

Telepharmacy: a pharmacist's perspective on the clinical benefits and challenges

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Abstract: The use of information and telecommunication technologies has expanded at a rapid rate, which has a strong influence on healthcare delivery in many countries. Rural residents and communities, however, often lack easy access to healthcare services due to geographical and demographical factors. Telepharmacy, a more recent concept that refers to pharmaceutical service provision, enables healthcare services, such as medication review, patients counseling, and prescription verification, by a qualified pharmacist for the patients located at a distance from a remotely located hospital, pharmacy, or healthcare center. Telepharmacy has many recognizable benefits such as the easy access to healthcare services in remote and rural locations, economic benefits, patient satisfaction as a result of medication access and information in rural areas, effective patient counseling, and minimal scarcity of local pharmacist and pharmacy services. Telepharmacy undoubtedly is a great concept, but it is sometimes challenging to put into practice. Inherent to the adoption of these practices are legal challenges and pitfalls that need to be addressed. The start-up of telepharmacy (hardware, software, connectivity, and operational cost) involves considerable time, effort, and money. For rural hospitals with fewer patients, the issue of costs appears to be one of the biggest barriers to telepharmacy services. Moreover, execution and implementation of comprehensive and uniform telepharmacy law is still a challenge. A well-developed system, however, can change the practice of pharmacy that is beneficial to both the rural communities and the hospitals or retail pharmacies that deliver these services.

Keywords: challenges, clinical benefits, healthcare services, pharmacist, telepharmacy

Introduction

During the 20th century, the use of information and telecommunication technologies has expanded at a rapid rate. This expansion has strongly influenced healthcare delivery in many countries. The availability of the Internet has created more informed consumers who demand more of healthcare professionals. However, a shortage of healthcare services and trained healthcare professionals, especially in the rural and regional areas, often hinders appropriate treatment and care for patients.^{1,2}

Rural communities have limited access to vital healthcare services, at least in part because of the closure of local pharmacies.³ Losing the only retail pharmacy within a rural community can influence the access to prescription and over-the-counter medications and, in some cases, leave the community without proximate access to any clinical healthcare provider.⁴ Pharmacies that currently operate in remote areas face the problem of service sustainability because of recruitment and retention of pharmacists, leading to difficulties in creating succession plans. As such, residents have to either drive to the nearest pharmacy or use mail order or online services to fill their prescription, which is

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a particular concern for frail individuals with limited mobility and limited support or without the connection/competence of information technology.

Technology has emerged as a potential mean to overcome some of these obstacles to patient care. Telemedicine, particularly telepharmacy, appears to be an enabling technology that represents a unique and innovative way to deliver quality pharmacy services to rural and regional areas particularly.⁵ Telepharmacy enables healthcare services such as medication review, patients counseling, and prescription verification by a qualified pharmacist for the patients located at a distance from a remotely located hospital, pharmacy, or healthcare center. This review highlights the concept of telemedicine with particular focus on telepharmacy models, their operation, role of a pharmacist, and clinical benefits and challenges. Although we recognize the differences in the approach of healthcare delivery in different countries, the focus of this review is to highlight pharmacist' viewpoints on the clinical benefits and challenges of healthcare delivery via telepharmacy.

Telemedicine

The term “tele” originated from the Greek word “Telos” meaning “at a distance” and the term “medicine” derived from a Latin word “Meden” meaning “to heal”. This technology was devised to provide healthcare services to medically deprived population in geographically remote locations with the help from long-distance medical centers.⁶ Telemedicine has been defined by the World Health Organization as

the delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities. (Reprinted from World Health Organization. *WHO Group Consultation on Health Telematics. A Health Telematics Policy in Support of WHO'S Health-For-All Strategy for Global Development: Report of the WHO Group Consultation on Health Telematics 11–16 December*. Definition, concept and functions of health telematics. Pg 10. Copyright [1998]).⁷

