RESEARCH - QUALITATIVE

Prime movers: Advanced practice professionals in the role of stroke coordinator

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Abstract

Background and purpose: Following a stroke quality improvement clustered randomized trial and a national acute ischemic stroke (AIS) directive in the Veterans Health Administration in 2011, this comparative case study examined the role of advanced practice professionals (APPs) in quality improvement activities among stroke teams.
Methods: Semistructured interviews were conducted at 11 Veterans Affairs medical centers annually over a 3-year period. A multidisciplinary team analyzed interviews from clinical providers through a mixed-methods, data matrix approach linking APPs (nurse practitioners and physician assistants) with Consolidated Framework for Implementation Research constructs and a group organization measure.
Conclusion: Five of 11 facilities independently chose to staff stroke coordinator positions with APPs. Analysis indicated that APPs emerged as boundary spanners across services and disciplines who played an important role in coordinating evidence-based, facility-level approaches to AIS care. The presence of APPs was related to engaging in group-based evaluation of performance data, implementing stroke protocols, monitoring care through data audit, convening interprofessional meetings involving planning activities, and providing direct care.
Implications for practice: The presence of APPs appears to be an influential feature of local context crucial in developing an advanced, facility-wide approach to stroke care because of their boundary spanning capabilities.

Introduction

The Veterans Health Administration (VHA) annually admits approximately 6000 veterans for inpatient treatment of acute ischemic stroke (AIS; Ross et al., 2011). Each year, acute hospital care for new strokes costs an estimated $111 million, with an additional $74 million for post-acute inpatient care and $88 million for the 60,000 outpatient visits that occur in the first 6 months poststroke

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(VHA Stroke QUERI, 2012). AIS is a time-sensitive condition where emergency treatment is critical for preventing long-term effects of stroke, which include moderate functional impairments and long-term disability. In 2011, the VHA issued an AIS Directive (Department of Veterans Affairs, 2011) aimed at reorganizing and standardizing acute stroke care delivery across Veterans Affairs medical centers (VAMCs). A formative evaluation of the Directive suggested a need for systematic nurse training and coordination among providers from different services (Damush et al., 2014). Because higher quality care is associated with coordination of care across settings and providers (McDonald et al., 2007), nurse practitioners (NPs) and other advanced practice professionals (APPs) may play a crucial role in facilitating quality improvements.

In large integrated healthcare systems, increased attention has focused on framing gaps in health services as opportunities for improvement (van Wijngaarden, de Bont, & Huijsman, 2006). For instance, forming teams dedicated to improving outcomes for stroke patients requires coordination between different disciplines that may include neurology, internal medicine, radiology, lab, pharmacy, and rehabilitation. Williams (2002) characterizes boundary spanners as individuals proficient with interpersonal relationships and as people who are considered "honest brokers" within interdependent systems. While the ability of professionals to cross boundaries or connect disparate groups has long been recognized in the organizational science literature (Tushman, 1977), limited evidence exists about the association of boundary spanning in healthcare outcomes. A recent review of boundary spanning in healthcare contexts defined boundary spanning as actions that bridge disciplinary silos, facilitate communication between different types of stakeholders, and cross professional divides to work toward a common purpose (Nasir et al., 2013).

Studies in the nursing management and implementation science literature have demonstrated how providers with nursing backgrounds are well suited to operate across disciplinary, service, and patient–provider boundaries (Abrahamson, Mueller, Davila, & Arling, 2014; Kilpatrick, Lavoie-Tremblay, Ritchie, Lamothe, & Doran, 2012). NPs and physician assistants (PAs) developed as distinct professions following the success of military medics working under supervision of physicians. Collectively known as APPs, these two clinical occupations arose in the 1960s in response to demand for primary care provision. Whereas PAs typically train in medical schools under the supervision of a physician, NPs and clinical nurse specialists fall into the broader category of Advanced Practice Registered Nurses (APRNs) with training in nursing schools. Future projections suggest that the number of full-time NPs alone may increase 130%, from 86,000 in 2008 to 198,000 in 2025 (Auerbach, 2012). There were 93,098 PAs certified in 2013 (American Academy of Physician Assistants, 2014). In addition, projections indicate that APPs will assume greater responsibility for patient care compared to physicians as a response to shortage in duty hours (Cooper, 2007; Moote, Krsek, Kleinpell, & Todd, 2011; Sargen, Hooker, & Cooper, 2011). In 2016, the VHA proposed granting full practice authority to APRNs in part to meet projected staffing shortages (U.S. Department of Veterans Affairs, 2016).

