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Use of a Prototype Acute Stroke Registry to Improve Care
Profile of Receptive Stroke Programs
Valerie T. Stewart, PhD

Abstract: A Wave-II Paul Coverdell Prototype Acute Stroke Registry collected data from 16 hospitals of various sizes and types in Oregon. The goal of this study was to identify whether particular process or structural characteristics of stroke programs in these hospitals were related to the use of reports from the prototype registry to improve care. Researchers surveyed hospitals to ask whether ongoing data completeness reports and monthly comparative quality reports were used to make changes in the acute care process. These self-reports were then confirmed by using the registry data to construct objective run-chart measures over 12 months. Results showed several programmatic characteristics that distinguished programs that used quality reports to make improvements. Hospitals that ignored monthly reports of key performance indicators showed either zero or one positive trend across seven preselected quality indicators. This finding is in contrast to the range of one to four positive changes in quality indicators for report users. Three main characteristics seem to define report users who could translate ongoing findings into potential care improvements: (1) documentation of care processes across departments; (2) access to local or remote stroke teams; and (3) data-collection experiences such as clinical trials, National Institutes of Health Stroke Scale (NIHSS), and outcome feedback. This study could lead to a better understanding as to which characteristics of stroke programs are most important for making rapid improvements for stroke care.

Introduction

The state of Oregon experienced an alarming increase in the number of deaths from strokes during the last decade. Adjusting for population increases, stroke deaths rose 19%. According to a 2000 report from the American Heart Association, Oregon had the fifth highest stroke-related death rate in the United States.1 Recent statistical updates show only a small improvement in these figures for the state.2 An unidentified factor has caused Oregon to become part of the stroke belt, a region that was previously limited to the southern United States. Although joining the stroke belt has raised awareness about stroke care in Oregon, improvement of the timely diagnosis of stroke and of stroke care processes is extraordinarily important for anyone with an acute stroke.

In 2002, the Center for Outcomes Research and Education in Portland received a 2-year grant from the Centers for Disease Control and Prevention to build a statewide stroke registry for the purpose of improving the quality of acute stroke care including emergency response and hospital services. The local project, called Oregon Stroke Centers Prototype Registry (OScPRey), was one of the Wave-II Paul Coverdell prototype stroke registries. OScPRey was conducted after a Wave-I group of four states had specified the required and optional fields3 for the registry. One key objective of OScPRey was to determine how registry data could be used to improve acute stroke care within hospitals. The hope was that by sharing standardized quality indicators and comparative reports, an important first step would be taken in understanding and removing barriers to excellent stroke care in Oregon communities.

In 2000, the working group on stroke from the conference proceedings for measuring and improving quality of care4 delineated structural and process measures for stroke. In their report they emphasized that all hospitals should have systems and procedures in place to evaluate care given to stroke patients. Simply providing quality reports to hospitals, however, as was done with the prototype registry, does not necessarily guarantee their use in quality improvement activities. Apparently, quality report characteristics and organizational culture are strongly associated with the perceived relevance of the data, application of information to actual procedures, and use of measures for positive changes in patient care.5
The goal of this study was to identify whether certain characteristics of stroke programs were associated with the use of quality reports from the OScPRey dataset. The study focused on finding out whether ongoing data-completeness reports and monthly comparative quality reports were used by 16 hospitals to make changes in the acute care process. “Change” was defined in a broad manner on the self-report survey to include any kind of modification, whether or not it resulted in improvements. “Objective change” was defined by observing the number of positive trends (0–7) over a 12-month period in run-charts for seven quality indicators as measured directly from the registry data. This descriptive study could lead to a better understanding about whether specific activities found within stroke programs could predispose hospitals to be receptive quality information users. Results could be particularly helpful for community or general hospitals without neurology specialists.

