# Description of telepharmacy services by emergency medicine pharmacists

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**Purpose.** Utilization of telemedicine and telepharmacy services has become increasingly popular, as specifically noted during the coronavirus disease 2019 (COVID-19) pandemic. This article describes the implementation of and services provided by emergency medicine pharmacists (EMPs) as part of a telemedicine team in the emergency department (ED).

**Summary.** This report describes the telemedicine and telepharmacy services provided to EDs in the Mayo Clinic Health System from the Mayo Clinic Rochester ED. Telepharmacy services provided by EMPs started in 2018. EMPs cover telepharmacy calls as part of their shift within the ED in Rochester. Recommendations and interventions are documented in the electronic medical record. A retrospective review evaluated interventions provided from November 18, 2018, through November 10, 2020. Baseline patient demographics, as well as the type and number of interventions provided by EMPs, hospital site, and time spent on the interventions, were collected. Telepharmacy consults could include multiple interventions and be classified as more than one type of intervention. During this time period, 24 pharmacists worked in the ED and were able to provide telepharmacy services. There were 279 consults included in this study, with 435 interventions. Most of the calls came from critical access hospitals (48.7%). The most common types of interventions documented were medication selection and dosing ($n = 238$), antimicrobials ($n = 141$), monitoring and follow-up ($n = 65$), discharge ($n = 56$), drug information ($n = 55$), and allergy review ($n = 50$).

**Conclusion.** Telepharmacy services can provide increased access to emergency medicine specialty pharmacists in areas that would not otherwise have these services.

**Keywords:** emergency medicine, telehealth, telemedicine, telepharmacy

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The American Society of Health-System Pharmacists (ASHP) defines telepharmacy as "a method used in pharmacy practice in which a pharmacist utilizes telecommunications technology to oversee aspects of pharmacy operations or provide patient-care services."[1] Telepharmacy has primarily been studied in the outpatient ambulatory care and inpatient intensive care unit (ICU) settings.[2,3] A systematic review of clinical telepharmacy services found that telepharmacy services in both ICU and non-ICU settings improved patient outcomes and nursing staff satisfaction and allowed pharmacy services to be expanded throughout health systems.[3] This review showed the potential benefit from telepharmacy services; however, no telepharmacy services in the emergency department (ED) were included, and available data is limited regarding implementation of telepharmacy services in the ED and its potential impact.[4,5]

At Mayo Clinic in Rochester, MN, telemedicine services for the ED were implemented in 2017 to provide resources to Mayo Clinic Health System ED sites. Telepharmacy was integrated into telemedicine services in 2018. The telemedicine team now consists of an emergency medicine physician,

pharmacist, and nurse to help provide resources and care to rural health-system sites. Telemedicine has particularly been found to have an integral role in optimizing patient care during the coronavirus disease 2019 (COVID-19) pandemic and will continue to evolve as we adapt healthcare practices and prepare for future pandemics.[6,7] This report describes the services provided as part of the ED telemedicine and telepharmacy service.

## Setting

The telemedicine team is based at Mayo Clinic in Rochester, MN, which is the tertiary referral center for the area. Within the Mayo Clinic Health System, there are 18 additional EDs that are serviced by telemedicine. These include 11 hospitals that hold the federal designation of a critical access hospital, 4 moderately sized community EDs and 3 large community EDs. Figure 1 shows the geographical locations of the health-system sites. One of the critical access hospitals, Springfield, is not included on the map but participated in the telepharmacy program until its closure on March 1, 2020. Within the health system, onsite emergency medicine clinical pharmacy services are available at one large community hospital for 10 hours a day; there are no emergency medicine pharmacists (EMPs) at any of the other health-system sites. The telepharmacy EMPs document their interventions and recommendations within the electronic medical record (EMR) as a telemedicine progress note.

