



Initial assessment of an interprofessional team-delivered telehealth program for patients with epilepsy

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ABSTRACT

Introduction: Epilepsy affects 3.5 million people in the United States (US). Rural-dwelling individuals have less access to healthcare and consequently poorer health outcomes. This study describes the outcomes of an interprofessional telehealth program for rural-dwelling individuals with epilepsy in one US state.

Methods: An academic medication therapy management pharmacist provided clinical services to rural-dwelling individuals with epilepsy between November 2015 and June 2018, using video-conferencing technology and follow-up telephonic consultation. Data collected included: demographics, prescribed seizure medications, comorbidities, drug-drug and drug-disease interactions, adverse drug reactions, therapeutic duplications, dose-related safety concerns, adherence concerns, and recommendations to resolve identified issues. Data were summarized using appropriate descriptive statistics.

Results: A total of 168 patients (51% male, mean age 28 ± 15 years), participated in this pilot study. Most participants (94%) were prescribed at least one seizure medication including: benzodiazepines ($n = 89$), lamotrigine ($n = 58$), and levetiracetam ($n = 56$). The majority (55%) had at least one comorbidity including: mood disorders ($n = 49$) and psychiatric disorders ($n = 26$). Common medications with reported precautions for people with a seizure history were: selective serotonin reuptake inhibitors ($n = 18$), second-generation atypical antipsychotics ($n = 17$) and benzodiazepines ($n = 16$). Participants had at least one: drug-disease interaction (33%), drug-drug interaction (54%), adverse drug reaction (37%), therapeutic duplication (13%); dose-related safety concerns (35%); and medication utilization concerns (13%).

Discussion: This pharmacist-delivered pilot program was effective in: reaching underserved patients with epilepsy, identifying and recommending resolutions to medication-related problems, and demonstrating the value of pharmacists in an interprofessional team. Further work is warranted to identify telehealth strategies to reduce medication associated problems.

1. Introduction

Prevalence of epilepsy is higher among individuals living in rural areas and these individuals also are at greater risk of having health problems. In particular, they may have higher levels of poverty, lower incomes, and less access to care, all of which may detrimentally affect their health outcomes (James, 2014; Wang et al., 2016). They also have mortality higher rates and may lose an estimated 10 years of life compared to the general population not affected by epilepsy (Hirtz et al., 2007; Gaitatzis et al., 2004).

To put it in perspective, epilepsy is the fourth most common

neurological disorder in the US (Begley and Durgin, 2015) and, in 2015, approximately three million adults and half a million children had a diagnosis of active epilepsy (Zack and Kobau, 2017). The total annual direct healthcare costs for people with epilepsy (adjusted to 2013 US dollars) range from \$10,192 to \$47,862, while their epilepsy-specific costs vary from \$1022 to \$19,749 (Begley and Durgin, 2015).

Epilepsy is a complex disease presenting challenges for healthcare professionals managing these patients yet, those living in rural areas may experience additional barriers. While previous studies have estimated the prevalence of epilepsy in rural areas in the US, ranging anywhere from 5.0 per 1000 individuals to 7.1 per 1000 individuals

Abbreviations: ADR, Adverse Drug Reaction; MPR, Medication Possession Ratio; MRP, Medication-Related Problem; MTM, Medication Therapy Management; SSRI, Selective Serotonin Reuptake Inhibitor; US, United States

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(Ablah et al., 2014; Hawley et al., 2015), there are a lack of studies that describe interventions to reach these patients with the intention of improving their health outcomes. One option is to offer medication therapy management (MTM) services, encompassing pharmacist-delivered comprehensive medication reviews, disease management and education, medication safety surveillance, and prevention or wellness services (American Pharmacists Association, 2017), using telehealth solutions (HealthIT.gov, 2017). Furthermore, telehealth services may offer a viable option to improve outcomes and access to care for patients with epilepsy living in rural areas (Haddad et al., 2015).

However, a gap still remains regarding how an interprofessional, team-delivered telehealth program could benefit people with epilepsy living in rural areas in the US. The purpose of this study was to assess the outcomes of an interprofessional telehealth program designed for all ages of rural-dwelling patients with epilepsy residing in a US state where the prevalence of epilepsy is among the highest in the nation.

2. Materials and methods

2.1. Study design and collaborators

This descriptive pilot study focused on the outcomes of a collaborative MTM program specifically designed for rural patients with epilepsy. An academic-based MTM provider partnered with an epileptologist, based out of an epilepsy clinic, to provide clinical services. Using multi-way video conferencing technology, synchronous appointments were conducted for rural patients with epilepsy. The Institutional Review Board approved this project.