Telemedicine involves a diverse range of technologies and applications. The most commonly described telemedicine practice is those involving the use of telephones, videoconference, and the Internet.⁸ Telemedical programs and consultations are gaining popularity each year since treatments via telemedical programs seem to achieve similar outputs as those obtained through face-to-face care.⁸ Advancements in

digital communication, data compression technologies, and digitalization processes have enabled the development of low-bandwidth personal computer-based videoconference that has indeed influenced the widespread use of telemedicine.⁸

Telepharmacy

Telepharmacy, analogous to telemedicine, is a more recent concept that refers to pharmaceutical service provision. Strategies to address the barriers to accessing pharmacy services have resulted in the creation of several models of telepharmacy. The National Association of Boards of Pharmacy defines “telepharmacy” as “the provision of pharmaceutical care through the use of telecommunications and information technologies to patients at a distance”.⁹ Telepharmacy delivers clinical pharmacy services and the dispensing of a prescription at a remote location without the physical presence of a pharmacist. Typical telepharmacy involves services such as medication order review, dispensing and compounding, drug information services, patient counseling, and therapeutic drug monitoring.¹⁰ Hence, telepharmacy uses state-of-the-art technology that allows a qualified pharmacist situated at a central location to supervise a pharmacy assistant or a pharmacy technician situated at a remote site in the dispensing of pharmaceuticals through audio and video computer links.⁵

Telepharmacy acts as a potential alternative to around-the-clock on-site pharmacist medication review for remote hospitals.¹¹ This has been adopted by many healthcare institutions as an alternative strategy of extending pharmacy coverage in areas where 24-hours pharmacy services are not available.¹² The emerging electronic health information systems and related technologies, such as fax, and electronic health records make information more readily available to pharmacist for review before a dose is available for administration to a patient. These technologies are advancing telepharmacy services and enabling pharmacist to contribute efficiently in improving medication use.¹³

How does telepharmacy work?

In general, a small rural hospital, pharmacy, or clinic in an isolated area is connected to a commonly utilized service model in larger urban center that has greater access (often 24 hours) to pharmacist staff. This connection is possible through videophone systems, novel software, and automated dispensing machine.¹ The rural site is usually staffed by either pharmacy technicians or nurses, depending on whether the site is a pharmacy or a clinic. They may communicate the prescriptions (eg, fax) from patients who report to these sites to the central site, which is then processed by a qualified

Table 1 Types of telepharmacy models

Types	Process
Traditional full-service pharmacy	Like traditional pharmacies, this telepharmacy site encompasses services such as filling prescriptions, medication reviews, and patient counseling. These telepharmacy sites have complete drug inventories that include prescription and over the counter medications along with other-health-and beauty aids and other general merchandise
Remote consultation sites	Prescriptions are prepared at the central pharmacy and are delivered to the rural sites. Audio and video computer links are used to deliver patient counseling and education
Hospital telepharmacy	Hospital pharmacist in urban medical center reviews processes and verifies the prescriptions that are issued and electronically sent from rural hospitals. Automated dispensing machine (ADM) is used to electronically release the prepackaged medication. A nurse or pharmacy assistant at rural end double-checks the label and medication prior dispensing them to patients. The pharmacist from central (urban) location monitors the verification process and involves in consultation between the patients, nurses, or physicians when required via videoconference link
ADMs	Pharmacist at a central location upon receiving drug order (electronically or by fax) confirms the patient profile, conducts proper drug utilization review, and finally instructs the ADM to release the medication. With the help of audio and video computer links, patient counseling is then conducted

Note: Data from Peterson et al¹, Casey et al⁹, and Casey et al¹⁶.

pharmacist. The central pharmacist reviews the prescription and releases the appropriate items at the rural (eg, prepackaged medication from the automated dispensing machines) and the label. Remote site processing and dispensing protocol of North Dakota¹ model is illustrated in Figure S1.