Methods

The sample design divided Oregon’s 63 hospitals into five strata by annual stroke volume. Sixteen hospitals were picked from these strata with 10 hospitals chosen from the two largest-volume strata and 6 chosen from across the smallest-volume strata. Hospital selection was done in a quasi-random manner, taking into account criteria such as geography. The resulting sample yielded a diverse set of urban and rural hospitals that were primarily general community hospitals, with one academic and one government institution. These hospitals treated over 50% of all stroke cases in the state at the time of sampling in 2002.

Program Assessment

During the first year of the project before any reports were released, a stroke service assessment questionnaire was mailed to the identified project coordinator at each of the 16 hospitals. The project contacts were asked to describe the types of services and level of program development at their hospitals. Items were based on identified dimensions of care from the American Stroke Association’s Program Capacity Assessment, such as availability of optimal acute stroke care, whether stroke teams were available locally or by consultation, the degree of coordination with emergency services, and other characteristics in the program such as secondary prevention.

OScPRey Data Collection and File Transmittal to Central Repository

Hospital staff entered prescribed data elements abstracted from local medical records into a software application provided by OScPRey for the statewide registry. The database used real-time error checking and data verification. Microsoft Access 2000, the platform used, allowed creation of an independent run-time application that did not require the host computer to run a licensed copy of Microsoft Access, thus accommodating hospitals with few technological resources. Data transmission to the OScPRey Central Registry was done primarily by email with encrypted files stripped of identifiers. Reports of missing data and other error reports were then generated for each hospital.

Quality Reports

Prior to analyses, hospital representatives chose a list of seven quality-of-care indicators for interhospital comparison using a consensus process. These seven indicators are listed in Table 1. Quality reports were then made available to each hospital on the OScPRey secure reporting website. In this way, over 90 data elements in the observational registry were trimmed to essential, state-derived benchmark quality measures.

There were two report formats for the seven quality indicators. One report format, shown in Figure 1, displayed all hospitals arrayed along an x-axis with each indicator measured along the y-axis. All 16 hospitals were only identified by a numeric code on the x-axis in this quality-report format. Hospitals received this report monthly. A second graphic format, shown in Figure 2, was released at the end of the project. It showed process run-charts for each hospital on seven quality indicators. These charts gave each hospital ongoing performance measures with months along the x-axis and values along the y-axis. This report summarized monthly values across 12 months of the project for each of the seven quality indicators. In this way, hospitals could apply monthly quality-feedback reports to the actual process of care improvements that ideally would be reflected in run-charts calculated from registry data. Typically, process improvements are most successful when microsystems are targeted for change, so hospitals were encouraged to focus on these seven indicators.

Postproject: Survey to Assess Quality Report Use and Exit Plan

The hospitals were surveyed at the project’s conclusion to determine whether the reports had been used to improve various aspects of stroke care at the hospitals. The questions were based on the very practical issues of report use and application to acute care process changes. Comments were allowed.

As an exit strategy from the externally funded phase of OScPRey, the project provided monetary support for 1-year licenses for “Get with the Guidelines—Stroke,” a program supported by the American Stroke Association. Subsequently, all OScPRey data were uploaded into this software. Hospitals

Table 1. Seven quality indicators reached by hospital consensus

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. First emergency department doctor seen within 10 minutes</td>
<td>First emergency department doctor seen within 10 minutes</td>
</tr>
<tr>
<td>2. Imaging done within 25 minutes of arrival</td>
<td>Imaging done within 25 minutes of arrival</td>
</tr>
<tr>
<td>3. IV tPA given (if appropriate) within 60 minutes of arrival</td>
<td>IV tPA given (if appropriate) within 60 minutes of arrival</td>
</tr>
<tr>
<td>4. Neurologist involved within 24 hours</td>
<td>Neurologist involved within 24 hours</td>
</tr>
<tr>
<td>5. Carotid ultrasound or MRA done before discharge</td>
<td>Carotid ultrasound or MRA done before discharge</td>
</tr>
<tr>
<td>6. Antithrombotic prescribed at discharge for appropriate cases</td>
<td>Antithrombotic prescribed at discharge for appropriate cases</td>
</tr>
<tr>
<td>7. Ischemic stroke with atrial fibrillation prescribed warfarin before discharge</td>
<td>Ischemic stroke with atrial fibrillation prescribed warfarin before discharge</td>
</tr>
</tbody>
</table>

IV, intravenous; MRA, magnetic resonance angiography; tPA, tissue-type plasminogen activator.
were given the option of enrolling in the exit strategy with the understanding that subsequent licenses would be purchased by the hospitals.