## Implementation and training

Telepharmacy involvement in the telemedicine team started as week-long pilot sessions with the provider. One dedicated EMP provided telepharmacy services for 8 hours a day, 1 week a month, over multiple months. During the pilot periods, the telemedicine team was located in a separate work area from the ED in Rochester. Once the service was launched, a work area was created within an office directly in the Rochester ED. Within the

## KEY POINTS

- Emergency medicine pharmacists (EMPs) can provide telepharmacy consults for emergency departments without an EMP, especially at critical access sites.

- EMPs provide interventions for a wide range of patients, including critically ill patients and those for whom recommendations are needed for discharge medications.

- The most common interventions made by EMPs are related to medication selection, dosing, and antimicrobial recommendations.

office, there are 3 computer stations each with 3 to 4 monitors to allow providers to look at multiple computer systems. Telemedicine and telepharmacy services were advertised in department meetings, newsletters, and emails to the health system's ED teams. Legal points must be taken into consideration when initiating a telepharmacy program that spans multiple states, and pharmacy laws in each state should be thoroughly reviewed. The legal department at our institution was consulted before initiating telepharmacy services across state lines.
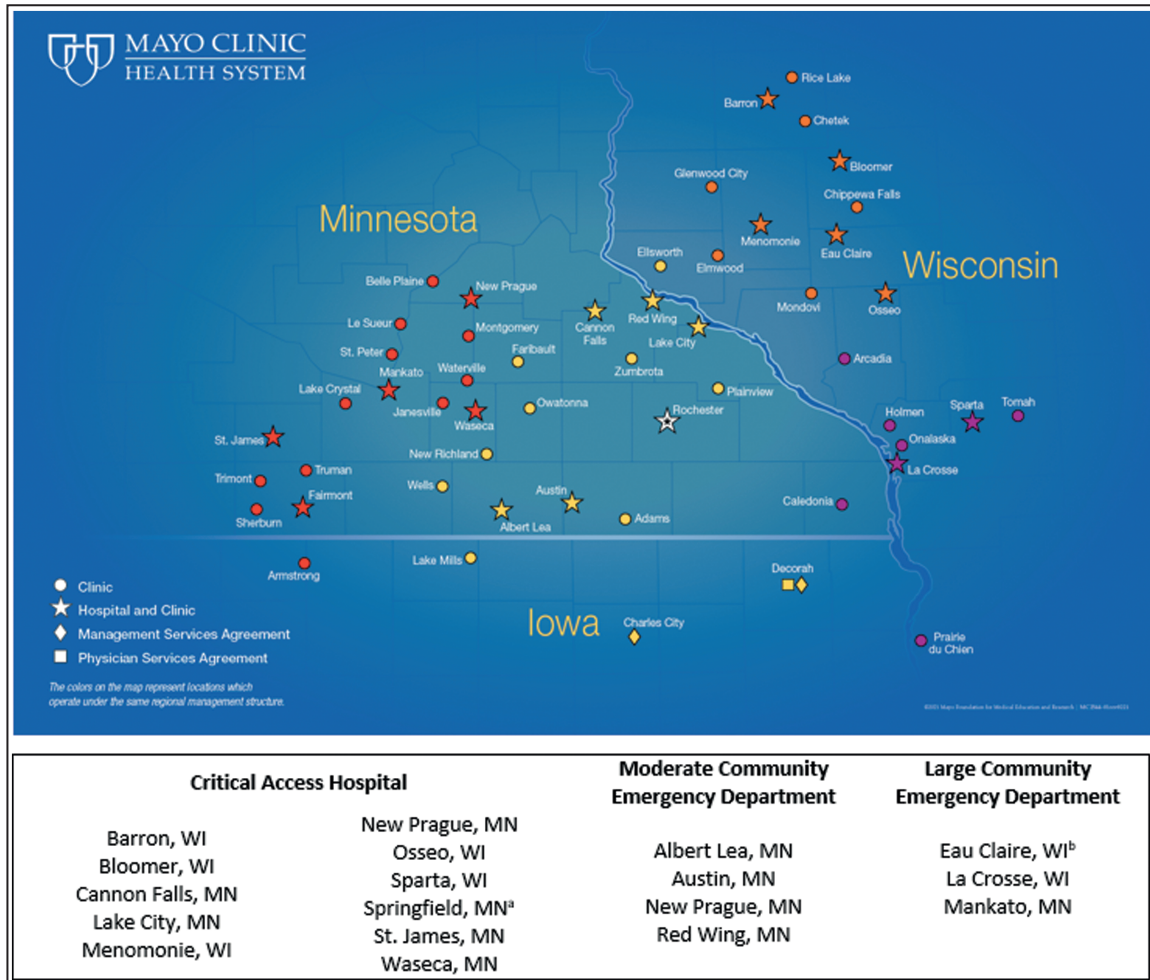
EMPs were trained on the real-time audiovisual technology used before the telepharmacy service was launched. All health-system sites utilize the same EMR, and telemedicine providers can log in to the appropriate ED. Given the initially lower number of calls, the pharmacy was unable to dedicate specific shifts to providing telepharmacy. Instead, telepharmacy services were worked into already existing shifts covering the main ED in Rochester. The pharmacists working at this site are all trained in emergency medicine or critical care and are available to provide consults for 17.5 hours a day.

