Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
Clinical short communication

Integrating neurology and pharmacy through telemedicine: A novel care model

Hanlin Li a,*, Imama A. Naqvi b, Sarah E. Tom c, Barbara Almeida b, Yuliya Baratt a, Christina M. Ulane b

a Department of Pharmacy, NewYork-Presbyterian Hospital, USA
b Department of Neurology, Columbia University Irving Medical Center, NewYork-Presbyterian Hospital, USA
c Department of Neurology and Epidemiology, Columbia University Irving Medical Center, USA

ARTICLE INFO

Keywords:
Teleneurology
Telepharmacy
Ambulatory care

ABSTRACT

Teleneurology had been best studied in acute stroke care, but the Coronavirus (COVID)-19 pandemic has highlighted applicability in outpatient practice. Telepharmacy is a convenient method for pharmacists to provide medication management to enhance care. Studies in the outpatient space suggest non-inferiority of teleneurology to increase access to specialized care for patients in rural locations. The role of telemedicine based interdisciplinary collaborations in a metropolitan and under-resourced setting has not been explored. We describe our approach to a teleneurology-telepharmacy collaboration at an urban academic medical center. Since its implementation pre-COVID, the program has expanded and transformed to serve the community further.

1. Introduction

Telemedicine is fast gaining acceptance as a health care delivery model. Access to neurological care in some areas is in part due to a shortage of neurologists. Telemedicine holds promise as a means for a cost-effective and efficient manner in which to increase access to care. Teleneurology was implemented most widely in acute stroke care before the COVID-19 pandemic. In the outpatient setting, teleneurology was utilized mainly to increase specialized neurological care for patients in remote or rural locations. [1,2] The pandemic has incentivized further infrastructure development and policies to expand these efforts. [3] Multiple specialties have reported the noninferiority of teleneurology when evaluating access to care and health outcomes. [4] Additionally, data suggest feasibility, acceptability, and cost savings for teleneurology in the outpatient setting. [5] This shift offers an opportunity to advance healthcare delivery and the potential to promote interdisciplinary collaboration. [6] A team-based care approach incorporating pharmacy can prevent medication errors and enhance clinical engagement to improve patient health outcomes. [7] Telemedicine may be a resource-efficient approach to improve health care through collaborative pharmacist services for neurology patients. [8] Telepharmacy interventions may positively impact disease management for specific disorders regarding utilization, self-management, and adherence. [7,9]. However, literature is scarce on the broader incorporation of telepharmacy services among patients with chronic general neurological conditions.

At our urban academic center, we serve the local community of patients who experience several barriers to care, including physical and cognitive disability due to chronic neurological disease, socioeconomic constraints, and limited digital and health literacy. Interdisciplinary care and the need to create digital health equity has great potential for under-resourced populations. [10] We developed and implemented a novel clinical care model to improve access to neurological and interdisciplinary care. The purpose of this report is to describe our experience of a teleneurology-telepharmacy collaboration, with a focus on refining and sustaining telepharmacy services to patients with chronic neurological conditions through the pandemic and beyond.

2. Methods

2.1. Program launch

Outpatient telemedicine in our general neurology practice began as a pilot in 2018 with three goals: 1) explore the feasibility of converting in-person follow-up appointments to telemedicine, 2) introduce telepharmacy services to enhance neurological care delivery, and 3) assess patient receptiveness to telehealth. A single-center, descriptive study
was completed to evaluate the program and its objectives. This study was reviewed and approved by the Institutional Review Board at New York-Presbyterian Hospital/Columbia University Irving Medical Center.

For the purposes of our program, we define teleneurology and telepharmacy as two-way video-conferencing between patient and neurologist, and patient and pharmacist, respectively. Existing patients in the Adult General Neurology Ambulatory Care Network Clinic were screened and approached for potential conversion from in-person to video follow-up appointments.

The structure of the paired video visits was as follows (Fig. 1A):
1st video appointment - telepharmacy: patient meets with the clinical pharmacist who provides patient care and completes documentation.

2nd video appointment - teleneurology: patient meets with the neurologist for clinical follow-up assessment. Prior to visit, neurologist has reviewed telepharmacy documentation and is prepared to discuss any issues related to medication adherence, tolerance and effectiveness.

An internal questionnaire developed through pharmacist and physician group feedback assessed patient experience and acceptability of the new care model. Patients who completed video visits received a phone call from the team to participate in an anonymous survey. The questions evaluated the patient’s comfort and satisfaction level around the quality of visits (Supplemental material).