2.2. Patient eligibility and enrollment

Eligible patients participated in an interprofessional telehealth appointment sometime between November 2015 and June 2018. Participation in the telehealth appointment was voluntary although patients did verbally provide consent to participate to the epilepsy clinic staff. Participants were excluded if they: had a diagnosis of cancer or end-stage renal disease; or were receiving hospice care.

2.3. MTM services

Eligible patients with epilepsy attended a local epilepsy clinic for an initial appointment. Staff at the epilepsy clinic included case managers, nurses, and medical assistants, who performed vitals, assisted with technology, and special education school program coordination. Using multi-way video conferencing technology, the telehealth pharmacist and epileptologist joined the consultation from two distinct remote locations across the nation. The telehealth pharmacist provided comprehensive MTM services, including: an initial patient consultation via video-conferencing technology; and a telephonic follow-up consultation. After the initial consultation, the patient received a printed copy of their medication list including recommendations for scheduling follow-up appointments with their other providers. The telehealth pharmacist discussed his/her recommendations with the offsite epileptologist and patient during the virtual clinic appointment and recorded progress notes in the clinic's electronic health record.

2.4. Data collection

These demographic data were collected: age, gender, and insurance status. Clinical data also were recorded for: number and types of: seizure medications taken, and comorbidities. Additionally, medication-related problem (MRP) data included: drug-disease interactions; drug-drug interactions; adverse drug reactions; therapeutic duplications; and dose-related safety concerns and the number and types of recommendations made to resolve these issues. Data were also collected for medication adherence (patient was asked how frequently medicines

were not taken in the past month) and medication utilization concerns. Finally, data were recorded for the amount of time the pharmacist and the nurse coordinator spent on each consultation.

2.5. Data analysis

Data analysis was descriptive in nature. Frequencies, percentages, means, and standard deviations were calculated to summarize the data as appropriate. Data analysis was conducted using Microsoft Excel, version 14.6.5 (Microsoft, Redmond, WA).

3. Results

This descriptive pilot study included 168 patients receiving care at an epilepsy clinic in one US state. The mean age of participants was 28.0 ± 15.4 , ranging from six to 77 years. There was roughly equal representation of male and female participants (51.2% and 48.8% respectively). Over half of the sample had primary insurance (52.4%), while a few had secondary insurance (7.7%).

3.1. Seizure medications and comorbidities

Most ($n = 157$, 93.5%) participants were taking at least one seizure medication; participants took an average of 2.3 ± 1.3 seizure medications. The most commonly used seizure medications were benzodiazepines ($n = 89$), Lamotrigine ($n = 58$), and Levetiracetam ($n = 56$). Over half ($n = 93$, 55.4%) of participants had at least one comorbidity, and on average, they had 0.9 ± 1.2 comorbidities. The most common comorbidities were mood disorders ($n = 49$) and psychiatric disorders ($n = 26$). See Table 1 for further details.

3.2. Medication-related problems (MRPs)

3.2.1. Drug-disease interaction

Approximately one-third of participants ($n = 55$, 32.7%) had at least one drug-disease interaction. A total of 77 medications were not recommended for individuals who had seizures, resulting in an average of 0.4 ± 0.7 non-recommended medications per patient. The most common medications with reported precautions for patients with a history of seizures included: selective serotonin reuptake inhibitors (SSRIs, $n = 18$); second-generation atypical antipsychotics ($n = 17$); and benzodiazepines ($n = 16$). To that end, associated recommendations were made for: patient counseling on recommendation ($n = 13$), additional monitoring to epileptologist ($n = 8$), and therapy change recommended to epileptologist ($n = 1$).

3.2.2. Drug-drug interaction

Over half the participants ($n = 91$, 54.2%) had at least one drug-drug interaction. A resulting total of 100 respective recommendations were made for: patient counseling on recommendation ($n = 72$), additional monitoring to epileptologist or primary care provider ($n = 26$), and therapy change recommended to epileptologist ($n = 2$).

3.2.3. Adverse drug reaction (ADR)

More than one-third of participants ($n = 62$, 36.9%) had at least one adverse drug reaction (ADR). A total of 69 recommendations were made for: patient counseling on recommendation ($n = 43$), additional monitoring to epileptologist or primary care provider ($n = 14$), and therapy change recommended to epileptologist or primary care provider ($n = 12$).

3.2.4. Therapeutic duplication

Few ($n = 22$, 13.1%) participants had a therapeutic duplication, resulting in a mean of 0.2 ± 0.5 therapeutic duplications per patient. Of those who had a therapeutic duplication, the most frequent was one per patient ($n = 18$) followed by two ($n = 2$) and three ($n = 2$). A

Table 1
Number and type of seizure medications and co-morbidities for study participants.