Pharmacy residents under the supervision of clinical pharmacists also participate in the telepharmacy program. Documentation by pharmacy residents is reviewed by supervising clinical pharmacists before final submission. When pharmacists were busy with patient care in Rochester, they could defer telephone calls and follow-up on nonurgent questions. If a telemedicine resuscitation was called, pharmacists attended if able. During the 6.5 hours when an EMP is not available for telepharmacy consults, providers consult pharmacists at the central pharmacy covering their site.

## Telepharmacy activation

The telepharmacy activation process is detailed in Figure 2. Telepharmacy consults can be initiated by emergency medicine physicians, nurse practitioners (NPs), physician assistants (PAs), and nurses at the health-system site. Depending on its scope, the consult can be performed over the telephone or through real-time audiovisual communication. If time allows, an EMP reviews the regional health system by utilizing the telemedicine dashboard within the EMR, built with predetermined activation criteria to identify patients who may benefit from EMP services.[8] EMPs carry a wireless telephone that can be called by the hospital's admissions and transfer center, by the telemedicine physician, or directly by the health-system site. Additionally, if there is a high-priority emergency, the telemedicine provider activates a telemedicine resuscitation, which immediately sends a text page to the EMP prompting them to virtually attend the resuscitation. During a telemedicine resuscitation, an EMP, a telemedicine provider, and a nurse all respond. The telemedicine nurse performs documentation in the EMR in real time to allow nursing staff at the health-system site to focus on bedside care. Following completion of the case, the EMP documents recommendations in the EMR as a progress note. EMPs do not participate in dispensing or prescribing, but may assist health-system

**Figure 1.** Map of Mayo Clinic Health System. [a]This hospital is closed as of March 10. 2020. [b]This hospital has onsite emergency medicine pharmacists.



| Critical Access Hospital | | Moderate Community Emergency Department | Large Community Emergency Department |
|---|---|---|---|
| Barron, WI | New Prague, MN | | |
| Bloomer, WI | Osseo, WI | Albert Lea, MN | Eau Claire, WI[b] |
| Cannon Falls, MN | Sparta, WI | Austin, MN | La Crosse, WI |
| Lake City, MN | Springfield, MN[a] | New Prague, MN | Mankato, MN |
| Menomonie, WI | St. James, MN | Red Wing, MN | |
| | Waseca, MN | | |

providers with medication selection, dosing, and administration based on the local formulary.

## Evaluation of interventions

After 2 years of providing telepharmacy services, we conducted a retrospective review of the interventions provided by EMPs. All documented telemedicine notes from EMPs that were placed in the EMR for patients from November 18, 2018, to November 10, 2020, were collected. Patients who were less than 18 years old and those who declined authorization for use of their medical records for research were excluded. The study was reviewed and approved by our investigational review board.

