







Store-and-forward teleneurology results in a large Brazilian city

Telerregulação em neurologia e seus resultados em uma grande cidade brasileira

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Arq. Neuropsiquiatr. 2022;80(8):802–805.

Abstract

Background Neurology is a high-demand specialty with long waiting lines. Some pathologies require rapid decision-making. Through technology, telemedicine can allow neurological patients to have faster access to specialized assessment. In store-and-forward telemedicine, the specialist physician evaluates data collected by a general practitioner and optimizes screening.

Objective The aim of the present study is to evaluate the effectiveness of asynchronous telemedicine, used to refer patients from primary care to neurology, in the city of Curitiba, in southern Brazil.

Methods A retrospective analysis of all patients referred from primary care to neurology between September 2019 and February 2020. After a request is made by a general medical doctor for a specialist's opinion, 5 neurologists with complete access to patients' records are tasked with the decision-making. The main variables analyzed were clinical reasons for telemedicine request, neurologist decision, final diagnosis, indication for diagnostic procedures, and subsequent follow-up.

Results Between September 2019 and February 2020, 1,035 asynchronous telemedicine consultations were performed. Headache (30.43%), epilepsy (19.03%), and dementia (15.85%) accounted for almost two-thirds of the primary care requests; one-third of the cases (33.62%) required a complementary diagnostic procedure. More than 70% of the cases did not require face-to-face assessment by a neurologist.

Conclusions In this study, store-and-forward teleneurology successfully reduced the need for in-visit consultation in 70% of cases. Further studies should identify the best opportunities for teleneurology in the city of Curitiba to facilitate better integrated care between primary care providers and neurologists.

Keywords

- ▶ Neurology
- ▶ Telemedicine
- ▶ Primary Health Care
- ▶ Telerregulation

received
October 19, 2021
accepted
December 20, 2021

DOI <https://doi.org/10.1055/s-0042-1755204>.
ISSN 0004-282X.

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Resumo

Antecedentes Neurologia é uma especialidade de alta demanda com grandes filas de espera. Algumas doenças necessitam de rapidez na tomada de decisões. A telemedicina permite que pacientes neurológicos tenham acesso mais rápido à avaliação especializada. Na telerregulação, um ramo da telemedicina, o especialista avalia os dados coletados pelo generalista e otimiza a triagem.

Objetivo Avaliar a eficácia da telerregulação assíncrona, usada para referenciar pacientes da atenção primária à neurologia, na cidade de Curitiba, no sul do Brasil.

Métodos Análise retrospectiva de todos os pacientes referenciados da atenção primária para a especialidade de neurologia, no período entre setembro de 2019 e fevereiro de 2020, em Curitiba, Brasil. Para cada pedido de avaliação do médico generalista, 5 neurologistas experientes tiveram acesso completo ao prontuário para a tomada de decisão. As variáveis analisadas foram: razões para o encaminhamento, decisão do especialista, diagnóstico final, indicação de exame complementar e necessidade de acompanhamento com a especialidade.

Resultados Durante o período de estudo, 1.035 telerregulações foram realizadas. Cefaleia (30.43%), epilepsia (19.03%) e demência (15.85%) compreenderam aproximadamente dois terços de todos os pedidos de consulta; para um terço dos casos, o especialista indicou exame complementar. Mais de 70% dos pacientes não necessitaram de consulta presencial com neurologista.

Conclusões A telerregulação assíncrona diminuiu de forma importante a necessidade de avaliação presencial pelo neurologista em 70% dos casos. Através da tecnologia, é possível conseguir melhor integração entre atenção primária e serviços especializados. Ainda são necessários mais estudos para explorar as janelas de oportunidade para a teleneurologia no Brasil.

Palavras-chave

- ▶ Neurologia
- ▶ Telemedicina
- ▶ Atenção Primária à Saúde
- ▶ Telerregulação

INTRODUCTION

The world's population is aging. The increase in the number of elderly people is accompanied by an increase in the number of patients affected by neurological diseases.^{1,2} In contrast, some countries have observed a reduction in the number of neurology specialists in recent years, producing a gap between the epidemiological impact and the specialty capacity.^{3,4} To reduce this gap, some opportunities have been developed, such as telemedicine.

Telemedicine (TM) is defined as medical practice at a distance, or not in person, using modern communications technology.⁵ It can be synchronous, through real-time video communication, or asynchronous. Asynchronous telemedicine refers to store-and-forward consultation between healthcare professionals as a form of triage or for definitive diagnosis and management.⁶ Teleneurology is an emergent branch of TM. Although neurological conditions commonly require a complex physical examination, the patient history is sufficient to improve triage referrals.⁷

The aim of the current study is to evaluate the effectiveness of asynchronous TM for patient referral from primary care to a neurology specialist in Curitiba.