The pharmacy technician or nurse at the rural site then scans the bar code so that the prescription matches with its label, attaches the label, and supplies it to the patient. The pharmacist at the central end can visually monitor the technician or nurse's work to ensure that the right medications have been filled and dispensed. At the end of the process, the central pharmacist provides a two-way video consultation for the patient to ensure that they understand the intended medication use and administration.¹⁵ This addresses any concerns from the patient's perspectives and enables efficient patient counseling from the central location.

Automated dispensing machines, however, are not always affordable for small rural hospitals or clinics. An alternative was developed by researchers in Fargo, ND, USA, where a technician under the videoconference supervision of a central pharmacist at a distant location prepares medication for dispensing, repackaging, and relabeling.¹⁵ These medications are then directly delivered to the nurse by the pharmacy technician or are dispensed through automated dispensing devices (when available). In another example, to facilitate 24-hour access to the pharmacist by physicians and nurses in the patient care area for face-to-face consultation and communication, a wireless mobile technology cart has been developed for use in remote hospitals.¹⁵ Table 1 summarizes the various types of telepharmacy models.

Involvement of pharmacists

In any telepharmacy model, pharmacist can play an active role in the delivery of pharmacy services. The pharmacist involving in telepharmacy models ensures high quality care for the community particularly areas such as medication reviews and patient counseling.⁵ A 2013 study of the impact of telepharmacy services has shown that the involvement of pharmacists in the remote review of medication orders when the hospital pharmacy was closed resulted in a decreased number of adverse drug events reported.¹⁷ Adverse drug events and other medication error contribute to several thousand deaths each year. The annual cost of preventable adverse drug events in the USA alone is estimated at US\$2 billion.¹¹ Similarly, a 2012 US study has shown that adverse patient outcomes including prolonged hospitalization and potential death may have been prevented using telepharmacy services as potential alternatives to around-the-clock on-site pharmacist medication review for rural hospitals.¹¹

With the growing population of patients with chronic medical conditions, all around the world involvement of pharmacists in telepharmacy models to improve monitoring and encourage medication compliance can decrease the risk of medication errors, adverse drug events, decreased medication cost, and the chances for treatment failure. This means that we need to be cautious of some of the telepharmacy models that often exclude active pharmacist involvement including Internet pharmacies, vending machine models, mail-order pharmacies, and models that shift pharmacist's roles to other healthcare professionals such as doctors and nurses.¹

Despite the differences in healthcare system between countries, telepharmacy models involving the active role of pharmacists are successful in several states of the USA and in Australia.^{1,17,18} In a 2005 Australian study, ~50% of

pharmacists in rural and remote Australian communities indicated their willingness in using telepharmacy models to conduct home medication review (HMR).¹⁸ HMR through telepharmacy has the potential to deliver a significant service to rural and remote communities, which would normally require visiting pharmacist to conduct this review. Telepharmacy models in the US, especially in the North Dakota,¹ include and retain the role of a pharmacist as the primary healthcare provider in the delivery of pharmacy services. This value-added quality assurance feature is often lacking in other telepharmacy models that exclude the involvement of pharmacists, resulting in no formal drug utilization review or patient counseling.¹ A study from the USA reported that the involvement of pharmacists in telepharmacy models has assisted in tracking and improving medication error rates.⁹ The models proved to be a valuable resource at sites, which previously had no pharmacy inputs, and suggested a trend toward improved medication documentation, reduced medication risk, and achievable minimum standard of pharmaceutical review.¹⁹ The impact of pharmacist involvement was further seen in the number of orders reviewed, modified, discontinued, or canceled by a remote pharmacist, reduced order processing time, and saving money.²⁰

Clinical benefits and challenges of telepharmacy

Advantages

Access to healthcare services

The primary advantage of telepharmacy is the easy access to healthcare services in remote and rural locations. Routine access to prescription medication and access to pharmacists are recognized as fundamental aspects to the delivery of patient-centered healthcare in remote and rural communities.² Pharmacist can provide high-level pharmaceutical care services in remote areas that have lost or are losing access to healthcare services.