Seizure medications and co-morbidities	N (%)
Number of seizure medications (n = 168)	
0	11 (6.5)
1	33 (19.6)
2	49 (29.2)
3	52 (31.0)
4	14 (8.3)
5	5 (3.0)
6	4 (2.4)
Seizure medication (n = 392)*	
Benzodiazepines	89 (53.0)
Carbamazepine	15 (8.9)
Ethosuximide	1 (0.6)
Felbamate	10 (6.0)
Gabapentin	7 (4.2)
Lacosamide	25 (14.9)
Lamotrigine	58 (34.5)
Levetiracetam	56 (33.3)
Oxcarbazepine	26 (15.5)
Perampanel	3 (1.8)
Phenobarbital	9 (5.4)
Phenytoin	5 (3.0)
Rufinamide	1 (0.6)
Topiramate	12 (7.1)
Valproate	29 (17.3)
Zonisamide	8 (4.8)
Other	38 (22.6)
Number of comorbidities (n = 168)	
0	75 (44.6)
1	54 (32.1)
2	23 (13.7)
3	10 (6.0)
4	3 (1.8)
5	1 (0.6)
6	2 (1.2)
Reported comorbidity (n = 159)*	
Attention-deficit/hyperactivity disorder	6 (3.6)
Hypertension	15 (8.9)
Migraine headaches	14 (8.3)
Mood disorders (including anxiety, depression, unknown)	49 (29.2)
Psychiatric disorders	26 (15.5)
Pulmonary disease	8 (4.8)
Sleep disorders	18 (10.7)
Other	23 (13.7)

* Study subjects could have been using multiple (or none) seizure medications or had comorbidities; hence the sum of seizure medications and the sum of comorbidities is greater than the number of subjects.

resultant total of 15 recommendations were made for: patient counseling on recommendation (n = 12), and an additional monitoring to the epileptologist or primary care provider (n = 3).

3.2.5. Dose-related safety concern

Approximately one-third (n = 59, 35.1%) of participants had safety concerns with most (n = 46, 78.0%) having one concern while few individuals (n = 13, 22.0%) had two or more concerns. In general, most (n = 49, 83.1%) dose-related concerns were referred to their healthcare provider. See Table 2 for further details.

3.3. Medication utilization concern

A few patients (n = 21, 12.5%) had at least one medication utilization concern, which led to a total of 23 concerns identified. These concerns included: medicine costing too much (n = 9, 39.1%), medicine inconvenient to take (n = 5, 21.7%), medicine not taken because patient felt worse (n = 1, 4.4%), and other reasons (n = 8, 34.8%).

Table 2
Pharmacist-identified medication-related problems among study participants.

Medication-related problems	N (%)
≥ 1 drug-disease interaction (n = 168)	55 (32.7)
Medications with reported precautions for patients with seizure history (n = 73)*	
Amphetamines	3 (1.8)
Aripiprazole	1 (0.6)
Atomoxetine	1 (0.6)
Baclofen	1 (0.6)
Benzodiazepines (including clonazepam and diazepam)	16 (9.5)
Ciprofloxacin	1 (0.6)
Hydroxyzine	1 (0.6)
Methylphenidate	1 (0.6)
Second Generation Atypical Antipsychotics (including olanzapine, quetiapine, and risperidone)	17 (10.1)
Selective Serotonin Reuptake Inhibitors (SSRI) (including citalopram, escitalopram, fluoxetine, and sertraline)	18 (10.7)
Tramadol	1 (0.6)
Trazodone	1 (0.6)
Zolpidem	2 (1.2)
Other	9 (5.4)
Resulting recommendation made (n = 22)*	
Counseled patient on recommendation	13 (59.1)
Advised additional monitoring by epileptologist	8 (36.4)
Therapy change recommended to epileptologist	1 (4.5)
≥ 1 Drug-drug interaction (n = 168)	91 (54.2)
Resulting drug-drug interaction recommendation made (n = 100)*	
Counseled patient on recommendation	72 (72.0)
Advised monitoring by epileptologist/primary care provider	26 (26.0)
Therapy change recommended to epileptologist	2 (2.0)
≥ 1 Adverse drug reaction (n = 168)	62 (36.9)
Resulting adverse drug reaction recommendation made (n = 69)*	
Counseled patient on recommendation	43 (62.3)
Advised additional monitoring by epileptologist/primary care provider	14 (20.3)
Therapy change recommended to epileptologist/ primary care provider	12 (17.4)
≥ 1 Therapeutic duplication identified (n = 168)	22 (13.1)
Outcome of therapeutic duplication (n = 15)*	
Counseled patient on recommendation	12 (80.0)
Recommended additional monitoring to epileptologist	3 (20.0)
≥ 1 Dose-related safety concerns identified (n = 168)	59 (35.1)
Dose-related safety concerns referred to physician (n = 59)*	49 (83.1)

* Study subjects could have been using multiple (or none) seizure medications that interacted with each other, or had multiple (or none) recommendations made as a result of an identified medication-related problem; hence the sum of seizure medications and the sum of recommendations made does not always equal the number of subjects.