2.2. Current state

As circumstances changed due to the coronavirus pandemic, our teleneurology and telepharmacy model adapted (Fig. 1B). Building on the pilot program, collaboration has continued and undergone several changes with Plan-Do-Study-Assess learning theory implementation into a patient-tailored program. [12] Beginning in March 2020 through June 2021, all neurology visits were converted from in-person to telemedicine to ensure patient, physician and staff safety during the height of the pandemic. Telepharmacy services were optimized to meet patient and practice needs. Based on information gathered from the pilot, the timing of the telepharmacy visit was adjusted to occur after the teleneurology visit, by referral from the neurologist or pharmacist self-referral based on criteria developed with careful consideration of goals and objectives of our collaborative efforts (Table 2).

In the most recent expansion phase, telepharmacy services are now integrated into an interdisciplinary secondary stroke prevention clinic [6]. The team developed a collaborative drug therapy management agreement for the co-management of hypertension in stroke patients under New York State law. [11] The agreement allows the pharmacist to address medication issues during care transitions and triages to follow-up services as appropriate to optimize post-discharge stroke patient care.

3. Results

During the initial program launch in May 2018 through March 2019, a total of 103 video visits (teleneurology and telepharmacy combined) with 56 unique patients were completed. A significant reduction in time spent per visit was observed. The average duration for an in-person neurology follow-up appointment at the clinic was approximately 90 min from check-in to check-out; the average combined duration of teleneurology plus telepharmacy appointments was approximately 35 min. Patient perception of the new model was assessed through the survey. Seventeen (30%) patients were reached and agreed to participate. Most agreed that the quality of the video visit was better than or the same as that of an in-person visit, and felt comfortable speaking with the neurologist and pharmacist during the video visit.

With the onset of the pandemic and the change in our teleneurology-telepharmacy model, a total of 103 telepharmacy visits were completed between April 2020 through January 2021. Clinical and demographic characteristics of patients participating in telepharmacy visits since the pandemic are shown in Table 1. Approximately half of the patients were non-English speaking, a majority were women (76%), most were seen for general neurological conditions such as migraine (79%), and the remainder (21%) were seen for various subspecialty conditions.

The patient-centered criteria developed for referral to telepharmacy and data regarding the frequency of utilization are shown in Table 2. Most patients were referred for a single criterion (84%). For those meeting two or more criteria, many required multiple telepharmacy appointments to meet the needs.

4. Discussion

We have described the implementation and feasibility of
telemedicine in an underserved patient population at an urban academic center. Our novel collaboration provided more efficient care and was generally well-accepted by patients. Our outpatient practices had to be drastically adapted due to the pandemic. Most significantly, this entailed a complete transition to telemedicine. Given this change and from our experience with the pilot teleneurology and telepharmacy program, we modified our workflow to better suit the needs of our patients. Criteria for referral to telepharmacy were created to reflect the standard treatment plans and changes that occur during a neurology visit. We demonstrated that both neurologist-referral and pharmacist review and self-referral effectively recruited patients for telepharmacy visits.

Our clinic serves a diverse population with chronic neurological conditions. Patients with general neurological diagnoses, such as migraines, neuropathy, back pain, and those with sub-specialty conditions including epilepsy, stroke, neuro-immunology participated in telepharmacy. Patients have often prescribed complicated medication changes with the initiation of medications, titration of doses, and or discontinuation of therapy all at the same time. The telepharmacy visit reinforces these changes, answers drug-related questions, and likely helps to ensure adherence and effectiveness of the regimen. Timely identification of medication-related issues and communication with the neurology team expedites problem resolution, and we presume this enhances the quality of care.

Patient perception of teleneurology and telepharmacy was evaluated using an internally-developed survey during the program’s initial phase. Understanding the needs of our diverse population is crucial to optimize health-related information provided and adjust our processes. [10] Education tools that are language-specific and designed with community participatory design to promote medication adherence may be one such approach. Routine assessment of patient and provider experience with telemedicine may be considered to improve workflows further.

There are opportunities to grow the telepharmacy services. In particular, integrated care with pharmacy-guided support to address barriers to medication adherence has been shown to augment blood pressure control in hypertensive patients. [12] Such an collaboration may improve secondary stroke prevention through vascular risk factor control. Our center developed a comprehensive agreement covering multiple associated disease states under the stroke umbrella, allowing pharmacists to augment care in these patients by titration of medications in between specialist appointments. Sub-specialties such as epilepsy and multiple sclerosis may also leverage and benefit from telepharmacy services. [13,14]

Our study has a small data sample and measured process metrics. Focus groups to understand the barriers and promoters among stakeholders in the community may inform our collaborative approach to include diverse populations. In the future, we hope to evaluate clinical outcomes of patients with chronic neurological diseases and the role of teleneurology and telepharmacy in these outcomes.

