Synchronous neurology–primary care collaboration in a medical home

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Abstract

Background

Synchronous collaboration as defined by a simultaneous encounter between primary care providers (PCPs), patients, and neurologists may improve access to neurologic expertise, care value, and satisfaction of PCPs and patients. We examined a series of synchronous collaborations and report outcomes, PCP satisfaction, downstream utilization, and illustrative case examples.

Methods

Within an outpatient collaborative primary care–neurology care model, we implemented synchronous video consultations from a central hub to satellite clinics while increasing availability of synchronous telephone and face-to-face collaboration. PCP experience was assessed by a post-collaboration survey. Individual cases were summarized. Clinical and utilization outcomes were assessed by a neurologist immediately after and by follow-up chart review.

Results

A total of 58 total synchronous collaborations were performed: 30 by telephone (52%), 18 face to face (31%), and 10 by video (17%) over 27 clinic half-days. The most frequent outcomes as assessed by the neurologist were reassurance of the PCP (23/58; 40%) and patient (22/59; 38%), and the neurologist changed the treatment plan (23/58; 40%). A subsequent face-to-face consultation was completed in 15% (6/58) of patients initially assessed by telephone or video. Test utilization was avoided in 40% (23/58). Unintended utilization occurred 9% (5/58). Most PCPs were very satisfied with the ease of access, quality of care, and reported high likelihood of subsequent use. PCPs perceived similar or less time spent during synchronous vs asynchronous collaboration and neurologist usually altered the testing (87.8%) and treatment plan (95.2%).

Conclusions

Synchronous collaboration between neurologists and PCPs may improve timely access to neurologic expertise, downstream utilization, and PCP satisfaction.

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In 2014, we implemented a care model of integrated community neurology (ICN) at our institution. The ICN model colocates general neurologists within a primary care medical home and blocks time within neurologist clinical calendars to collaboratively deliver specialty advice via electronic, curbside, and face-to-face consultations. In a pilot study, the ICN model was associated with improved access to subspecialists, decline in unnecessary face-to-face visits, and reductions in testing utilization without compromising patient safety.¹

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The ICN model includes both synchronous (patient evaluated at the same time) and asynchronous (patient evaluated at different times) primary care–specialty collaboration. Asynchronous collaboration occurs when a primary care provider (PCP) and specialist communicate without the presence of the patient. Examples of asynchronous collaboration include electronic consultations and curbside consultations by telephone or electronic health record messaging when the patient is not present. Synchronous collaboration is defined by a shared real-time care encounter that includes the patient, PCP, and specialist. Examples of synchronous collaboration in neurology include telestroke^{2,3} and teleneurology^{4,5} in the hospital setting. Outpatient synchronous collaborative care delivery models have not been well described.⁶ In the ICN pilot study, synchronous collaborations were not specifically distinguished from asynchronous collaborations.¹

For the present study, we increased the availability of the ICN specialist to provide synchronous telephone and face-to-face consultations and established synchronous video consultations from a central location to satellite clinics. We report types of synchronous collaboration with outcomes, PCP satisfaction, follow-up care and utilization, and illustrative case examples.

Methods

Stakeholders and preparation

The Mayo Clinic Employee and Community Health practice comprises Internal Medicine, Family Medicine, and their trainees serving the primary care needs of 155,000 individuals residing in Olmsted County and adjacent communities in Southeastern Minnesota. The ICN practice is part of a multi-specialty collaborative group practice called the Integrated Community Specialty Clinic (including neurology, cardiology, gastroenterology, sleep medicine, spine, and behavioral health).