The role of NPs and PAs in developing and coordinating VHA stroke care programs within an acute stroke care team can help demonstrate how boundary spanning operates in practice. Comparatively few studies have examined the role of APPs in inpatient medical settings despite their growing presence in hospitalist roles (Kartha et al., 2014). Case studies have suggested that APPs may play three key roles in interdisciplinary teams in stroke care: facilitating communication, promoting standardized care, and tracking performance measures for acute stroke care (Green & Newcommon, 2006; Kiernan & Demaerschalk, 2010; Kuerbitz & Goldstein, 2015). While medical protocols often specify explicit ways to coordinate care, there is often less visible but no less important coordination provided by individuals who play boundary spanning roles (Suchman, 1995).

The overall aim of the present longitudinal study was to evaluate how contextual factors affected local initiatives to improve acute stroke care at 11 VHA facilities (Miech & Damush, 2015). Our specific aim of this secondary analysis was to understand how the activities of APPs or other members of stroke teams operated across disciplinary and service boundaries. Thematic analysis of qualitative interviews with clinical providers and team-based analysis of contextual factors identified how stroke teams improved the quality of patient care, coordinated planning efforts, and initiated efforts to monitor clinical performance reports.

Methods

Study design

The present study draws from an observational, longitudinal evaluation of acute stroke care at 11 U.S. VAMCs (Miech & Damush, 2015). The study utilized a mixed-methods approach to evaluate an existing random-controlled trial of stroke care quality improvement (Williams et al., 2016). In three distinct waves of facility visits, the study team explored factors that influenced the implementation of acute stroke care at the 11 VAMCs over the preceding 12 months. At each visit, semistructured interviews with key informants enabled the study team

Table 1 Characteristics of study facilities and participants

Facilities, participants, interviews	*N*
Facilities (Veterans Affairs Medical Centers)	11
Total site visits (three per facility)	33
Facilities where advanced practice practitioner was active	5
Facility visits where advanced practice practitioner was active	12
Staff interviews	312
Average number of participants per facility (range)	13.8 (6–42)
Average length of interview (all site visits)	35 min

to elicit detailed perspectives on strategies, activities, and patterns in the organization of stroke care providers. The analysis of contextual factors was guided by the Consolidated Framework for Implementation Research (CFIR), a theory- and evidence-based typology for understanding implementation and hypothesizing mechanisms of change in a health services context (Damschroder et al., 2009). We used a comparative case-based approach to explore how contextual factors could explain improvements in multidisciplinary team organization related to the presence of APPs, examining factors that were present or absent over the 33 1-year time intervals (i.e., three annual facility visits at 11 VAMCs).

Participants and data collection

Facility visits took place between July 2012 and February 2015. Frontline staff providers involved in the provision of acute stroke care were eligible to participate in the study. Participants who had contributed to the stroke quality improvement trial study (Williams et al., 2016) as members of stroke clinical teams were initially targeted. These participants were supplemented with additional staff involved with AIS over time as identified by local key informants including neurologists, pharmacists, NPs, nurses, health technicians, and rehabilitation therapists. As described in Table 1, 312 interviews were conducted with 152 participants. Over the course of 2-day site visits by two health services researchers with qualitative expertise (one investigator and one staff member), 292 interviews were conducted in-person and another 20 by phone. The semistructured interview guide focused on perceptions of the genesis and impact of local efforts to improve stroke care and the exploration of individual beliefs, preferences, and experiences with stroke improvement initiatives. Interviews were audio-recorded and transcribed verbatim by a professional service. All research reported in this manuscript was approved by the VHA Central IRB in Washington, DC and the local Research and Development committee.

Analysis

Data analysis drew upon qualitative thematic coding and systematic team-based assignment of scores for specific CFIR constructs and level of group organization (GO) to provide care for each of the 33 1-year intervals. First, transcribed interview transcripts were checked for accuracy and imported into NVivo10 for data management and coding. A multidisciplinary team of eight analysts carried out an iterative thematic analysis. Open inductive coding in teams of two generated a codebook with definitions and inclusion/exclusion criteria. Subsequently, the full study team assigned codes to the full set of interviews. Next, the team scored each VAMC facility visit with a template organizing approach (Crabtree & Miller, 1999) according to a subset of CFIR constructs relevant to providing and improving acute stroke care (see Table A1). Analysts independently coded segments in each interview transcript as having positive, neutral, or negative valence in terms of their effect on the provision of acute stroke care. Summary reports with evidence supporting recommended scores were created by each team of two. Next, the entire team reviewed these ratings and scored the specific facility visit at a facility level for each CFIR construct. For each construct, unanimity on scores was reached by discussion and voting through by a digital, real-time secret ballot via an Audience Response System. Possible scores for valence included positive, neutral, negative, polarized, or minimally referenced (MR). For positive or negative scores, the team agreed on a score of "±1" (*weak*) or "±2" (*strong*) to indicate the magnitude of the construct on local provision of acute stroke care. For example, a consensus score of "+1" on the "Champions" CFIR construct would indicate that the presence of clinical champions had a positive, weak influence on the provision of stroke care at that facility. Using this process, the team scored CFIR constructs 726 times (22 constructs multiplied by 33 facility visits; Miech & Damush, 2016).

