidance to health-care providers, managers, and researchers about determinants of success in quality-improvement programs. Third, the study design was observational and there was no formal control group. Although the participating stroke services had shorter LOHSs than the nonparticipating stroke services, the indicators for well organized stroke services were not assessed for the nonparticipants. Moreover the participating teams self-reported the LOHS, and we could not validate or verify their data. Therefore, it is unknown whether the improvements seen in the participating stroke services were attributable primarily to the intervention or to other factors. Moreover, the participating teams were self-selected, and the results may not be applicable to different teams, or even other stroke teams. In addition, the mechanism by which a QIC influences the team characteristics remains to be determined. The composition of a multidisciplinary improvement team is an explicit requirement of a QIC. Because of the cross-sectional design, we could not distinguish whether good team characteristics were present in the stroke service or were a consequence of participating in the QIC. Experimental data are needed to establish this kind of causal relationship.

Despite these limitations, this is one of the first studies showing significant relations between the performance of participants in a QIC and the characteristics at the team level. Our results reinforce the view that a QIC focusing on care for stroke patients can reduce the LOHS and strengthen the current opinion that teams are a means of improving the quality of medical care. Future work is needed to refine our findings and explore how to create and encourage good team functioning in quality-improvement programs.

Acknowledgments

The authors extend their gratitude to all the stroke service teams who participated in this QIC effort to develop well organized and coordinated service for stroke patients. We thank Prismant for displaying the national LOHS data (www.prismant.nl).

Disclosures

None.

References

1. Elkins JS, Johnston SC. Thirty-year projections for deaths from ischemic stroke in the United States. *Stroke*. 2003;34:2109–2112.
2. Somerford PJ, Lee AH, Yau KK. Ischemic stroke hospital stay and discharge destination. *Ann Epidemiol*. 2004;14:773–777.
3. Langhorne P, Dey P, Woodman M, Kalra L, Wood-Dauphinee S, Patel N, Hamrin E. Is stroke unit care portable? A systematic review of the clinical trials. *Age Ageing*. 2005;34:324–330.
4. Saxena SK, Ng TP, Yong D, Fong NP, Gerald K. Total direct cost, length of hospital stay, institutional discharges and their determinants from rehabilitation settings in stroke patients. *Acta Neurol Scand*. 2006;114:307–314.
5. Adams HP Jr, del Zoppo G, Alberts MJ, Bhatt DL, Brass L, Furlan A, Grubb RL, Higashida RT, Jauch EC, Kidwell C, Lyden PD, Morgenstern LB, Qureshi AI, Rosenwasser RH, Scott PA, Wijdicks EF; American Heart Association; American Stroke Association Stroke Council; Clinical Cardiology Council; Cardiovascular Radiology and Intervention Council; Atherosclerotic Peripheral Vascular Disease and Quality of Care Outcomes in Research Interdisciplinary Working Groups. Guidelines for the early management of adults with ischemic stroke: a guideline from the American Heart Association/American Stroke Association Stroke Council. *Stroke*. 2007;38:1655–1711.
6. Kalra L, Evans A, Perez I, Knapp M, Swift C, Donaldson N. A randomised controlled comparison of alternative strategies in stroke care. *Health Technol Assess*. 2005;9:iii-79.
7. Langhorne P, Cadilhac D, Feigin V, Grieve R, Liu M. How should stroke services be organised? *Lancet Neurol*. 2002;1:62–68.
8. Langhorne P, Pollock A. What are the components of effective stroke unit care? *Age Ageing*. 2002;31:365–371.
9. Langhorne P, Duncan P. Does the organization of postacute stroke care really matter? *Stroke*. 2001;32:268–274.
10. Anderson C, Ni MC, Brown PM, Carter K. Stroke rehabilitation services to accelerate hospital discharge and provide home-based care: an overview and cost analysis. *Pharmacoeconomics*. 2002;20:537–552.
11. Alberts MJ, Latchaw RE, Selman WR, Shephard T, Hadley MN, Brass LM, Koroshetz W, Marler JR, Booss J, Zorowitz RD, Croft JB, Magnis E, Mulligan D, Jagoda A, O'Connor R, Cawley CM, Connors JJ, Rose-DeRenzy JA, Emr M, Warren M, Walker MD; Brain Attack Coalition. Recommendations for comprehensive stroke centers: a consensus statement from the Brain Attack Coalition. *Stroke*. 2005;36:1597–1616.
12. Alberts MJ, Hademenos G, Latchaw RE, Jagoda A, Marler JR, Mayberg MR, Starke RD, Todd HW, Viste KM, Girgus M, Shephard T, Emr M, Shwayder P, Walker MD. Recommendations for the establishment of primary stroke centers. Brain Attack Coalition. *JAMA*. 2000;283:3102–3109.
13. Organised inpatient (stroke unit) care for stroke. *Cochrane Database Syst Rev*. 2002;CD 000197.
14. Kalra L, Langhorne P. Facilitating recovery: evidence for organized stroke care. *J Rehabil Med*. 2007;39:97–102.