The pilot study proposal was drafted and approved by the Mayo Clinic IRB #17-004474 and designated a quality improvement project not requiring written informed patient nor provider consent. The proposal was presented to the ICN leadership team and the neurology department chair. Administrative approval was granted to proceed with operational planning and implementation. Neurologist face-to-face visit schedules were blocked from scheduling in advance for 2 half-days per week for 6 months to avoid patient scheduling that would interfere with synchronous collaboration. A telemedicine practice administrative team assisted with navigating the proposal through the legal department, compliance experts, and technical requirements of internet connectivity with satellite clinics, establishing wired video connection at the central location of the neurologist, and granting electronic access to providers. A single electronic tablet with the InTouch Health telemedicine software application was installed in a central location in each of 3 satellite clinics.⁷

In the weeks leading up to the pilot initiation, the telemedicine practice administrative team and neurologist attended monthly department meetings at the satellite clinics to inform them of the pilot. During these meetings, the use of video or nonvideo synchronous collaboration was encouraged during the pilot time. Primary care teams were encouraged to use which mode of collaboration seemed best for their patient at the time of a visit. A schedule of pilot time was posted in each primary care examination room alongside ICN provider contact information. PCPs were instructed to contact the neurologist via a service pager with dual capability of being activated by phone or text page via an intranet-based hyperlink. Phone calls not immediately answered were routed to the ICN clinical assistants who were instructed to take a message regarding the purpose of call, intent, and call back number, which was shared with the covering neurologist. PCPs were also invited to text page the ICN neurologist directly.

Clinical assistants and nursing staff were informed of the pilot and instructed on the location, care, and activation of the electronic tablets, which provided the interface for the video consultation. PCPs could retrieve the tablet independently or via a care team member. Once connected by telephone, the PCP and neurologist mutually agreed if the subsequent collaboration would occur by telephone, face to face (if located in the same building), or video (to a satellite clinic with video support). At the conclusion of the collaboration, the PCP completed the clinical encounter as usual and documented the collaboration in the clinical note. Telephone collaborations were documented by the PCP only. Separate consultation notes were documented by the ICN neurologist for all face-to-face and video consultations. The video consultation note included a disclaimer documenting that the patient was assessed via video only. Face-to-face visits were billed based on standard billing requirements. No charge was submitted for telephone or video collaborations.

Intervention adaption

Because of low collaboration volumes after 2 weeks, the ICN neurologists sent personal email reminders to primary care teams using an email distribution list at the beginning of each pilot afternoon.

Assessments

Types and outcomes of synchronous collaborations

Synchronous case collaborations were prospectively documented in a REDCap⁸ database. The same day as the collaboration, the ICN neurologist participating in the collaboration documented a brief summary of each case with a qualitative assessment of outcomes including PCP reassurance, patient reassurance, confirmation of PCP diagnosis, expedited testing or specialty consultation, confirmation of PCP treatment plan, and change of PCP diagnosis or treatment plan. More than 1 outcome was possible for each case. Frequency of consultations, types, and outcomes were quantified.

PCPs perceived similar or less time spent during a synchronous compared with an asynchronous collaboration. Most PCPs perceived an alteration in the diagnosis and patient treatment.

Satisfaction of referring primary care providers and patients with synchronous collaborations

An electronic satisfaction survey was developed and administered via REDCap⁸ and sent to PCPs after participating in all types of synchronous collaboration. A paper satisfaction survey was developed for patients participating in the video consultations only and provided immediately after the video interaction.

Postsynchronous collaboration follow-up care and utilization

A retrospective follow-up electronic medical record chart review was planned at least 6 months after collaboration and performed by a single ICN neurologist (N.P.Y.) to assess follow-up outcomes and utilization.

Case examples of synchronous collaboration

Representative individual cases were selected to highlight collaborations associated with the main outcomes assessed including patient or PCP reassurance, confirmation of PCP diagnosis or treatment, alteration of PCP diagnosis or treatment, safe avoidance of unnecessary testing, and unintended utilization or potential harm.

Results

Types and outcomes of synchronous collaborations

The ICN team conducted 58 total synchronous collaborations by telephone (30/58; 52%), face to face (18/58; 31%), and video (10/58; 17%) over 27 clinic half-days (table 1). The median number of collaborations per half-day was 3.5 (range 1–6). Most patients had not been evaluated by the neurology service previously (45/58; 78%). The most frequent outcomes as assessed by the neurologist for all collaborations were reassurance of the PCP (23/58; 40%) and patient (n = 22/59; 38%), and the neurologist changed the treatment plan (23/58; 40%). The neurologist infrequently changed the PCP diagnosis (3/58; 5%). A subsequent face-to-face consultation was recommended and completed in 15% (6/58) of patients assessed initially by telephone or video collaboration.