Based on the CFIR scoring and qualitative analysis, the team evaluated and scored each VAMC in terms of how well their team was organized to provide acute stroke care according to a rubric described in Table B1. Using this instrument, known as the "GO" score, the team scored each facility visit with a level of "group organization" for providing acute stroke care that ranged from beginning (e.g., practice defined by traditional silos) to advanced (e.g., national recognition as an acute stroke center). To explore an emergent hypothesis that surfaced during the data analysis period, all 33 facility visits were subsequently coded for the presence or absence of an APP actively involved in stroke care at the medical center for each of the 33 year-long intervals. To identify patterns in the relationships between APPs and acute stroke care, the final phase involved

comparing factors across the 33 cases through a data matrix approach (Averill, 2002; Miles, Huberman, & Saldaña, 2014).

Results

Overall, APPs were present at five of the 11 VAMCs and in 12 of the 33 year-long intervals. Table 2 displays a data matrix illustrating patterns across intervals in terms of the presence of an APP, GO score, and scoring for four key CFIR constructs (ranging from −2 to +2). The first column indicates each interval: the year (1, 2, or 3) and deidentified facility number.

As Table 2 indicates, the presence of an APP (NP or PA) involved in acute stroke care during a year-long interval directly connected with an advanced level of GO to provide stroke care during that same interval: APPs were present in all nine intervals where an advanced level of GO was also present. Facilities that established advanced levels of organization to provide acute stroke care generally shared several characteristics. At these VAMCs, APPs were involved in developing and implementing a standardized, facility-wide approach to patient care. This

Table 2 CFIR and group organization scores by facility visit

Facility (year)	APP[a]	GO score[b]	Reflecting and evaluating[c]	Access to info/knowledge	Champions	Planning
Year 1, Facility 400	**Present**	**ADV**	**+2**	**+2**	**+2**	**+2**
Year 2, Facility 400	**Present**	**ADV**	**+2**	**+2**	**+2**	**+2**
Year 3, Facility 400	**Present**	**ADV**	**+2**	**+2**	**+2**	**+2**
Year 1, Facility 100	**Present**	**ADV**	**+2**	**+1**	**+2**	**+2**
Year 2, Facility 100	**Present**	**ADV**	**+2**	**+2**	**+2**	**+2**
Year 3, Facility 100	**Present**	**ADV**	**+2**	**+2**	**+2**	**+2**
Year 3, Facility 200	**Present**	**ADV**	**+2**	**+2**	**+2**	**+2**
Year 2, Facility 900	**Present**	**ADV**	**+1**	**+1**	**+2**	**+2**
Year 3, Facility 900	**Present**	**ADV**	**+1**	**+1**	**+2**	**+1**
Year 1, Facility 900	**Present**	INT	**+1**	**0**	**+2**	**+1**
Year 1, Facility 1100	**Present**	INT	**0**	**0**	**+1**	**0**
Year 2, Facility 200	**Present**	INT	**+1**	**+1**	**+2**	**+2**
Year 1, Facility 1000	Absent	INT	+1	+1	+1	+1
Year 2, Facility 1000	Absent	INT	+1	+1	+2	+2
Year 3, Facility 1000	Absent	INT	0	+1	+1	0
Year 3, Facility 1100	Absent	INT	0	0	0	0
Year 1, Facility 600	Absent	INT	+1	+1	+1	+1
Year 2, Facility 600	Absent	INT	+1	+1	+1	+1
Year 3, Facility 600	Absent	INT	+1	+1	+1	+1
Year 1, Facility 200	Absent	DEV	0	+1	+2	+2
Year 2, Facility 1100	Absent	DEV	−1	0	−1	−1
Year 1, Facility 700	Absent	BEG	−1	0	0	0
Year 2, Facility 700	Absent	BEG	−1	0	0	0
Year 3, Facility 700	Absent	BEG	−1	0	0	−1
Year 3, Facility 800	Absent	BEG	−2	−1	+1	+1
Year 1, Facility 300	Absent	BEG	−1	MR	+1	−1
Year 2, Facility 300	Absent	BEG	−2	MR	+1	−2
Year 3, Facility 300	Absent	BEG	−2	MR	+1	−2
Year 1, Facility 500	Absent	BEG	−1	0	−2	−2
Year 2, Facility 500	Absent	BEG	−2	0	−2	−2
Year 3, Facility 500	Absent	BEG	−2	MR	−2	0
Year 1, Facility 800	Absent	BEG	−2	−1	−2	−2
Year 2, Facility 800	Absent	BEG	−2	−1	−1	−1