Approximately half of the 410 small rural hospitals in the USA reported on-site pharmacist availability (<5 h/wk), and 90% of the hospitals reported that nurses were responsible for medication dispensing and administering.^{21,22} Development of several models of telepharmacy addressed this scenario by enabling full-services operation that encompasses active role of remote and central pharmacists, medication utilization review, patient counseling, and patient education to the remote site using various technologies.

Economic benefits

Telepharmacy has several economic benefits. It is reported that starting a new pharmacy store is much expensive than the

cost involved in the equipment and recruitment of pharmacy technician for telepharmacy. One skilled pharmacist can provide service to multiple sites. Hence, considering the rising pay scale for pharmacist and further expenses in hiring additional pharmacists for rural sites, costs are minimized. A telepharmacy model targeted to low-income population showed that >60% of patients would have faced difficulties in affording their medications if the telepharmacy model did not exist.¹⁴ Garrelts et al²³ studied the impact of telepharmacy in a multihospital health system, which showed a net estimated saving of US\$1,132,144 annually.

Telepharmacy on the other hand saves travel time and expense, which are major barriers for rural elderly and disabled veterans.²⁴ A telepharmacy program focusing on medication therapy management services in 96 elderly patients in Connecticut, USA, succeeded in saving ~US\$300,000.²⁵ Healthcare providers receive telepharmacy as an ideal alternative to treatment delays when pharmacists are not present on site. Travel time and other costs associated with the travel are avoided when patients are not referred to other sites.²⁶

Patient satisfaction

Medication access and information in rural areas via telehealth has an advantage of patient satisfaction. One of the prominent barriers in the clinic used to be with the elderly patients missing their appointments because they did not want to go out of their homes. This remote technology has allowed pharmacists to review patient's medications without them having to travel. This has increased patient trust and satisfaction with the service.²⁵ A US study to identify the underlying factors determining patient satisfaction depending upon healthcare delivery mode or community-specific factors reported that rural community patients value receiving pharmacy services locally via telepharmacy services rather than having to travel outside of their community.²⁷ Similar study in the USA aiming to evaluate the telepharmacy program reported that >75% of the patients involved in the study were satisfied with the service and communication with pharmacist via videoconference.¹⁴ A study on patient survey in Queensland, Australia, reported that patients are very satisfied with the service that they received via telepharmacy.²⁸

Effective patient counseling

Telepharmacy ensures greater satisfaction of patients with regard to the pharmacist counseling and time required obtaining medication.¹⁴ A study on telepharmacy-related services and outcomes in the USA reported that pharmacists recommend using the webcam-enabled telepharmacy services because they provide better privacy and longer counseling

duration.²⁹ Effectiveness of telepharmacy counseling was also illustrated by another study that used compressed video to explain the metered-dose inhaler techniques instead of using traditional package insert instructions.³⁰

Skoy et al explored the ability of students to provide effective patient consultation via telepharmacy and examined any differences of students to counsel patients via telepharmacy and face-to-face consultation. They reported that students can successfully provide patient consultation without having prior practice with telepharmacy equipment.³¹ However, the study also highlighted that students performed better during the face-to-face consultation, suggesting that additional training and practices with telepharmacy consultation are warranted.

Minimal scarcity of pharmacists

A number of hospitals, clinics, and medical centers in rural settings are currently facing the scarcity of local pharmacy services where medications are supplied without the involvement of a pharmacist.^{32,33} In situations where pharmacists are not available in rural and remote areas, the majority of pharmacy services are shifted toward nurses, doctors, and other healthcare providers who may not have been trained in the areas of appropriate medication management. This scenario has potentially created a system that is not ideal and that does not meet the government policies around the provision of quality pharmaceutical services to all citizens. Telepharmacy has the potential to address these issues. The pharmacy profession has an impending role to be actively involved in the trials of telepharmacy. A remote telepharmacy service is a viable option to cover these shifts of pharmacy profession to other professions. Hence, telepharmacy addresses pharmacist shortages in rural areas and improves patient access to pharmaceuticals and pharmacy services.