Results

Program Assessment

Results are shown in Table 2 from 25 program characteristics in descending order of the proportion of “yes” answers. It is interesting to note that the characteristic with the lowest percentage was the one regarding quality benchmarks in place for stroke care. The need for the registry project was demonstrated by the answer to this item. While all 16 hospitals reported having image services available at all times, they did not all report having physicians available to read them within the standard of 20 minutes.

OScPRex Data Collection and File Transmittal to Central Repository

All hospitals continued to transmit data files on a monthly basis to the central repository throughout the project. Yet two hospitals, one very large urban hospital and one very small rural hospital, revealed that they had never used the initial data completeness reports to improve the quality of their documentation or data recording, despite the availability of these tools from the very early days of the project. In both hospitals where data error reports were not used, institutional support for the stroke registry project was not strong or well integrated into their organizations. The remaining 14 hospitals responded that data completeness reports were useful for missing fields and documentation improvements.

Quality Reports

Use of quality reports to create change in the acute care process showed that four of the sampled hospitals never utilized the two types of report formats to make changes in their hospitals over the year, making their registry experience primarily an exercise in data collection. Combining postproject survey responses to preproject program assessments facilitated the creation of

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Figure 1. Example report format comparing quality indicators, identities coded. *Only relevant for ischemic stroke patients with atrial fibrillation and without contraindications. 95% confidence interval.
a profile of characteristics associated with programs
that implemented quality improvement activities as a
result of report feedback. Figure 3 shows the main
program characteristics that distinguished report users
from report nonusers. These program traits were se-
lected because they showed at least 25 percentage point
differences between quality indicator users and nonus-
ers (in favor of the report users). Because hospitals are
the units of analysis and the sample is small, statistical
analyses are not possible.10 Thus, the results reported
here are only descriptive. However, larger numbers of
hospitals in the sample would most likely have pro-
duced significant results in these program categories.

As can be seen in Figure 3, the characteristics of
quality report users fell into three main structural and
process areas: (1) frequent documentation of care
process—PROC; (2) access to a stroke team either
locally or through consultation—ST; and (3) previous
data collection experiences in National Institutes of
Health (NIH) scales, clinical trials or outcome feed-
back—FB. The four programs that were nonusers of
quality reports were diverse in their location and pa-
tient volume; two were in highly urban areas of Oregon
and thus had high stroke volumes, and two were in
small rural areas. Of the smaller hospitals, one had few
stroke cases per year, while the other had medium-sized
stroke volumes because of its relatively isolated geo-
graphic location. Two programs were part of very large
health systems in the state, and two were in independ-
ent hospitals. The diversity of the hospitals in this
group of report non-users lends support to the idea
that characteristics or skills within the stroke programs
themselves, rather than traits of the hospitals alone
(i.e., stroke volume, location, system affiliation, and so
on), result in greater receptiveness and ability to act on
quality reports.

Using run-charts calculated from the central registry,
an analysis of improvement across the seven quality
indicators from Table 1 was done for every hospital. The
key issue was whether quality report use translated into
actual improvements in stroke care. In the chosen
quality indicator run-charts, each hospital could have
from zero to seven observable improvements. Figure 2
is an example of a “sustained positive change” with
values trended upward in the last 3 months and an
obvious departure from previous performance values.
Despite the short interval of time (12 months) and the
description of the project as a prototype pilot, the
report-user group showed a range of one to four
sustained positive changes in the seven quality indica-
tors over the last 3 months of the study. Hospitals not
using reported data showed zero to one sustained
changes in the seven quality indicators. Most difficult
process indicators to change appeared to be “IV tPA
given, if appropriate, within 60 minutes” (no hospital
showed any positive changes in run-charts) and “atrial
fibrillation prescribed warfarin before discharge in
ischemic stroke” (only two hospitals showed some pos-
tive sustained change).