[a]APP: presence/absence of an APP (a NP or a PA) in the facility's acute stroke care program. Facilities visits where an APP was present are indicated in bold.
[b]GO score: score describing the level of group organization in providing acute stroke achieved by stroke team at the facility level. ADV (indicated in bold), advanced; INT, intermediate; DEV, developing; BEG, beginning.
[c]Ratings of individual CFIR constructs were systematically assigned by the study team based on the strength of influence of a given construct on the ongoing development of the facility's acute stroke program at the time of the site visit. Scores consisted of a valence of positive (+), negative (−), neutral (0), or minimally referenced (MR); for positive and negative valence, a magnitude of weak (±1) or strong (±2) was also assigned. Scores are in bold for facility visits where an APP was present.

was accomplished by tracking patients through both inpatient and outpatient pathways to maintain continuity of care. APPs coordinated regular, multidisciplinary meetings of key providers that facilitated group reflection and evaluation on the data and developing follow-up plans. Likewise, APPs collected, pulled, and/or reported stroke-related data to monitor performance; in two VAMCs, APPs conducted real-time monitoring of stroke patients. Convening meetings and collecting regular performance data enabled multidisciplinary teams to engage in periodic review of progress in providing and improving stroke care.

Five VAMCs independently came up with the idea of creating new stroke coordinator positions and then staffing that position with an APP. While there was no requirement to staff the coordinator role with an APP, their unique capabilities were valued by service chiefs:

> I want it to be a nurse practitioner to write orders ultimately to get back to length of stay in the hospital. It doesn't help me to have another nurse ... that can't write orders. When it comes to discharge orders and discharge planning, to have a nurse practitioner ultimately to write orders; it could have been a PA. But I actually wanted a nurse practitioner because I knew a lot of the job was going to be patient and staff education and I thought a [NP] would be better at that. (Site 200)

At Site 200, several years of facility-wide planning involving multiple disciplines determined that an ideal candidate for a stroke coordinator position would need to have a distinct skillset in addition to clinical experience, including the ability to collaborate; strong communication skills; openness to new approaches; and experience with the VA system. Specific clinical experience with stroke was explicitly not a prerequisite for the facilities staffing stroke coordinator positions with APPs. Rather, the skillsets, general knowledge, and boundary spanning abilities of APPs were regarded as primary assets, with an opportunity to learn more about stroke care on the job.

Analysis of longitudinal changes at VAMCs where the status of APPs in stroke coordinator roles changed from absent to present (or vice versa) over the course of the 3-year study further indicated their importance (see Table 2). With the addition of an APP, one medical center (Site 200) moved from an intermediate to an advanced level of organization within 2 years. Conversely, Site 1100 lost an APP midway through the study, and declined in its GO level during the following year.

A second finding was that APPs engaged in boundary-spanning activities on behalf of developing and supporting acute stroke programs at VAMCs. At high performing facilities, APPs drew on their diverse skills, working relationships, and professional competencies to address the particular requirements of timely acute stroke care. Effective APPs were instrumental in making sure that clinicians had timely access to necessary clinical information to members of the broader stroke team at facilities with advanced GO levels. For example, one APP developed an educational stroke packet: each clinician involved in treatment of a patient admitted with an acute stroke had access to a laminated version of the clinical algorithms, checklists for using the NIH Stroke Scale, and the checklist for administering thrombolytic therapy with tissue plasminogen activator (tPA). APPs helped fostered a facility-wide approach to acute stroke care in part through educational activities.

In addition, APPs in stroke coordinator positions drew upon their clinical experience and networks to develop discrete program components. According to one service chief, at one VAMC the APP built the acute stroke care program from the "ground up." This NP coordinated the development of a multidisciplinary pathway by involving neurology, emergency medicine, and postacute providers. Specifically, the APP set up a stroke paging system, developed an electronic observation note for neurology that involved meetings with several disciplines and the medical records committee, and created a database of patients for tracking patients. Some APPs helped identify opportunities for improvement through simulated stroke exercises and the use of "tracers," a method for tracking patient experiences through the hospital:

> We had mock code strokes using robots, you know those little sim robots and they really enjoyed it, even the silly things like you can push buttons and make the robot groan and things like that, the little robot got a stat non-con head CT every time, you know and that was always a fun thing. (Site 900)

Such coordination enabled rapid facility-wide quality improvement projects in ways that were appealing to staff. For example, at Site 200 even after a series of educational "blitzes" aimed at improving understanding about how to deliver tPA, the supply time between pharmacy and the emergency department was stuck at 17 min. To further improve staff coordination and communication, the APP helped coordinate the creation of two portable "stroke kits":

> Rather than having them go one place to get the box of tPA, having to go to the other side of the pharmacy to get the tubing, going to another side to get syringes and needles and things, we basically had them order almost like a fishing tackle box—we made two of them. We have it labeled as a **stroke kit**, and inside the box is every supply you would need to prepare the drug in one spot. (Site 200)