METHODS

The study is a retrospective analysis of all patients referred from primary care to neurology, between September 2019

and February 2020, in a tertiary hospital. The study was approved by the Ethical Committee of the Hospital das Clínicas of the Federal University of Paraná, and the board waived the need for patient consent. Each teleneurology session comprised an asynchronous evaluation, by a trained neurologist, of patients' records in primary care in the city of Curitiba in Southern Brazil.

The inclusion criteria were: 1) patients from Curitiba with a primary care evaluation in any primary healthcare center, 2) complete information available on the patient, and 3) the patient's last consultation within the last 4 months. Meanwhile, the exclusion criteria were: 1) duplicate consultations with the same patient, 2) citizens outside of Curitiba, 3) clinical information not available or not enough to make a decision.

All patients were placed in the store-and-forward system by a general medical doctor from the primary healthcare system of the city of Curitiba; 5 neurologists with at least 5 years of specialty experience were educated and trained to communicate with other physicians and provide useful consultations. Each neurologist had complete access to the patients' records for the decision-making process. Each patient record was evaluated by one of the five neurologists. When a patient's complaint was related to a neurology subspecialty, this specialist oversaw the final management.

The following variables were considered: sex; age in years; specific clinical reason for enrollment into TM; general clinical reason for enrollment into TM (diagnosis,

management); the TM decision (i.e., if more data are required); diagnosis from the TM appointment; subsequent follow-up (the decision to keep patients in primary care or if in-person evaluations are required); and indications for diagnostic procedures. For the patients that remained in primary care, neurologists guided the primary care providers regarding diagnosis and management, including therapeutic options, drug titration, and drug monitoring with laboratory tests.

After data collection, a descriptive analysis of the variables was conducted. Quantitative variables are presented as means and standard deviations (SD) or by median, minimum, and maximum values according to their adherence to normal distribution. Categorical variables are presented as frequencies and percentages.

RESULTS

Between September 2019 and February 2020, 1,035 consultations were performed. The mean age was 49.98 ± 19.63 years, and 584 (56.43%) of the total number of patients were women. In 11 (1.06%) patients, the sex was not communicated.

When considering the general clinical reasons for TM request, 322 (31.11%) were for diagnosis, 336 (32.46%) were for therapeutic reasons or for the management of current conditions, 236 (13.14%) were diagnostic procedure requests (i.e., electroneuromyography), 100 (9.66%) were intended for other specialties, 49 (4.73%) were for answers to a previous consultation, 16 (1.55%) were for judicial demand, and 271 (26.18%) were for other reasons. Furthermore, 195 (18.84%) patients had more than one general clinical reason for participating in TM.

When considering the specific clinical reason for the TM request, headache was the main complaint presented in 315 (30.43%) patients. This was followed by epilepsy in 197 (19.03%), dementia in 164 (15.85%), neuromuscular disorders in 107 (10.34%), cerebrovascular diseases in 110 (10.63%), vestibular/dizziness in 101 (9.76%), and movement disorders in 80 (7.73%) patients. Other complaints were observed in 176 patients (17.00%); 237 patients (22.90%) had more than one complaint based on the primary care evaluation.

Based on the primary care information, more data were needed in 427 (41.26%) requests before a full decision could be made. When considering the final decision, follow-up in primary care was recommended for 713 (68.89%) patients, 298 (28.79%) patients were sent to face-to-face neurological evaluation, and only guidance was required for 24 (2.32%) patients. Additionally, for 64 (6.18%) patients, the TM session led to the decision to send them to a specified center.

During the process, 348 (33.62%) patients received complementary examinations. More than one test was suggested for 125 patients (12.08%). Finally, a computed tomography (CT) was required for 156 (44.83%) patients; magnetic resonance imaging (MRI) for 113 (32.47%); electroencephalography (EEG) for 48 (4.64%); vascular imaging, such as angiotomography or magnetic resonance angiography, for

Table 1 Descriptive analysis of 1,035 patients referred from primary care to neurology in Curitiba – Brazil

		n = 1,035	%
Population characteristics	Women	584	56.43
	Men	440	42.51
	No defined	11	1.06
	Age (mean \pm SD)	49.98	19.64
Teleregulation indication	Diagnosis	322	31.11
	Therapeutics and management	336	32.46
	Request of diagnostic procedure	236	13.14
	Other specialty	100	9.66
	Judicial demand	16	1.55
	Other	271	26.18
	More than one question	195	18.84
	Not defined	29	2.80
	Review of previous TR	49	4.73
Additional request	More clinical data from primary care	427	41.26
Final decision	Maintain in primary care	713	68.89
	Indication of diagnostic test by neurologist	348	33.62
	Send to neurological evaluation	298	28.79
	Refer to specific center	64	6.18

Abbreviations: SD, standard deviation; TR, Teleregulation.