Headache was the most common diagnosis (21/58; 36%) with a broad distribution of general neurologic problems

(figure 1). In a subset analysis of the collaborations for headache, 71% (15/21) were by telephone, 24% (5/21) were video, and 5% (1/21) were face-to-face consultation.

Satisfaction of referring primary care providers and patients with synchronous collaborations

Overall, PCPs were very satisfied with the ease of access, quality of care, and likelihood of using the service again (table 2). PCPs perceived similar or less time spent during a synchronous compared with an asynchronous collaboration. Most PCPs perceived an alteration in the diagnosis and patient treatment. All but 1 PCP indicated that they would definitely use the service again, and the remaining PCPs probably would use the video option again. Patients participating in video collaboration were all able to see and hear well. Most patients 66% (4/6) felt that the video consult was the same or better than a traditional face-to-face consultation (table 3). All patients felt that the quality of care via video was very good (1/6) or excellent (5/6).

Postsynchronous collaboration follow-up care and utilization

The median time from patient encounter to follow-up chart review was 10 months (range 8–13 months). Utilization was avoided in 40% (23/58) of collaborations (figure 2). Unintended utilization occurred after a synchronous collaboration in 9% (5/58) including emergency department visit and CT of the head (n = 1), electromyogram (n = 1), brain MRI (n = 1), and neurology face-to-face consult (n = 2). In 3 cases, we estimated that an earlier face-to-face visit with a neurologist

Table 1 Synchronous collaboration types and outcomes

	Total (n = 58)
Collaboration types	
Synchronous telephone, n (%)	30 (52)
Synchronous face to face, n (%)	18 (31)
Synchronous video, n (%)	10 (17)
Collaboration outcomes ^a	
PCP reassurance, n (%)	23 (40)
Patient reassurance, n (%)	22 (38)
Confirmation of PCP diagnosis, n (%)	21 (36)
Expedited testing or specialty consultation, n (%)	19 (33)
Confirmation of PCP treatment plan, n (%)	14 (24)
Changed PCP diagnosis, n (%)	3 (5)
Changed PCP treatment plan, n (%)	23 (40)

Abbreviation: PCP = primary care provider.
^a More than 1 outcome per encounter possible.

may have avoided an MRI/EEG for a patient with syncope, a brain MRI in a headache patient, and ineffective medication trial for essential tremor in a patient with a parkinsonian tremor.

Case examples of synchronous collaboration

A brief summary of each individual case is included in appendix e-1 (links.lww.com/CPJ/A146). The following cases were selected to highlight the strengths and limitations of synchronous collaboration.

Case 13—synchronous face to face: emergency department visit avoided

An 85-year-old woman with chronic lymphocytic leukemia and multiple medical comorbidities presented to primary care with back pain and right leg pain and paresthesia developing over days without fever. Pain medications were helpful but associated with partial urinary retention. Synchronous face-to-face evaluation demonstrated a reduced patellar reflex and no signs of myelopathy. Without the timely specialty assistance, the PCP stated that they planned to send to the emergency department for an emergent MRI. After

Collaboration of all types was associated with avoidance of downstream utilization of face-to-face neurologic consultations and diagnostic testing.

evaluation, the neurologist recommended a plan for pain control and urgent outpatient imaging, which was safely performed after the weekend. Lumbar MRI demonstrated an intervertebral disk herniation that improved with conservative management.

Case 31—synchronous telephone: PCP and patient reassurance, brain MRI avoided

A 43-year-old woman attended a primary care visit for increasing frequency and severity of migraine headaches.