In 2010, a study was undertaken in Queensland, Australia, which reported the feasibility of successful implementation of telepharmacy models to provide pharmacist medication review for patients at rural hospitals.¹⁹ Later in 2013, a government-supported funding enabled the delivery of clinical pharmacy service in remote and rural parts of Queensland. Pharmacist staffing needs in small rural hospitals are addressed by hospital telepharmacy networks that provide an affordable, convenient, and flexible solution. Telepharmacy eases difficult scheduling periods, when pharmacist replacements and relief help may not be readily available, and supports staff coverage for after hours, weekends, vacations, and during emergencies.

Disadvantages

Pharmacy regulation laws

Despite the widespread potential of telepharmacy, the laws and policies that govern pharmacy operations do not adequately address the growing industry. A number of policy issues, such as the physical location of pharmacists that provide telepharmacy services, minimum amount of time that pharmacist must be on site, the types of technology used, and the roles of pharmacists, pharmacy technicians, nurses, or other healthcare providers in medication distribution systems, need to be addressed. The regulations govern not only the system that ensures safe medication handling but also the operation of comprehensive medication use system, defining what role telepharmacy plays in this broader scope of pharmacy services in acute-care settings.⁹

Telepharmacy is still a novel concept, and there is a delay in the implementation of new laws, although professional and technological innovations are being used. In places where telepharmacy laws exist, there is a lack of uniformity among various jurisdictions. Execution and implementation of comprehensive and uniform telepharmacy law is still a challenge.

Operational difficulties

Telepharmacy undoubtedly is a great concept, but it is sometimes challenging to put into practice. The rural hospitals and clinics with telepharmacy services experience operational and resource challenges. Telepharmacy services experience operational and resource challenges. Telepharmacy services may only be possible with more complex and sophisticated equipment with high-speed digital connection (eg, Integrated Service Digital Network), which are often limited in rural areas.³⁴ Organizational cultures can also play significant roles as barriers for incorporating and embedding telepharmacy technologies into existing healthcare systems.² Face-to-face versus remote workflow might often be overwhelming and less spontaneous for both patients and healthcare providers. A study on normalization (the routine integration of program in everyday practice) of telehealthcare suggested that successful normalization of telehealthcare services was dependent upon a positive link with a policy level sponsor, involvement of organized, cohesive groups, development of supportive organizational structure, and the expansion of new procedures by professionals.³⁵ Although telepharmacy is well integrated into traditional health care in the USA, complication at these levels is usually underestimated, which leads to the failure of telehealth programs to become integrated as mainstream health services.²

Telepharmacy involves substantial changes in the existing workflow for the rural and remote hospitals where some sites may experience significant challenges adopting the required changes.¹¹ An issue with increased workload appears when a single pharmacist oversees several remote pharmacy sites. This may also involve time-consuming travel requirements to the remote sites, especially when a monthly on-site visit is recommended by the pharmacy law.

More time, effort, and money

The start-up of telepharmacy (hardware, software, connectivity, and operational cost) involves considerable time, effort, and money. The North Dakota telepharmacy project estimated tentative cost (drug store fixtures: US\$20,000, drug inventory: between US\$60,000 and US\$80,000, the digital subscriber lines: US\$800/month, hardware: US\$2,000, pharmacy operation software: US\$5,000–7,000, videoconference setup: US\$6,500, videoconference equipment: US\$3,500–15,000, transmission/connectivity: US\$250/month, firewall security systems: US\$1,200, and other miscellaneous costs) for the operation of successful telepharmacy model.¹ This cost estimation, however, is based on a 2004 study.¹ The actual cost today is expected to increase several folds. Moreover, the integration of telepharmacy systems to the traditional healthcare systems has not been implemented in countries that use telepharmacy services. This makes private as well as government healthcare programs reluctant in funding telepharmacy expenditures. For example, individuals currently paying their health insurance will get funded only from the traditional healthcare expenditure, while their telepharmacy expenditures will not be covered. The integration of new healthcare system is required for the development of telepharmacy services around the world. This integration will be a challenging and time-consuming task that requires reviewing the laws and setting up rules and regulations for telepharmacy operations in the coming years.