The CFIR domains of Reflecting and Evaluating, Planning, Champions, and Access to Information and Knowledge offer further evidence of the impact of APPs as stroke coordinators (see Table 3 for exemplar quotations). Facilities that achieved high scores for Reflecting and

Table 3 Exemplar quotations of four relevant CFIR constructs at sites with APPs

CFIR construct	APP activities	Exemplar quotations
Reflecting and evaluating	■ Performance data are collected, reported, and regularly shared by APP amongst stroke team ■ Peer- and guideline-based standards used as comparison ■ Data are organized by APP used for service provision and quality improvement projects (e.g., dysphagia screening rates)	"It's not about just the data for this number set, it's pulling it out and saying, where did the goals not get met and how can we make that better? If we're shooting for a 90% passing grade, is that 10% that we didn't achieve because of one factor that can be fixed or mediated or addressed? Is it someone that continues to perpetuate the same pattern or problem, per se? Unless you have that information that comes out of the data, it's pretty numbers. At the monthly stroke meetings [where] everybody gets the data ahead of time, we have a chance to say, this is what this really meant . . . I have a broader picture in terms of the Joint Commission standards are for documentation. I'm the chart police." (Site 100) "I get the data that's stroke care specific related to our Joint Commission and internal VA goals, is reported monthly on the dashboard, which is accessible to many on the team [via] shared drives." (Site 400) "The biggest thing that we battled against at the beginning was this perception that, oh, we're fine with that. And we tried to show them the data that we got through QUERI . . . that can't be right . . . it took a lot to overcome that barrier, we had to do, what we found is we had to do a few things, we had to educate on the stroke measures that is dysphagia screen prior to any oral intake." (Site 900)
Access to knowledge and information	■ Developing systems to ensure that clinical staff have access to necessary diagnostic tools and medication ■ Delivering educational materials for acute stroke regularly and on demand ■ APP uses shared networked drives, handouts, electronic communication, etc. to keep staff trained and updated	"Every year I put together what I call the stroke education book, and it's simply a three-ring binder . . . of recent literature and evidence-based articles of literature that's in the ER that they can just grab and read." (Site 1000) "You remember I had those little plastic badge cards that were [on] how to activate the Stroke Team. So I made sure that I had a whole stack of those so that anybody who came up to the sim lab, they would give them the badge. So anybody who missed getting the badge, even though I had them give it a new nurse orientation I had to give it a ACLS and CPR classes to make sure that the badge got out to everybody about how to activate the Stroke Team." (Site 400)
Champions	■ APP is a champion who doesn't take "No" for answer; constantly talks to others about stroke ■ APP willing to adapt, expand, or create workarounds to existing processes ■ APP is able to work with multiple champions in different disciplines that communicate regularly and have sustained interest in acute stroke ■ Focus on improving facility-level outcomes	"My motto is that if the rules weren't made to be broken, they're made to be bent, and I certainly bend a lot of them." (Site 1000) "One of the nurses from the emergency room volunteered to be the emergency room stroke champion, so he's been very involved with kind of developing this as well, and together me and him and the nurse manager and the nurse educator developed a stroke packet. We have a team of stroke champions, multidisciplinary, most of which originated from the workgroup that developed the care path. We meet weekly to run through our stroke patients for that week and kind of do Multidisciplinary team rounds, but then also just to talk about any issues that arise." (Site 200) "It's coordinating a lot of different clinical services. I think the key that I have found is just making sure that there's buy-in from everybody and having everybody take ownership of this; this is not my program, it's not [Neurologist]'s program, it's, you know, it's everybody's responsibility and everybody's program. What we're doing is not because I say it's the right thing to do or because American Heart Association says that this is a performance measure, but because we're wanting to improve the outcomes." (Site 200)
Planning	■ APP coordination of resources and incentives that are linked to planned developments ■ Quality improvement efforts or strategic plans, typically based on data, that lead toward planned improvements	"There's a lot of strategic planning involved (laugh). It just depends on what the, where the fire is really. With the CARF accreditation, we have three years to prepare, so we're not caught off guard with that. Patient care always comes first." (Site 100) "I was part of the plan-ification, implementation and transitional phase to become a hospital certified stroke protocol facility. They gave me a guideline in terms of we chart the requirements and how soon and how quick they need the results of our initial stroke protocol test, specifically the correlation test which is real important to establish a baseline." (Site 400)

Evaluating (+2) were characterized by APP efforts to create an infrastructure for gathering and reflecting on clinical data in meaningful ways. At one facility, an APP coordinated weekly meetings that were used both to review externally reported data as well as evaluate data from chart audits. At this facility, data-driven reflection on performance required frequent meetings with providers from multiple teams with adequate preparation:

> At the monthly stroke meetings [where] everybody gets the data ahead of time, we have a chance to say, this is what this really meant. This is the numbers, that's what they reflected on. It's not just here's the sheet, here's your numbers. (Site 100)

APPs both acted as champions themselves as well as the nexus between other champions across multidisciplinary stroke teams. In the CFIR construct, champions are defined as individuals who have an intrinsic commitment to change, enthusiastically work toward change without assurance of recognition, and demonstrate creative problem solving (Damschroder et al., 2009). As one APP explained, team-based stroke care often required more than one champion:

> We have a team of stroke champions ... multidisciplinary, most of which originated from the workgroup that developed the care path ... I think the key that I have found is just making sure that there's buy-in from everybody and having everybody take ownership of this.