**Data collection variables and definitions.** An automated report within the EMR was developed to identify telepharmacy chart notes filed by pharmacists and pharmacy residents who worked in the hub ED during the study period. This report was validated via manual chart review of 10% of charts and included patient baseline demographics, hospital site, discharge disposition, and emergency severity index (ESI) level. Intervention data and time spent on interventions were collected through manual chart review of these notes by study investigators. Time spent on telepharmacy consults was not documented for all consults. If documented, time spent was categorized into the following categories: less

than 5 minutes, 5 to 15 minutes, 16 to 45 minutes, and more than 45 minutes. The total number of interventions was determined for each telepharmacy consult. Interventions were classified as follows:

1. Drug information: medication-specific information including adverse effects, drug compatibility, or administration information

2. Toxicology: information specific to a suspected or confirmed medication intoxication

3. Resuscitation: telemedicine resuscitation activation for local medical extremis or trauma activation

4. Medication selection and dosing: assistance with medication selection

**Figure 2.** Activation of emergency department telepharmacy services. ED indicates emergency department; EMP, emergency medicine pharmacist; MRP, medication-related problem; TeleEM, tele-emergency medicine.
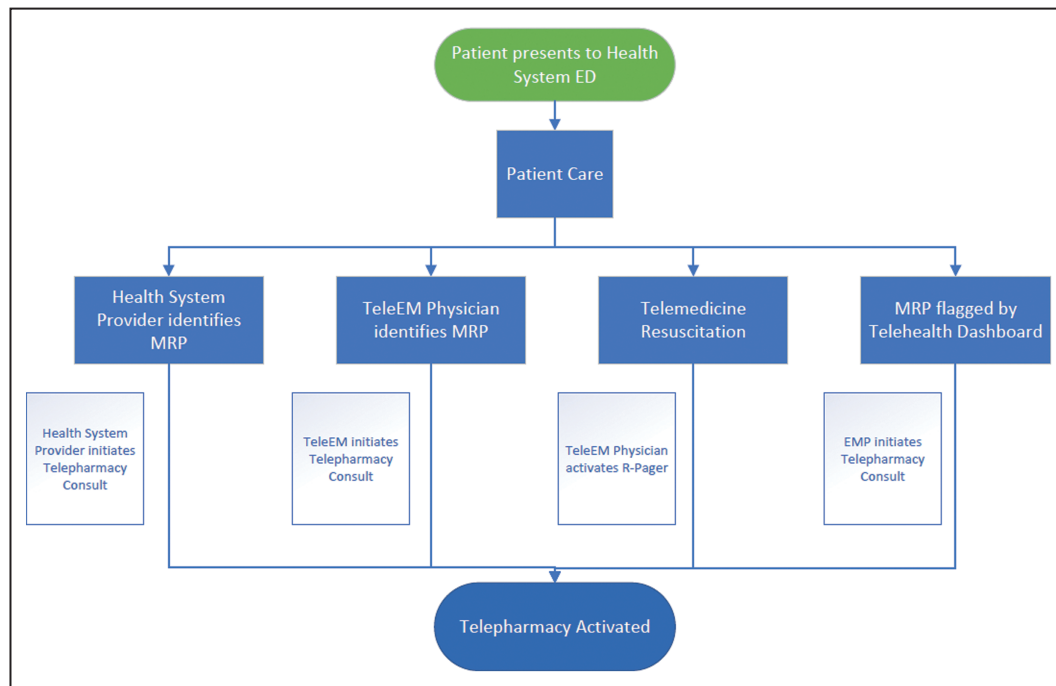