Moreover, despite having an optimistic future of telepharmacy services, Chief executive officers in remote clinics and on-site hospitals find difficulties funding telepharmacy costs. Pharmacists on the other hand believe that they can overcome technological and regulatory barriers, but they are not certain that they can afford this service in the long term. Ultimately, for rural hospitals with fewer patients, the issue of costs appears to be one of the biggest barriers to telepharmacy services.

Others Security

Telepharmacy involves the transmission of personal and health-related information over the Internet. Security of

information becomes concern because it is essential to keep this huge transfer of data under control. Patient's personal information can only be used in the studies that are respectful to human rights and personal privacy.

Reluctance to use technology

Other disadvantage of telepharmacy involves reluctance or inability to use the technology. This is predominant in elderly people who are suspicious about technology.³⁶ When face-to-face interaction is not present, the pharmacist's ability to fully assess patient's condition might be hindered.

Continuity of care

In circumstances where face-to-face contact is not possible, the pharmacist should provide an ethical indirect supply service that adheres with the regulations of quality use of medicines.³⁷ Ensuring continuity of care and compliance with good dispensing practice becomes more complex on remote sites. Pharmacy technicians must rely upon the pharmacist in all aspects of pharmacy practice.¹ Despite pharmacy technician being monitored or supervised by pharmacists from central location, risk of violation of regulations is difficult to avoid. Unlike regular pharmacies, the use of unauthorized medications or dispensing medications without proper prescription is hard to control.

Conclusion

Rural residents and communities lack easy access to healthcare services often due to geographical and demographical factors. Telepharmacy holds significant promise as a technology to improve access to pharmaceutical care for people living in rural and remote communities. Telepharmacy is quickly becoming an integral part of modern pharmacy practice that has the potential to provide quality pharmaceutical services, such as medication management, dispensing, patient counseling, and drug information. Inherent to the adoption of these practices are legal challenges and pitfalls that need to be addressed. A well-developed system, however, can change the practice of pharmacy that is beneficial to both the rural communities and the hospital or retail pharmacies that deliver these services.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Peterson CD, Anderson HC. The North Dakota telepharmacy project: restoring and retaining pharmacy services in rural communities. *J Pharm Technol.* 2004;20(1):28–39.