At facilities with high GO levels, APPs acting as champions reached out to other VAMCs to solicit ideas and share knowledge and took novel approaches to navigating disciplinary boundaries within their own facility.

Advanced VAMCs demonstrated regular, well-attended stroke team meetings where planning activities occurred. At one VAMC, a stroke committee that met monthly decided to pursue hiring a full-time NP in a stroke coordinator program after deliberately assessing deficits in current staffing and the demands of the national stroke directive through a cost-benefit analysis. Once in place, APPs helped ensure that regularly scheduled stroke committee meetings reflected on goals or milestones laid out in strategic plans. Longitudinal analysis indicates that the loss of an APP in a stroke coordinator role had negative consequences. As displayed in Table 2, when Site 1100 lost an APP, who was known affectionately as the "stroke lady," midway through the study, the year-long interval after her departure had lower scores for Reflecting and Evaluating, Champions, and Planning.

Discussion

While the activities of APPs have been generally seen as beneficial to improving the quality of medical care, the interplay of specific processes or contextual factors involved in organizing care has been largely invisible. This study examined acute stroke care teams at 11 VAMCs over 3 years to understand how components of local context specified in CFIR constructs were related to changes in the provision of patient care. Comparative analysis of these cases using a data matrix approach yielded the finding that the presence of an APP actively involved in stroke care in a coordinator role was directly connected to an advanced GO level. This finding was unexpected, emerged late in the analysis, and was not a specific focus of the original research aims. Complementary in-depth analysis of interview data helped explain how APPs worked in conjunction with stroke neurologists to provide and monitor patients across the continuum of care, ensured a facility-wide approach, and played a critical role in crossing disciplinary and service-oriented boundaries. Qualitative analyses indicated that APPs were involved in the activities described by four CFIR constructs: organizing planning efforts; coordinating opportunities to reflect on clinical performance; ensuring that clinicians had access necessary information; and acting as champions themselves and connecting with other clinical champions. Taken together, our findings suggest that APPs may be considered "prime movers" who are uniquely positioned to facilitate quality improvement in stroke coordinator positions.

Moreover, these findings suggest that APPs were involved in a wide range of work activities that involve direct care as well as coordinating team-based meetings. As in other studies that have examined the role of nurses and NPs as boundary spanners, this study found that the work performed by APPs is largely "behind the scenes" and invisible (Abrahamson et al., 2014; Timmermans & Freidin, 2007). Beyond simply coordinating between individuals, APPs in these VA facilities were distinctly able to help providers working in different clinical microsystems work with each other. For instance, NPs were well positioned to translate the concerns of emergency room physicians and neurologists to radiologists, pharmacists, and primary care providers, such as in cases when patients transitioned to outpatient services after being admitted for a transient ischemic attack or stroke. In addition, APPs were able to maintain their role as patient advocates during the transition to outpatient acute stroke care, especially in coordinating effective discharge communication about hypertension control between providers and stroke patients (Rattray et al., 2017). In a telling finding, when champions or strong communication networks were present but APPs were absent, high levels of GO did not result, including facilities where stroke neurologists assumed the lead role in coordinating local stroke teams but there were no APPs in stroke coordinator roles.

The boundary spanning activities of NPs and APPs have important implications for how clinical teams manage complex responsibilities and adapt to shifting demands to deliver high-quality, patient-centered care. Ensuring that cross-service teams have access to the knowledge and information that they need to deal with acute stroke—a high-stakes but relatively low-frequency condition in many VAMCs—entails skills and working relationships that span traditional boundaries. APPs played a dual role in actively promoting a facility-wide approach to stroke care and coordinating planning and data-driven reflection and evaluation. Moreover, they served as champions themselves who worked with other champions in physician or nursing roles. These findings suggest that for facilities with poor quality acute stroke care, VHA leadership may consider investing in full-time equivalent staffing of stroke coordinator positions with APPs.

This study was limited in that it was an observational study that relied on the reports of participants. Its longitudinal and cross-site study design, however, offers insight into variation across time and facilities over a 3-year period. The study also demonstrates how the CFIR framework can be used effectively to systematically compare facilities using a common set of constructs tailored to specific research questions. In this study, identifying the boundary spanning activities of APPs was an emergent, unanticipated finding made possible through this mixed-methods analytical approach.