Figure 1 Frequency of neurologic problem type

Table 2 Survey of primary care provider experience of synchronous collaboration

Survey question	Telephone (n = 20)	Face to face (n = 14)	Video (n = 7)	Total (n = 41)
First collaboration (n, %)	Yes (6, 30.0%)	Yes (2, 14.3%)	Yes (4, 57.1%)	Yes (12, 29.2%)
	No (14, 70.0%)	No (12, 85.7%)	No (3, 42.9%)	No (29, 70.8%)
Ease of obtaining	Excellent (14, 73.7%)	Excellent (11, 84.6%)	Excellent (5, 71.4%)	Excellent (30, 73.2%)
	Very good (4, 21.1%)	Very good (2, 15.4%)	Very good (2, 28.6%)	Very good (8, 19.5%)
	Good (1, 5.3%)	Good (0, 0.0%)	Good (0, 0.0%)	Good (0, 0.0%)
	Fair (0, 0.0%)	Fair (0, 0.0%)	Fair (0, 0.0%)	Fair (0, 0.0%)
	Poor (0, 0.0%)	Poor (0, 0.0%)	Poor (0, 0.0%)	Poor (0, 0.0%)
Time spent vs asynchronous telephone or medical record inbox message	Faster (17, 85.0%)	Faster (11, 78.6%)	Faster (4, 57.1%)	Faster (32, 78.0%)
	Similar (2, 10.0%)	Similar (2, 14.3%)	Similar (2, 28.6%)	Similar (6, 14.6%)
	Slower (1, 5.0%)	Slower (0, 0.0%)	Slower (1, 14.3%)	Slower (2, 5.0%)
	Not sure (0, 0.0%)	Not sure (1, 7.1%)	Not sure (0, 0.0%)	Not sure (1, 2.4%)
Time spent vs asynchronous electronic consultation	Faster (18, 90.0%)	Faster (13, 92.9%)	Faster (5, 71.4%)	Faster (36, 87.8%)
	Similar (2, 10.0%)	Similar (0, 0.0%)	Similar (1, 14.3%)	Similar (3, 7.4%)
	Slower (0, 0.0%)	Slower (0, 0.0%)	Slower (1, 14.3%)	Slower (1, 2.4%)
	Not sure (0, 0.0%)	Not sure (1, 7.1%)	Not sure (0, 0.0%)	Not sure (1, 2.4%)
Altered which tests I would have ordered without collaboration	Yes (17, 85.0%)	Yes (13, 92.9%)	Yes (6, 85.7%)	Yes (36, 87.8%)
	No (1, 5.0%)	No (0, 0.0%)	No (1, 14.3%)	No (2, 4.9%)
	Not sure (2, 10.0%)	Not sure (1, 7.1%)	Not sure (0, 0.0%)	Not sure (3, 7.3%)
Altered treatment plan I would have recommended without collaboration	Yes (18, 90.0%)	Yes (14, 100.0%)	Yes (7, 100.0%)	Yes (39, 95.2%)
	No (1, 5.0%)	No (0, 0.0%)	No (0, 0.0%)	No (1, 2.4%)
	Not sure (1, 5.0%)	Not sure (0, 0.0%)	Not sure (0, 0.0%)	Not sure (1, 2.4%)
How likely to use again?	Definitely (20, 100.0%)	Definitely (14, 100.0%)	Definitely (6, 85.7%)	Definitely (40, 97.6%)
	Probably (0, 0.0%)	Probably (0, 0.0%)	Probably (1, 14.3%)	Probably (1, 2.4%)

Synchronous telephone evaluation provided reassurance to patient and PCP that a brain imaging study could safely be avoided. Triptan and preventive therapies were recommended. The patient improved and did not require imaging or specialty consultation.

Case 40—synchronous telephone: neurologist altered diagnostic testing and expedited diagnosis and treatment

A 40-year-old woman without a previous history of headache presented to primary care with a new, severe unusual occipital headache for 1 week. The PCP assessed the patient and called the neurologist who assisted with obtaining further history over the speakerphone that the pain was mainly unilateral and not consistent with a primary headache disorder. PCP stated that they had planned a brain MRI with contrast and inquired about further evaluation and treatment. Neurologist recommended a magnetic resonance (MR) angiogram of the neck with

consideration of dissection and recommended aspirin and avoidance of triptan medication. The MR angiogram confirmed a vertebral artery dissection, and the patient was subsequently seen by the general neurologist and a cerebrovascular subspecialist.