2. Goodridge D, Marciniuk D. Rural and remote care overcoming the challenges of distance. *Chron Respir Dis*. 2016;13(2):192–203.
3. U.S. Department of Health and Human Services. National Advisory Committee on Rural Health and Human Services. The 2006 Report to the Secretary: Rural Health and Human Service Issues. 2012.
4. Todd K, Ullrich F, Mueller K. RUPRI Center for Rural Health Policy Analysis, University of Iowa College of Public Health, Department of Health Management and Policy. Rural pharmacy closures: implications for rural communities. *Rural Policy Brief*. 2013;2012(5):1–5.
5. Kimber MB, Peterson GM. Telepharmacy – enabling technology to provide quality pharmacy services in rural and remote communities. *J Pharm Pract Res*. 2006;36(2):128–133.
6. Zundel KM. Telemedicine: history, applications, and impact on librarianship. *Bull Med Libr Assoc*. 1996;84(1):71.
7. WHO Group Consultation on Health Telematics. A Health Telematics Policy in Support of WHO'S Health-For-All Strategy for Global Development: Report of the WHO Group Consultation on Health Telematics 11–16 December. Geneva: World Health Organization; 1997.
8. Angaran DM. Telemedicine and telepharmacy: current status and future implications. *Am J Health Syst Pharm*. 1999;56(14):1405–1426.
9. Casey MM, Sorensen TD, Elias W, Knudson A, Gregg W. Current practices and state regulations regarding telepharmacy in rural hospitals. *Am J Health Syst Pharm*. 2010;67(13):1085.
10. Keeys C, Kalejaiye B, Skinner M, et al. Pharmacist-managed inpatient discharge medication reconciliation: a combined onsite and telepharmacy model. *Am J Health Syst Pharm*. 2014;71(24):2159–2166.
11. Cole SL, Grubbs JH, Din C, Nesbitt TS. Rural inpatient telepharmacy consultation demonstration for after-hours medication review. *Telemed J E Health*. 2012;18(7):530–537.
12. National Association of Boards of Pharmacy. *The Model State Pharmacy Act and Model Rules of the National Association of Boards of Pharmacy*. National Association of Boards of Pharmacy; 1992, Mount Prospect, IL.
13. Pedersen CA, Schneider PJ, Scheckelhoff DJ. ASHP national survey of pharmacy practice in hospital settings: Monitoring and patient education – 2015. *Am J Health Syst Pharm*. 2016;73(17):1307–1330.
14. Clifton GD, Byer H, Heaton K, Haberman DJ, Gill H. Provision of pharmacy services to underserved populations via remote dispensing and two-way videoconferencing. *Am J Health Syst Pharm*. 2003;60(24):2577–2582.
15. Peterson CD, Rathke A, Skwieria J, Anderson HC. Hospital telepharmacy network: delivering pharmacy services to rural hospitals. *J Pharm Technol*. 2007;23(3):158–165.
16. Casey M, Elias W, Knudson A, Gregg W. *Implementation of Telepharmacy in Rural Hospitals: Potential for Improving Medication Safety*. Upper Midwest Rural Health Research Center; 2011. Available from: http://rhrcc.umn.edu/wp-content/files_mf/telepharmacy.pdf. Accessed July 18, 2016.
17. Schneider PJ. Evaluating the impact of telepharmacy. *Am J Health Syst Pharm*. 2013;70(23):2130–2135.
18. Lee WY. Telepharmacy to Improve Healthcare Provision by Community Pharmacists in Rural and Remote Australia. [Honours Thesis]. Hobart: University of Tasmania; 2005.
19. Poulson LK, Nissen L, Coombes I. Pharmaceutical review using telemedicine—a before and after feasibility study. *J Telemed Telecare*. 2010;16(2):95–99.
20. Sankaranarayanan J, Murante LJ, Moffett LM. A retrospective evaluation of remote pharmacist interventions in a telepharmacy service model using a conceptual framework. *Telemed J E Health*. 2014;20(10):893–901.
21. Cochran G, Jones K, Xu L, Mueller K. *Prevalence of Evidence-Based Safe Medication Practices in Small Rural Hospitals*; 2008 RUPRI Center for Rural Health Policy Analysis. Rural Issue Brief 2008-1. Available from: <http://cph.uiowa.edu/rupri/publications/issuebriefs/IssueBrief2008-1.pdf>. Accessed June 12, 2016.
22. Wakefield DS, Ward MM, Loes JL, O'Brien J, Sperry L. Implementation of a telepharmacy service to provide round-the-clock medication order review by pharmacists. *Am J Health Syst Pharm*. 2010;67(23):2052.
23. Garrelts JC, Gagnon M, Eisenberg C, Moerer J, Carrithers J. Impact of telepharmacy in a multihospital health system. *Am J Health Syst Pharm*. 2010;67(17):1456–1462.
24. Win AZ. Telepharmacy: Time to pick up the line. *Res Social Adm Pharm*. 2015, June 23; pii: S1551-7411(15)0119-9. DOI: 10.1016/j.sapharm.2015.06.002. [Epub ahead of print].
25. Traynor K. Telepharmacy services bring new patient care opportunities. *Am J Health Syst Pharm*. 2013;70(7):565–566.
26. Gordon HL, Hoerber M, Schneider A. Telepharmacy in a rural Alberta Community Cancer Network. *J Oncol Pharm Pract*. 2012;18(3):366–376.
27. Freisner D, Scott DM. Exploring the formation of patient satisfaction in rural community telepharmacies. *J Am Pharm Assoc*. 2009;49(4):509–518.
28. Rothwell M, Hogan A. Clinical pharmacists connecting with patients in rural and remote towns via telehealth. *13th National Rural Health Conference*. 2015, May 24–27, 2015, Darwin Convention Centre, NT, Australia.
29. Lam AY, Rose D. Telepharmacy services in an urban community health clinic system. *J Am Pharm Assoc*. 2009;49(5):652–659.
30. Bynum A, Hopkins D, Thomas A, Copeland N, Irwin C. The effect of telepharmacy counseling on metered-dose inhaler technique among adolescents with asthma in rural Arkansas. *Telemed J E Health*. 2001;7(3):207–217.
31. Skoy ET, Eukel HN, Frenzel JE, Schmitz TM. Performance and perceptions evaluation of pharmacy students' consultation via telepharmacy. *J Pharm Technol*. 2015;31(4):155–160.
32. Commonwealth Department of Health and Aged Care, The National Key Centre for Social Applications of Geographical Information Systems (GISCA), and the Pharmacy Guild of Australia. Pharmacy access/remoteness index of Australia (PHARIA). Barton (ACT): Pharmacy Guild of Australia; 2000. Available from: [https://www.health.gov.au/internet/main/publishing.nsf/Content/E2EE19FE831F26BFCA257BF0001F3DFA/\\$File/ocpanew14.pdf](https://www.health.gov.au/internet/main/publishing.nsf/Content/E2EE19FE831F26BFCA257BF0001F3DFA/$File/ocpanew14.pdf). Accessed October 05, 2016.
33. Nissen L, Tett S. Can telepharmacy provide pharmacy services in the bush? *J Telemed Telecare*. 2003;9(suppl 2):39–41.
34. May C, Harrison R, Finch T, et al. Understanding the normalization of telemedicine services through qualitative evaluation. *J Am Med Inform Assoc*. 2003;10(6):596–604.
35. Collins B, Borders TF, Tebrink K, Xu KT. Utilization of prescription medications and ancillary pharmacy services among rural elders in west Texas: distance barriers and implications for telepharmacy. *J Health Hum Serv Adm*. 2007;30(1):75–97.
36. Pharmaceutical Society of Australia. *Professional Practice Standards, Version 4*. © Pharmaceutical Society of Australia; 2010; Deakin West ACT 2600.