Conclusion

APPs appeared to play an important role in coordinating evidence-based, facility-wide approaches to AIS care. The presence of APPs connected directly with advanced GO levels. Across multiple cases, APPs worked with multiple services and disciplines to facilitate a facility-wide approach through stroke protocols, monitoring stroke care through ongoing data review and reporting, providing direct care, and convening interprofessional meetings. These important activities by the APP fostered key engagement between clinical providers in neurology, emergency medicine, internal medicine, nursing, and radiology. Most importantly, effective APPs were associated with engaging in reflecting and evaluating on their quality performance data that was associated with facility quality improvement. In acute stroke care teams, APPs played both a "behind-the-scenes" coordinating role as well as a more visible role that benefited both veterans and VA staff at multiple facilities. Compared to other professionals, APPs were uniquely able to monitor and manage the provision of stroke care where rapid, coordinated teamwork is essential to achieving desired clinical outcomes. Given ongoing shifts in the staffing of medical centers, an enhanced understanding of the value that NPs and PAs can bring to clinical teams takes on even more importance. This study indicates that staffing stroke coordinator roles with an APP can pay ongoing, system-wide benefits.

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Appendix

Table A1 CFIR constructs and definitions used in qualitative analysis (Damschroder et al., 2009)

Outer setting	
Patient needs and resources	The extent to which patient needs, as well as barriers and facilitators to meet those needs are accurately known and prioritized by the organization.
Cosmopolitanism	The degree to which an organization is networked with other external organizations.
Peer pressure	Mimetic or competitive pressure to implement an intervention, typically because most or other key peer or competing organizations have already implemented or in a bid for a competitive edge.
External policy and incentives	A broad construct that includes external strategies to spread interventions including policy and regulations (governmental or other central entity), external mandates, recommendations and guidelines, pay-for-performance, collaborative meetings, and public or benchmark reporting.
Inner setting	
Structural characteristics	The social architecture, age, maturity, and size of an organization. Includes organizational structure (e.g., neurology consult, contract MDs).
Networks and communications	The nature and quality of webs of social networks and the nature and quality of formal and informal communications within an organization. How interconnected is the organization.
Culture	Norms, values, and basic assumptions of a given organization.
Tension for change	The degree to which stakeholders perceive there is a current need to change. Dissatisfaction with the status quo.
Relative priority	Individuals' shared perception of the importance of the implementation within the organization—how important is this specific initiative.
Organizational incentives and rewards	Extrinsic incentives such as goal-sharing awards, performance reviews, promotions, and raises in salary and less tangible incentives such as increased stature or respect.

(*Continued*)

Table A1 (*Continued*)

Goals and feedback	The degree to which goals are clearly communicated, acted upon, and fed back to staff and alignment of that feedback with goals.
Learning climate	A climate in which: (a) leaders express their own fallibility and need for team members' assistance and input, or (b) team members feel that they are essential, valued, and knowledgeable partners in the change process, or (c) individuals feel psychologically safe to try new methods, or (d) there is sufficient time and space for reflective thinking and evaluation.
Leadership engagement	Commitment, involvement, and accountability of leaders and managers with the implementation.
Available resources	The level of resources dedicated for implementation and on-going operations, including money, training, education, physical space, and time.
Access to knowledge and information	Ease of access to digestible information and knowledge about the intervention and how to incorporate it into work tasks. The key is access.
Characteristics of individuals	
Self-efficacy	Individual belief in their own capabilities to execute courses of action to achieve implementation goals.
Individual identification with organization	A broad construct related to how individuals perceive the organization and their relationship and degree of commitment with that organization.
Process	
Planning	The degree to which a scheme or method of behavior and tasks for implementing an intervention are developed in advance and the quality of those schemes or methods.
Opinion leaders	Individuals in an organization who have formal or informal influence on the attitudes and beliefs of their colleagues with respect to implementing the intervention
Champions	Individuals who dedicate themselves to supporting, marketing, and driving through an implementation, overcoming indifference or resistance that the intervention may provoke in an organization.
Executing	Carrying out or accomplishing the implementation according to plan.
Reflecting and evaluating	Quantitative and qualitative feedback about the progress and quality of implementation accompanied with regular personal and team debriefing about progress and experience.