15. Sinha S, Warburton EA. The evolution of stroke units-towards a more intensive approach? *QJM*. 2000;93:633–638.
16. Verschoor H, Stolker DHCM, Franke CL. *Stroke services anno 2003*. 2004. Den Haag: Nederlandse Hartstichting.
17. Huijsman R, Klazinga NS, Scholte op Reimer WJM, van Wijngaarden JDH, van Exel NJA, van Putte-Boon C, Prestholt FT, Koopmanschap MA, Niessen LW. *Beroerte, beroering, en borging in de keten. Resultaten van de Edisse-studie. Den Haag: ZonMw; 2001*.
18. van Exel NJ, Koopmanschap MA, Scholte op RW, Niessen LW, Huijsman R. Cost-effectiveness of integrated stroke services. *QJM*. 2005; 98:415–425.
19. Schouten LMT, Hulscher MEJL, van Everdingen JJE, Huijsman R, Grol RPTM. Evidence for the impact of quality improvement collaboratives: a systematic review. *BMJ Online*. 2008; doi: 10.1136/bmj.39570.749884.BE.
20. Shortell SM, Marsteller JA, Lin M, Pearson ML, Wu SY, Mendel P, Cretin S, Rosen M. The role of perceived team effectiveness in improving chronic illness care. *Med Care*. 2004;42:1040–1048.
21. Bower P, Campbell S, Bojke C, Sibbald B. Team structure, team climate and the quality of care in primary care: an observational study. *Qual Saf Health Care*. 2003;12:273–279.
22. Curral L, Forrester RH, Dawson JF, West MA. It's what you do and the way that you do it: team task, team size, and innovation-related group processes. *Eur J Work and Organiz Psych*. 2001;10:187–204.
23. Heuschmann PU, Kolominsky-Rabas PL, Misselwitz B, Hermanek P, Leffmann C, Von Reutern GM, Lachenmayer L, Bücker-Nott HJ, Berger K. Factors influencing duration of hospitalization after stroke in Germany. *Dtsch Med Wochenschr*. 2004;129:299–304.
24. Rudd AG, Hoffman A, Irwin P, Pearson M, Lowe D. Stroke units: research and reality. Results from the National Sentinel Audit of Stroke. *Qual Saf Health Care*. 2005;14:7–12.
25. Wilson T, Berwick DM, Cleary PD. What do collaborative improvement projects do? Experience from seven countries. *Jt Comm J Qual Saf*. 2003;29:85–93.
26. Lemieux-Charles L, McGuire WL. What do we know about health care team effectiveness? A review of the literature. *Med Care Res Rev*. 2006;63:263–300.
27. ØVretveit J, Bate P, Cleary P, Cretin S, Gustafson D, McInnes K, McLeod H, Molfenter T, Plsek P, Robert G, Shortell S, Wilson T. Quality collaboratives: Lessons from research. *Qual Saf Health Care*. 2002;11(4):345–351.
28. Grol RP, Bosch MC, Hulscher ME, Eccles MP, Wensing M. Planning and studying improvement in patient care: the use of theoretical perspectives. *Milbank Q*. 2007;85:93–138.
29. Proudfoot J, Jayasinghe UW, Holton C, Grimm J, Bubner T, Amoroso C, Beilby J, Harris MF. Team climate for innovation: what difference does it make in general practice? *Int J Qual Health Care*. 2007;19:164–169.
30. Strasser DC, Falconer JA, Herrin JS, Bowen SE, Stevens AB, Uomoto J. Team functioning and patient outcomes in stroke rehabilitation. *Arch Phys Med Rehabil*. 2005;86:403–409.
31. Campbell SM, Hann M, Hacker J, Burns C, Oliver D, Thapar A, Mead N, Safran DG, Roland MO. Identifying predictors of high quality care in English general practice: observational study. *BMJ*. 2001;323:784–787.
32. Grumbach K, Bodenheimer T. Can health care teams improve primary care practice? *JAMA*. 2004;291:1246–1251.