Postproject: Comments about Quality Report
Use and Exit Plan

Based on comment text, the data-quality reports and
quality indicators were used in different ways for each
hospital. One hospital representative stated that
quality-indicator reports were communicated to nurses, ancillary personnel, and physicians for one hospital, which resulted in documented changes in care delivery. “It is certainly true that if it is measured and reported, there is a much greater likelihood of impacting change,” commented that hospital representative. For other hospitals, it is possible that a year was not long enough to incorporate quality data reports into their normal operations. One comment from a nonuser of the quality feedback seems to support this idea. “The neurological services program is just learning to integrate data in the overall performance improvement process.” Comments also showed a large range of cost estimates difficult to generalize.

The funded year of licensure for the “Get with the Guidelines” software expired in Spring 2005. One measure of receptivity and commitment to ongoing stroke quality improvement might be a simple count of how many of the 16 hospitals relicensed for a second year using hospital funds, since the use of the software and data reports can lead to documented improvements in some stroke care processes.11 A local representative for the Oregon chapter of the American Stroke Association (Enterline A, American Stroke Association, personal communication, July 2005) indicated that two of the original four nonusers of quality information remained unlicensed in mid-2005. Interestingly, these hospitals were two independent organizations, not part of a large health system in the state, and had moderate to large stroke volumes. In addition, a hospital stroke program with high use of data and quality reports dropped out. Therefore, three of the originally sampled hospitals chose a different method of data collection for quality reporting in their stroke program or did not collect data at all (this most likely for two of the three) at the time of writing this article.

### Conclusion

This study is a descriptive profile of stroke programs that used the registry’s quality reports to make stroke care changes. The sample of hospitals was small and does not allow statistical comparison. Yet the program attributes that distinguished quality report users from nonusers appear related to skills required to make positive changes happen in stroke care. Moreover, it was learned that having stroke teams or access to them was learned that having stroke teams or access to them for remote consultation in small hospitals seemed essential for facilitating quality report use locally. Even in semi-isolated geographic locations, remote consultation with stroke teams appeared to facilitate quality-improvement activities in the overall care program. This finding makes research on the use of rural stroke networks very relevant for community hospitals that might not otherwise have access to specialists.12

These findings should be viewed with caution because the potential for selection bias is significant. Hospitals were not randomized into equivalent comparison groups. As a result, unmeasured factors could have played a role in creating positively trended changes in the reported quality indicators. Had the study selected more hospitals, statistical techniques might have overcome these interpretability issues. Future studies must
address the issues of selection bias so that stronger conclusions will be possible.

The cautious observations from this descriptive study appear to be that: (1) three major program characteristics—frequent documentation across departments, access to stroke teams, and data collection or feedback on outcomes—might be associated with greater ability to use data and make positive changes in stroke care; (2) access to local or remote stroke teams appears to be a major distinguishing characteristic for quality report use; (3) some hospitals may need more time than other hospitals to develop the program attributes and skills for quality data application in their acute care process; (4) independent hospitals may have greater difficulty than networked hospitals finding resources to collect and use quality data; and (5) external funding to hospitals facilitated a shift in quality measurement in community hospitals that has endured beyond the government-funded mechanism.

According to Berwick, changes within systems such as providing data and benchmark reports do not bring about care improvements in and of themselves. Rather, changes of entire systems must occur to provide optimal care. These system changes in this case might entail getting access to stroke teams, creating an atmosphere of continuous learning, and supporting frequent shifts in the delivery of care based on quality measurement and reporting. This descriptive study shows that measurement tools and benchmark reports will be of limited use in creating positive change without the stroke leaders who are in a position to create the characteristics needed in this dynamic system.

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