Case 49—synchronous video: the patient with headache was not reassured and attended an emergency department visit

A 24-year-old female health care provider presented to a satellite clinic with a migraine headache after a minor head injury without loss of consciousness. The patient was evaluated by synchronous video evaluation. The neurologist reassured the patient and PCP that imaging could safely be avoided and recommended treatments for migraine treatment. The patient attended an emergency department visit the following day where a head CT was normal. There was no further follow-up for migraine or concussion.

Table 3 Patient experience with video consultation

Summary survey question	Response total (n = 6)
Was this your first video consult?	Yes (6, 100%)
Able to see the neurologist well?	Yes (6, 100%)
Able to hear the neurologist well?	Yes (6, 100%)
How did your experience compare with traditional face-to-face consultation?	Better (2, 33%)
	Same (2, 33%)
	Worse (0, 0%)
	I do not know (2, 33%)
Overall quality of care?	Excellent (5, 83%)
	Very good (1, 17%)
	Good (0, 0.0%)
	Fair (0, 0.0%)
	Poor (0, 0.0%)

Case 55—synchronous video: assessment of tremor altered PCP diagnosis and expedited further evaluation and treatment

A 72-year-old man presented to a satellite clinic with tremor. Synchronous video evaluation allowed the neurologist to diagnose a resting tremor mixed with essential tremor and confirm that the patient did not want treatment of the essential tremor. After the video visit, the patient attended a routine face-

to-face neurology consultation. A carbidopa/levodopa trial was initiated instead of treatment for essential tremor. The patient reported improved quality of life and function at last follow-up.

Discussion

We describe synchronous telephone, face-to-face, and video collaboration between PCPs and a neurologist within a primary care medical home. Most PCPs perceived that synchronous collaboration was faster or just as fast for them as asynchronous collaboration (electronically or by telephone). Most PCPs also perceived that the neurologist altered the diagnosis and treatment plan for patients, although the neurologist perceived fewer changes in diagnosis or treatment. PCPs reported high levels of satisfaction with all types of synchronous collaboration and intent to use the services again. We observed a lower frequency of requests for synchronous video than for synchronous telephone and face-to-face consultations. Collaboration of all types was associated with avoidance of downstream utilization of face-to-face neurologic consultations and diagnostic testing.

These findings help to support our previous observations that the ICN model including primary care–neurology collaboration is associated with safe reduction of face-to-face neurology visits and diagnostic testing.^{1,9} Unlike the pilot study of the ICN model, this study uniquely highlights synchronous collaboration including a video option for PCP but does not include further assessment of asynchronous collaboration, which remains a major part of the ICN practice.

Figure 2 Estimated test utilization avoided

We observed a difference between PCP and neurologist perception of whether the collaboration altered the diagnosis or treatment plan. Both assessments were subjective and subject to the bias of the individuals assessing the effect of the collaboration. Further study is suggested to better understand this difference and the potential under- or over-estimation of the value of synchronous collaboration.

Synchronous video consultations via telestroke³ or teleneurology^{10–13} services have demonstrated safety and efficacy mainly in the inpatient or emergency setting but usually do not include the referring provider in a collaborative effort. We were able to demonstrate feasibility of synchronous video collaboration within the outpatient practice. Synchronous video consultation was used less than other synchronous care options. The total number of video collaborations performed and patient and PCP surveys returned were small and may have included significant selection bias toward the favorable results observed. Further study is needed to better understand why the volumes of video collaboration were so low and if video may be preferred over telephone consultation as it is in telestroke.¹⁴ It is possible that video visits were perceived as more time consuming and less user friendly due to the inefficiency of connecting to a single computer tablet located outside of the patient examination room, but the provider survey did not show this to be the experience of those that used the service.