and dosing based on indication and patient-related factors

5. Anticoagulation: recommendations provided regarding anticoagulant use

6. Anticoagulation reversal: recommendations for reversal of anticoagulation

7. Antimicrobials: recommendations for antimicrobial selection

8. Allergy review: recommendations requiring evaluation of patient allergies

9. Pregnancy and lactation: recommendations requiring consideration of active pregnancy or lactation

10. Monitoring and follow-up: recommendations including monitoring or follow-up parameters

11. Discharge: recommendations facilitating discharge of patients

The intervention categories were adapted from the ASHP guidelines on EMP services.[9] The categories were selected from these guidelines as well as an internal survey of practicing EMPs to represent clinically meaningful interventions. A single telepharmacy consult could include more than one intervention (eg, recommendations for antibiotics and anticoagulation). Additionally, an intervention could be classified in more than one category. For example, if recommendations were made for antibiotic selection, this would be classified as "medication selection and dosing" and "antimicrobial" interventions. Results for intervention type are reported as the number of consults involving the specified type of intervention. Percentage is reported as the percentage of consults involving that type of intervention.

**Outcomes and data analysis.** The primary outcome was the number of telepharmacy interventions made by EMPs. Secondary outcomes included the types of interventions, time spent on interventions, number of consults per month over study duration, and characterization of the health system's utilization of the telepharmacy service. Because of the high acuity of patients for resuscitation, we also report the median number of interventions per telepharmacy consult that included resuscitation as compared to the median number of interventions per telepharmacy consult for all consults not including resuscitation. Study results were reported with descriptive statistics using Excel (Microsoft Corporation, Redmond, WA).

*Patient and consult demographics.* There were 360 telepharmacy consults with documented notes from EMPs. After excluding 43 patients who were under the age of 18 and 38 patients for lack of authorization for research in Minnesota, 279 telepharmacy consults were included in the study. Patient demographics can be found in Table 1. Patients had a median ESI of 3 (range, 2-3), and their disposition was most often transferred to another healthcare facility (36.9%) or discharged from the ED (39.4%). Telepharmacy consult demographics can be found in Table 2. Of the 18 hospitals in our health system, 15 had documented consults to EMPs. Most consults were from our critical access hospitals (48.7%) and moderately sized community hospitals (40.9%) (Table 2). Over half of the consults (60.2%) were between 5 and 15 minutes in length. During the study period, there were 18 individual pharmacists who documented telemedicine notes, 4

**Table 1.** Patient Demographics

| Characteristic | Patients (*n* = 279) |
|---|---|
| Sex (female), No. (%) | 154 (55.2) |
| Age, median (IQR), years | 66 (51-77) |
| Race, No. (%) | |
| White | 261 (93.5) |
| American Indian/ American Native | 5 (1.8) |
| Black/African American | 3 (1.1) |
| Asian | 3 (1.1) |
| Other | 7 (2.5) |
| ESI level, median (IQR) | 3 (2-3) |
| Patient disposition, No. (%) | |
| Discharge | 110 (39.4) |
| Transfer to another hospital | 103 (36.9) |
| Hospital admission | 42 (15.1) |
| Hospital observation | 16 (5.7) |
| Deceased | 6 (2.2) |
| Left against medical advice | 2 (0.7) |

Abbreviations: ESI, emergency severity index; IQR, interquartile range.

**Table 2.** Consult Demographics

| Characteristic | Consults (*n* = 279) |
|---|---|
| Hospital size, No. (%) | |
| Critical access | 136 (48.7) |
| Moderately sized community | 114 (40.9) |
| Large community | 29 (10.4) |
| Time spent, No. (%) | |
| <5 minutes | 46 (16.5) |
| 5-15 minutes | 168 (60.2) |
| 16-45 minutes | 50 (17.9) |
| >45 minutes | 15 (5.4) |
| Pharmacist type, No. (%) | |
| Pharmacist | 260 (93.2) |
| Pharmacy resident | 19 (6.8) |

of whom were pharmacy practice residents, who combined took 19 of the calls (6.8%).

*Number and type of interventions.* A total of 435 interventions were provided by EMPs in the 279 telepharmacy consults. The types of intervention for all consults are shown in Figure 3. The most common interventions were medication selection and dosing (*n* = 238, 85.3%), antimicrobials (*n* = 141, 32.4%), monitoring and follow-up (*n* = 65, 14.9%), discharge (*n* = 56, 12.9%), drug information (*n* = 55, 12.6%), and allergy review (*n* = 50, 11.5%). Table 3 shows additional findings from resuscitation consults. The median number of interventions per telepharmacy consult was 1 (range, 1-2).