Supplementary materials

**STEP-BY-STEP PROTOCOL FOR
PROCESSING NEW PRESCRIPTIONS
AT REMOTE TELEPHARMACY SITE**

New Prescription is received by Pharmacy Technician from:

<u>Patient</u>	<u>Prescriber</u>
Written prescription	Phone/fax/computer

[Some pharmacists prefer the prescription to be faxed to the central pharmacy for entry.] [Some pharmacists prefer calls to come to the central pharmacy.]

[In North Dakota it is permitted for the pharmacy technician to perform these functions if allowed by the pharmacist.]

IF PATIENT IS KNOWN	IF PATIENT IS NOT KNOWN
Verify Insurance	Get demographic/Allergy info
Any new allergies	Insurance/Family history Disease status

Verify prescription has all required elements:

Noncontrolled substance NDAC 61-04-06-02	Controlled substance 61-04-06-03
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Is prescription readable and understandable?
ANY Questions – contact pharmacist

Enter prescription into the computer patient profile
Pharmacist performs drug utilization review:

No Allergies or Drug–Drug/ Drug–Disease Interactions:	Allergies Drug–Drug/ Drug–Disease Interactions: Contact pharmacist for verification
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Proceed to select correct product
Prepare prescription for dispensing and label proper use instructions
Bill through insurance–Clear any third-party problems (early refill etc.)
Final check performed by pharmacist
Seat patient in consultation room
Connect patient to pharmacist via audio/video link
Place filled prescription on a table in front of the patient
Pharmacist performs patient education counseling – Dispensing takes place here
Bag/Package prescription including written product information
Complete financial transaction

Thank you/come back soon

Figure S1 North Dakota telepharmacy project – step-by-step protocol for processing new prescriptions at remote telepharmacy site.

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