Table B1 Group performance (GO) score for acute stroke care (ASC)

Level of proficiency	Type of program	Description
Advanced	ASC SYSTEM + CENTER ASC practices defined by facility-wide ASC system	**ASC Center nationally recognized for excellence.** ASC Center voluntarily applies for and receives advanced certification for ASC by national third-party organization (Joint Commission, DNV, etc.). Facility widely known and recognized for sustained system of excellence in ASC-specific practices. ASC Center routinely provides assistance to outside facilities in response to inquiries and requests for help around developing and/or implementing ASC-specific practices, programs, and/or systems. **ASC system plus real-time monitoring.** ASC practices defined by mature facility-wide multidisciplinary ASC system plus real-time or near-real-time monitoring of ASC patients by ASC Center staff during patients' in-hospital stay. ASC Center staff respond and/or intervene as indicated to meet patient needs and/or meet expectations of ASC system of care (e.g., data or documentation missing from medical record, existing data indicate patient requires timely follow-up, etc.). ASC Center staff can intervene appropriately. Excellence in ASC-specific practices a clear priority of facility. New ASC-specific practices and innovations routinely trialed. **ASC system of care.** ASC practices defined by comprehensive, 24/7 facility-wide multidisciplinary ASC system of care that is mature, supported by an ASC Center that is appropriately and well staffed with part- and/or full-time positions, firmly rooted within larger organization, and can handle the departure of key personnel. ASC Center staff actively support and promote facility-wide ASC program. ASC Center has its own identity largely independent of traditional organizational silos. ASC-specific practices have largely been mastered throughout facility and constitute a full-fledged system of ASC.

(*Continued*)

Table B1 (*Continued*)

Level of proficiency	Type of program	Description
Intermediate	COMPREHENSIVE ASC PROGRAM ASC practices defined primarily by facility-wide ASC program	**ASC practices defined by facility-wide ASC program, 24/7.** ASC practices defined primarily by comprehensive facility-wide ASC program rather than traditional organizational silos or individual provider preferences. ASC protocols and procedures implemented, with formal collaboration mechanisms (pagers, codes, stat alerts, etc.) in place and used routinely. Proficient ASC consistently provided throughout facility on 24/7 basis, and cross-service ASC-specific practices coordinated across all areas and all shifts. Providers feel sense of responsibility and/or accountability for ASC outside of their own immediate area. **ASC practices defined by facility-wide ASC program, regular business hours.** ASC practices defined primarily by comprehensive facility-wide ASC program rather than traditional organizational silos or individual provider preferences. ASC protocols and procedures implemented, with formal collaboration mechanisms (pagers, codes, stat alerts, etc.) and used routinely. During regular business hours, proficient ASC consistently provided throughout facility and cross-service ASC-specific practices coordinated across all areas. Providers feel sense of responsibility and/or accountability for ASC outside of their own immediate area.
Developing	ASC PROJECTS POLICIES; DISCRETE COMPONENTS Cross-service practices emerging specific to ASC; developing facility-wide ASC approach	**Implementation of facility-wide approach specific to ASC**. Providers from different clinical areas coordinating cross-service practices related to components of ASC-specific care. Cross-service communication and collaboration around ASC starting to happen routinely. Basic ASC protocols and procedures have been developed and formally approved, and their implementation has begun. Variation in ASC practices based on individual providers within services and units not a major issue. **ASC practices influenced by cross-service processes, with development of facility-wide approach specific to ASC.** Multidisciplinary group starting to develop a facility-wide approach specific to ASC that formally coordinates cross-service ASC-specific care and transcends traditional organizational silos. ASC-specific protocols, procedures, templates, collaboration mechanisms, etc. at least partially developed. ASC practices vary based on shift and clinical area.
Beginning	PEOPLE ASC practices defined by traditional organizational silos and individual providers; no facility-wide approach to ASC	**ASC practices dominated by organizational silos and individuals, with some collaboration around specific ASC practices.** Traditional silos of units, departments, and services dominating ASC practices. Clusters of providers within and/or across departments and services starting to communicate and collaborate on semiregular basis around particular ASC-specific practices and initiatives. No multidisciplinary stroke team or program. ASC practices vary based on shift and clinical area. No facility-wide approach specific to ASC. **ASC practices defined by organizational silos and individuals, with some individual-driven ASC activity**. Individuals practicing on their own within traditional silos of units, departments, and services. Cross-service ASC-specific practice and communication occurring on limited, ad hoc basis based on individual providers involved. Certain individuals pursuing ASC-specific practice-based initiatives based on own priorities and areas of perceived need. No mechanisms designated specifically for ASC-specific cross-service communication. No special procedures for responding to in-hospital strokes. No multidisciplinary ASC stroke team or program. ASC practices vary based on shift and clinical area. No facility-wide approach specific to ASC. **ASC practices defined by organizational silos and individuals.** Individuals practicing on their own within traditional silos of units, departments, and services, with no sense of responsibility or accountability for ASC outside their area. Little to no activity, communication, or collaboration happening related specifically to ASC. No multidisciplinary ASC program. Substantial variation in ASC practices within services and units based on individual providers. No mechanisms designated specifically for cross-service communication for ASC patients. No special procedures for responding to in-hospital strokes. No facility-wide approach specific to ASC.