When assessing only consults that were categorized as resuscitations, there were 33 documented consults that included 88 interventions. The median number of interventions per telepharmacy consult for resuscitations was 2 (range, 1-4), compared to 1 (range, 1-2) for all other consults. The most common types of intervention in resuscitation calls were medication selection and dosing (*n* = 25, 75.8%), monitoring and follow-up (*n* = 17, 51.5%), drug information (*n* = 8, 24.2%), and antimicrobials (*n* = 5, 15.2%). At the beginning of the study period in December 2018, there were 11 telepharmacy consults, while at the end of the study period in October 2020 there were 13 consults. The number of consults varied significantly from month to month (Figure 4).

## Discussion

This article reviews a novel clinical offering, emergency medicine telepharmacy, which has been effectively integrated into telemedicine and functions independently as a consult service. Over the 2-year study period, we saw fluctuations in overall utilization of emergency medicine telepharmacy services (Figure 4), including a temporary decrease in ED visits from March 2020 to July 2020 secondary to the COVID-19 pandemic. Our study highlights the breadth of interventions EMPs provide for critical access hospitals. Not surprisingly, the largest proportion of consults resulted in interventions regarding medication

selection and dosing (*n* = 238, 54.7%), followed by antimicrobial selection (*n* = 141, 32.4%), which frequently accompanied allergy review (*n* = 50, 11.5%). Antimicrobial selection interventions highlight antimicrobial stewardship efforts by EMPs impacting a large, diverse geographical area and patient population, which may have a long-term positive influence on antimicrobial resistance and prescribing patterns.

Traditional telepharmacy services mainly offer remote order entry, verification, and dispensing, as well as consultation and counseling for patients in the ambulatory care setting.[1,2] Recently, tele-ICU services have expanded to include telepharmacy as a means of incorporating evidence-based medication recommendations and intervening in real time on critical medication-related problems in collaboration with the multidisciplinary team, in line with the decentralized pharmacy practice model.[10] In agreement with ASHP's statement on telepharmacy, we have utilized the practice of emergency medicine telepharmacy to expand pharmacy practice to sites beyond the physical site of practicing EMPs.[1] Emergency medicine telepharmacy has extended access to clinical EMPs at sites that previously were working without clinical pharmacists at the bedside. Of the sites within the 18-ED regional health system, only one has onsite EMPs, so we have been able to create a multidisciplinary, collaborative pharmacy practice at critical access and other smaller EDs where there was previously no clinical pharmacist presence.

Telepharmacy combined with telemedicine is a force-multiplier that brings critical expertise via video or telephone to locations that do not have pharmacy available for consultation. Consider, in particular, small, rural critical access facilities that may be staffed by a single nurse and a single provider (physician, NP, or PA.) In combination with telemedicine, telepharmacy can double the number of care team members present virtually

**Figure 3.** Type and frequency of emergency medicine pharmacist interventions.
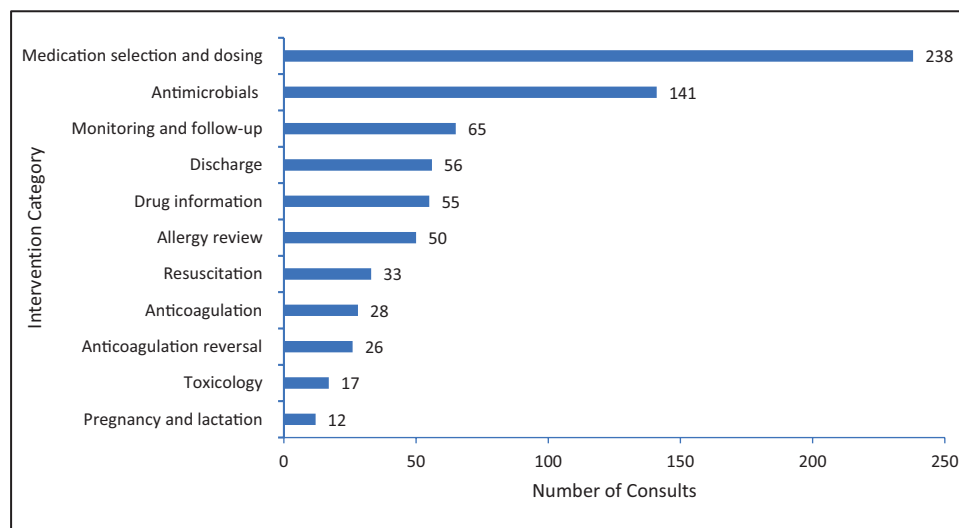