To our knowledge, this is the first study to describe a patient-centered teleneurology-telepharmacy interdisciplinary collaboration in an outpatient neurology clinic at an urban academic center with an underserved patient population. The further development of a sustainable model of teleneurology and telepharmacy integration has the potential to improve access to care, quality of care and efficiency of care.

Author contributions

HL and CMU conceived and implemented the program and collected the data. BA coordinated patients and providers. SET performed data analysis. HL, YB, and IAN drafted a significant portion of the manuscript and carried out the workflow. All authors discussed the results and contributed to the final manuscript.

Declaration of competing interest

All authors have no relevant conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jns.2021.120085.

References

[1] E.R. Dorsey, et al., Teleneurology and mobile technologies: the future of neurological care, Nat. Rev. Neurol. 14 (5) (2018) 285–297.
[2] R.B. Schneider, K.M. Biglan, The promise of telemedicine for chronic neurological disorders: the example of Parkinson’s disease, Lancet Neurol. 16 (7) (2017) 541–551.
[3] A.C. Smith, et al., Telehealth for global emergencies: implications for coronavirus disease 2019 (COVID-19), J. Telemed. Telecare 26 (5) (2020) 309–313.
[4] K. Halbert, C. Bautista, Telehealth use to promote quality outcomes and reduce costs in Stroke care, Crit. Care Nurs. Clin. North Am. 31 (2) (2019) 133–139.
[5] C.S. Kruse, et al., Telehealth and patient satisfaction: a systematic review and narrative analysis, BMJ Open 7 (8) (2017), e016242.
[6] Telehealth After Stroke Care: Integrated Multidisciplinary Access to Post-stroke Care (TASC) [cited 2021 05/07/2021]; Available from, https://clinicaltrials.gov/ct2/show/NCT04640519, 2020.
[7] J.E. Basaraba, et al., Pharmacists as care providers for Stroke patients: a systematic review, Canadian J. Neurol. Sci. 45 (1) (2018) 49–55.
[8] T. Le, M. Toscani, J. Colsuzi, Telepharmacy: a new paradigm for our profession, J. Pharm. Pract. 33 (2) (2020) 176–182.
[9] F.A. McAllister, et al., Case management for blood pressure and lipid level control after minor stroke: PREVENTION randomized controlled trial, Can. Med. Assoc. J. 186 (8) (2014) 577–584.
[10] J.A. Rodriguez, C.R. Clark, D.W. Bates, Digital health equity as a necessity in the 21st century cares act era, Jama 323 (23) (2020) 2381–2382.
[11] NYSED.gov Office of the Professions, Education Law Article 137, Pharmacy [cited 2021 05/07/2021]; Available from: http://www.op.nysed.gov/prof/pharm/article137.htm, 2021.

Table 1
Characteristics of neurology patients completing telepharmacy visits (n = 103)*.

| Criteria for referral to telepharmacy | N (% of all referral criteria) |
|--------------------------------------|-------------------------------|
| Drug titration                       | 69 (39%)                      |
| Drug initiation                      | 42 (24%)                      |
| Medication reconciliation            | 38 (21%)                      |
| Drug discontinuation                 | 14 (8%)                       |
| Medication education                 | 13 (7%)                       |
| Complex medication regimen           | 1 (0.5%)                      |
| Medication Adherence                 | 1 (0.5%)                      |

* Patient may be referred for more than one criterion, total number of referral criteria n = 178.
[12] R.J. McManus, et al., Effect of self-monitoring and medication self-titration on systolic blood pressure in hypertensive patients at high risk of cardiovascular disease: the TASMIN-SR randomized clinical trial, Jama 312 (8) (2014) 799–808.

[13] A. May, O. Morgan, K. Quairoli, Incorporation and impact of a clinical pharmacist in a hospital-based neurology clinic treating patients with multiple sclerosis, Int J MS Care 23 (1) (2021) 16–20.

[14] A. Fogg, et al., An exploratory study of primary care pharmacist-led epilepsy consultations, Int J Pharm Pract 20 (5) (2012) 294–302.