38 (10.92%); echocardiography and carotid Doppler for 30 (8.62%); electromyoneurography (EMNG) for 6 (1.72%); and common laboratory tests for 4 (1.15%) (**Table 1**).

DISCUSSION

The current study demonstrated that store-and-forward teleneurology reduced the need for in-person neurological evaluations in more than 70% of cases. Headache, epilepsy, and dementia represented almost two-thirds of primary care requests, and one-third of cases required a complementary diagnostic procedure.

Compared with previous studies, there was a similar predominance of women, who were approximately 50 years of age.⁸ The most common requests were for diagnosis and management, comprising 63% of cases, which is a lower number than that of a recent study where these requests represented more than 80% of the demands.⁸ Probably, a higher stratification for these criteria was presented in the current study. In Curitiba, primary care providers are not allowed to directly demand some complementary tests (13% of the consultations). Additionally, other specialists cannot directly request neurological evaluations without primary care connection.

Headache, epilepsy, dementia, neuromuscular disorders, and cerebrovascular disease were the 5 main complaints of the current study. However, in other countries studies, imaging findings, tingling/numbness, multiple sclerosis, and paresthesia were in the top requests.^{8,9} A possible explanation for this is that primary headaches are not properly diagnosed and managed in Brazil due to the lack of public policies addressing this problem.¹⁰ A recent review suggested that teleconsultations should be encouraged in the care of these patients.¹¹

In 41% of the TM appointments, the neurologist had to request more information. We postulate that this can delay the specialist's final decisions. When a request is incomplete, the neurologist will review it more than once, possibly delaying the decisions of other patients. If the case report was complete, with all the necessary information for referral and description of the neurological condition, the neurologist would spend less time analyzing each patient.

The rate of reduction in the need for in-person consultations reaffirms the need for improving the teleneurology system. More than 70% of the cases did not require face-to-face assessment by a neurologist. In the current study, almost 70% of patients remained in primary care and 298 patients (28.79%) were sent for presential neurological evaluation.

Improving the telehealth system has the potential to reduce waiting lines, as demonstrated by a study conducted in Rio Grande do Sul, in Southern Brazil. In this study, the implementation of protocols of telemedicine achieved a general reduction in the queue volume for specialized consultation by approximately 30%.¹² Besides reducing waiting lines, neurological patients may have functional incapacity. Therefore, instead of bringing a sick patient to see a doctor, teleconsultation allows neurological care to reach this patient, thereby overcoming functional distance. In this scenario, teleneurology has emerged as a useful tool for better diagnosis and patient care.¹³

Some limitations were present in the current study. First, this was a single-center retrospective analysis. Furthermore, in 41% of the cases, the neurologist requested more information, and this number was higher than expected. For better communication, our local system needs appropriate training for primary care providers, and sufficient monitoring of processes and outcomes. As an initial analysis, we still have no data regarding patient outcomes, such as reduction in hospitalization or mortality.

Nevertheless, this study provides important insights for our local healthcare system. In Brazil, the long wait to see a specialist is one of the main reasons for dissatisfaction referred by public Unified Health System users.¹⁴ According to the Curitiba municipal health secretary, the median waiting time for a specialist consultation is 10 months.¹⁵

In conclusion, the current study demonstrated that store-and-forward teleneurology achieved a 70% reduction in the intended consultation for neurology specialists. Further studies are needed to evaluate the effects of teleneurology in the city of Curitiba. We see this as a window of opportunity for structural reforms and better integrated care, particularly for those with neurological conditions.

Authors' Contributions

VCS: project administration, database organization, analysis, and interpretation of results, writing-original draft and responsible for submission; MZR, GA: project administration, database organization, data curation, and initial data analysis; VHFZ: supervision, writing review & editing; RDPD: study conceptualization, established methodological guidelines for the study, discussion of results, writing review & editing; MCL: creation of database, study conceptualization, established methodological guidelines for the study, discussion of results, writing review & editing.

Conflict of Interest

The authors have no conflict of interests to declare.

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