at the bedside. With rapid evolution of drug development and indications for use in multisystem, complex patients, telepharmacy brings a strong knowledgebase to the bedside virtually. Whether this be for highly complex, highly acute critically ill patients requiring resuscitation or medication infusions, patients with intentional ingestion or polypharmacy challenges, or clinicians with questions on anticoagulation reversal, across the spectrum, telepharmacy in the ED brings a new level of safety and quality to the bedside not seen before, especially in our rural, austere care locations. Although the ideal state would be an EMP at the bedside in all EDs, this is not currently the case. We are continuing to work to add dedicated EMPs to our health-system sites, with EMP services currently being piloted at 2 of our moderately sized EDs.

Resuscitations accounted for 11.8% of the consults received. However, of these 33 consults, 28 (84.85%) were from critical access hospitals (Table 3). These 33 resuscitation calls resulted in 88 interventions, with resuscitation consults most commonly involving recommendations for medication dosing and selection ($n = 25$, 75.7%), monitoring and follow-up ($n = 17$, 51.5%), and drug information ($n = 8$, 24.2%) (Table 3). Additionally, a larger

proportion of consults for resuscitation required either 16 to 45 minutes ($n = 17$, 45.9%) or more than 45 minutes ($n = 10$, 27%) to complete compared to all consults, where a majority took 5 to 15 minutes ($n = 168$, 60.2%). This is reflective of the critically ill patients being cared for during resuscitation consults and the greater attention required of the EMP and entire team. With access to a clinical pharmacist, clinicians can focus on the patient along with other aspects of patient care, including procedures, medical decision-making, and care coordination. At the quaternary care hub of the regional health system, for any resuscitation, patients are cared for by a large multidisciplinary team, made up of physicians, nurses, and pharmacists, among other experts in their field. In the critical access sites or other mid-sized EDs, when there is a resuscitation, resources are limited, particularly for the 11 critical access hospitals in our health system. Utilization of a multidisciplinary telemedicine team that includes an EMP imparts additional resources that increase the level of care provided to patients. EMPs are available to review EMRs, assessing home medication lists, adverse drug events, and allergies, and make recommendations for optimization of therapies, exactly as we would at the bedside.

There are many factors to take into consideration when initiating an ED telepharmacy service. Implementation of ED telepharmacy services required organization, training, and extensive communication of the telemedicine workflow among physicians, NPs, and PAs throughout the health system.[2] One potential obstacle to implementation of telepharmacy services in the ED was allocation of time for consults. Our current model includes 17.5 hours a day for EMP coverage in the ED, with 10 hours of overlapped coverage between EMPs; however, there is no dedicated pharmacist for telemedicine. Resuscitation activations can be synchronous in nature, and the EMP on duty responds if there is not another concurrent resuscitation within the ED. When there is a telephone consult, EMPs have the option to take a telephone number and call back if they are unavailable at the time of consultation. By allowing open communication between EMPs and practitioners in the health system, we have been able to provide consistent telepharmacy services. As we continue to move this service forward, we hope to secure dedicated shifts to cover telemedicine.