3.4. Medication adherence

When asked how frequently they failed to take their medications in the past month, the majority of participants responded never (n = 118, 70.2%) missing a dose.

3.5. Healthcare practitioner time

Pharmacists spent a mean of 32.1 ± 11.3 min and nurses spent 9.6 ± 2.8 min on the initial telehealth consultation with patients.

4. Discussion

Two key findings emerged from this study including: more than half of patients in this sample of rural-dwelling individuals had a drug-drug interaction; and one third had a drug-disease interaction, adverse drug reaction, or dose-related safety concern. Additionally, several therapeutic duplications and medication utilization concerns were detected.

These findings support the need for provision of healthcare services for rural patients with epilepsy who may potentially experience a greater number of medication-related problems (MRPs) than their urban-dwelling counterparts. Furthermore, integrating a telepharmacist to identify these MRPs is imperative to help improve health outcomes for these patients.

In the current study, a total of 372 MRPs (including drug-disease interactions, drug-drug interactions, ADRs, therapeutic duplications, dose-related safety concerns, and medication utilization concerns) were identified in this sample ($n = 168$). Thus, this demonstrates the important clinical value of the pharmacist's role as well as the program itself in care provision for patients with epilepsy. The current findings on MRPs adds to the evidence base that parallels others' work from the US and abroad (Isetts et al., 2008; Manan et al., 2014), yet, while others reported economic outcomes, the current study did not. Additionally, Isetts et al. reported that pharmacist-delivered MTM, in collaboration with physicians, improved clinical outcomes and reduces patients' healthcare costs (Isetts et al., 2008), however, they did not specifically report provision of services for rural residents. In contrast, Johnson et al. found that a pharmacist-delivered MTM program identified 237 medication-related interventions in a sample ($n = 517$) of rural-dwelling individuals with diabetes or hypertension (Johnson et al., 2018). Yet, neither study (Isetts et al., 2008; Johnson et al., 2018) involved caring for patients with epilepsy, making the current study unique with regard to the chronic disease state and location of personal residence (i.e., rural). Despite these differences, it is plausible to suggest that similar MTM programs have the potential to identify considerable numbers of MRPs among patients with other medical conditions and in other settings, that when appropriately addressed could result in improved health outcomes.

Another interesting finding was that 82% of participants self-reported never or rarely ever missing a dose of their epilepsy medication, suggesting good adherence among our sample. Although this is an encouraging finding that has not been previously reported by others, it also suggests that approximately one-fifth of rural-dwelling people with epilepsy are non-adherent to their medication. Others have studied medication adherence among people with epilepsy. For example, a previous study, using the Morisky questionnaire to capture self-reported adherence data, found that more than half (59%) of adults in the United Kingdom were non-adherent to their epilepsy medication (Jones et al., 2006). In the US, Davis et al. observed that 39% of patients were non-adherent to their epilepsy medications, defined as a medication possession ratio (MPR) of < 0.8 (Davis et al., 2008). More recently, a literature review reported prevalence of medication non-adherence ranging from 26% to 79% (Malek et al., 2017). However, studies reporting adherence to epilepsy medications among rural-dwelling individuals in the US are lacking. Further work is therefore warranted to update the medication adherence estimates among people with epilepsy, particularly in rural areas of the US, and to implement methods to address non-adherence among those particular individuals.

Finally, this program tracked the time spent by the pharmacist on the initial consultation. This study did not seek to calculate the financial value or return on investment for adding the telehealth pharmacist to the program, however, the number of MRPs identified and recommendations made to resolve them in this sample demonstrates the value of both the telehealth pharmacist and this novel telehealth program in improving health outcomes for rural-dwelling patients with epilepsy in the US, and may serve as a model for others seeking to implement a similar program elsewhere.

4.1. Limitations

While this pilot study included an adequate sample size ($n = 168$) and availability of data to assess multiple medication-related problems, there were limitations. For example, there were limited data available for demographic characteristics and reasons for non-adherence, which

could be collected in future studies. Data for medication adherence were self-reported by the patient, which may be subject to bias. Furthermore, this pilot study was conducted at one site only, thus, limiting the generalizability of these findings solely to this population.

5. Conclusion

This interprofessional team approach integrating pharmacist-delivered MTM services was successful in reaching underserved, rural-dwelling patients with epilepsy and identifying a large number of medication-related problems. However, further work is warranted to investigate the prevalence of medication problems in larger samples of diverse patients with epilepsy living in rural communities, seek innovative solutions to reduce their occurrence and improve their health-related outcomes. Finally, this integrated program may serve as a model for successful identification of medication-related problems among patients with other clinical conditions, and in other, more diverse settings.

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Declaration of Competing Interest

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