Strengths of the study include the assessment of a novel approach to providing care for patients with neurologic symptoms and disease, use of multimodalities that PCPs could select depending on perceived patient need, and assessment of the PCP experience. We prospectively assessed cases and outcomes of the consultations in a large series of patients with typical general neurologic symptoms or diagnosis. The reported observations are novel and will help justify further study to determine the value, indications, and most efficient types of collaboration. Inclusion of PCP satisfaction helped to balance any bias of the neurologists collecting the data and analyzing outcomes of individual cases.

Our study has several limitations. We did not directly compare synchronous to asynchronous collaboration with respect to patient outcomes or patient and provider satisfaction. During the pilot, we encouraged the utilization of the service with email reminders of neurologist availability, which may have falsely increased the utilization of synchronous collaboration when other sources of advice may have been used by accessing online resources, other primary care colleagues, or asynchronous collaboration. Also, chart reviews were not blinded, and case descriptions were summarized from the perspective of the neurologists who also provided the collaborations. We did not assess the perceptions of the neurologists because of the small numbers of providers. We also did not assess patient satisfaction with nonvideo collaboration to avoid prolonging the complexity of synchronous evaluations, which may have reduced utilization. Finally, we did not assess the duration of each type of consultation or burden of documentation.

The generalizability of synchronous collaboration is likely most limited by economic factors. Practitioners in practices with geographically proximate specialty and primary care practices with financial models that support innovation and do not restrict practices to strict fee for service might lend themselves to adopting this model. Curbside consultations are already common in the practice of medicine. Any neurologist could provide the expertise required of a synchronous collaboration with a PCP, but most are not given time reimbursement for these services and may work in compensation systems that disincentivize reductions billable services. A salary compensation model or productivity credit for this work would likely be needed to align provider compensation with nonbillable collaborative work for the benefit of patients and the overall practice. Key institution factors that may help justify time for collaboration at ours and similar institutions include (1) preservation of access for high-demand high-yield complex care in subspecialty practices by allowing a general neurologist to care for more patients in collaboration with primary care and (2) economic incentives to improve the value of care for self-insured employees and their dependents and populations of patients in a capitated or shared-risk payment model such as an accountable care organization. Additional economic factors not directly related to revenue that require further study include ability to improve patient care outcomes, recruit and retain providers, reduce provider burnout, and improve patient satisfaction. When compared with a traditional consultative neurology practice at our institution, we have already demonstrated that collaborative care models reduce utilization.⁹ Value-based payments models should consider these findings and novel ways to economically support collaborative practice models.¹⁵

The cost of care and burden of neurologic disease are rising at a time when health care reimbursement is moving toward value-based payment models.¹⁵ Health care organizations are challenged to develop sustainable clinical care models that improve care outcomes at less cost while facing provider shortages^{16–19} and burnout.^{20,21} Development of “medical neighborhoods” incorporating specialists into the primary care medical home has been promoted as a model for improving value by increasing care coordination and reducing unnecessary referrals and diagnostic testing.²² The ICN care model at our institution was developed in part to address these challenges. This study highlights the potential value of primary care–neurology care models that include synchronous collaboration between neurologists and PCPs to improve timely access to neurologic expertise, downstream utilization, and PCP satisfaction.

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TAKE-HOME POINTS

- Synchronous primary care–neurology collaboration occurs when the patient, PCP, and neurologist collaborate together in real time.
- Synchronous collaboration is feasible in practice and may improve access to neurologic expertise and downstream utilization.
- Collaborative care models that provide access to synchronous collaboration may be economically viable for practices with high demand for care and incentives to contain cost of care.
- PCPs are satisfied with synchronous collaboration and perceive that a neurologist often changes their diagnosis and treatment plan.
- Which types of synchronous collaboration are most effective, efficient, and preferred by PCPs and patients requires further study.

Disclosure

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David B. Burkholder, MD	Mayo Clinic, Rochester, MN	Major role in the acquisition of data; analyzed the data; and revised the manuscript for intellectual content

Appendix (continued)

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