As telemedicine expands and telepharmacy consults increase in number, further considerations are necessary. Our current model of utilizing
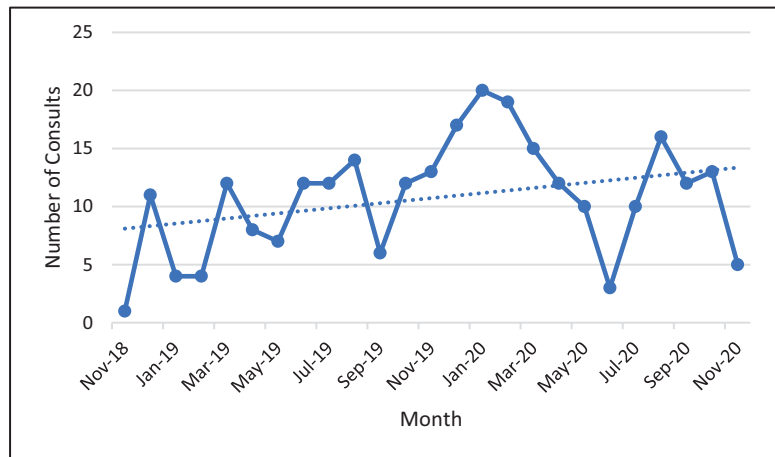
**Table 3.** Resuscitation Consults

| Characteristic | Consults (*n* = 33) |
|---|---|
| Hospital size, No. (%) | |
| Critical access | 28 (84.9) |
| Moderately sized community | 4 (12.1) |
| Large community | 1 (3.0) |
| Time spent, No. (%) | |
| <5 minutes | 0 (0) |
| 5-15 minutes | 10 (30.3) |
| 16-45 minutes | 13 (39.4) |
| >45 minutes | 10 (30.3) |
| Intervention type, No. (%)[a] | |
| Medication selection and dosing | 25 (75.8) |
| Monitoring and follow-up | 17 (51.5) |
| Drug information | 8 (24.2) |
| Antimicrobials | 5 (15.2) |
| Toxicology | 3 (9.1) |
| Anticoagulation reversal | 3 (9.1) |
| Anticoagulation | 1 (3.0) |
| Allergy review | 1 (3.0) |
| Pregnancy and lactation | 0 (0) |
| Discharge | 0 (0) |

[a]A single consult could involve multiple intervention types.

**Figure 4.** Telepharmacy consult volume by month.



EMPs from the main hub may not be sufficient, and additional full-time equivalents fully dedicated to ED telepharmacy services may be warranted. Additionally, we are fortunate to share an EMR with the other EDs within our health system and can view data in real time, including vital signs, pertinent laboratory results, and medication administrations. Any addition of outside hospitals utilizing a different EMR would present a significant challenge.

There were a number of limitations to this study that should be addressed. First, the data we present is limited to the interventions documented by the pharmacist. Any consults that were completed but not documented were not captured here. Other consults such as those regarding nursing staff questions, follow-up culture questions, and nonclinical topics (eg, EMR order entry) were not documented. Second, this study did not capture whether the recommendations we made were accepted by physicians, NPs, and PAs or how our interventions affected patient outcomes. This is an area for further study. Finally, from a business development perspective, we did not capture the exact amount of time spent per intervention, but rather grouped the time spent into blocks. Because time spent is an estimated number, there is a risk for inherent bias from the documenting EMP; however, a majority of consults were in the range of 5 to 15 minutes (60.2%). This is typical for a teleconsult for an unfamiliar patient, in which sufficient background information must be gathered to adequately answer the drug information question at hand. Future work will focus on robust capture of time spent to assess the cost impact per time for the service. We hope that this model can be emulated across the country, but we need to clarify the specific range of time required, allowing for future planning, development, and growth.

## Conclusion

To our knowledge, this is the first description of the implementation and utilization of telepharmacy services for EDs across a geographically dispersed academic and community-based health system. ED telepharmacy services can provide increased access to emergency medicine specialty pharmacists in areas that would not otherwise have these services.

## Acknowledgments

## Disclosures

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