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Data privacy and security in health information management: Challenges for nursing and pharmacy professionals

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***Abstract*---Background:** The integration of information and communication technologies in healthcare has revolutionized patient care globally. However, rural and remote areas face challenges in accessing essential healthcare services, including pharmacy care. Telepharmacy has emerged as a promising solution to bridge this gap and provide quality pharmaceutical services to underserved populations. **Methods:** This study reviews the concept of telepharmacy, focusing on its models, operational processes, and the role of pharmacists in delivering remote pharmacy services. It explores the use of technologies like videoconferencing and automated dispensing systems in telepharmacy setups, detailing how pharmacists interact with patients and healthcare providers in distant locations. **Results:** Telepharmacy models have shown significant success in improving medication access and patient outcomes in remote areas. Studies indicate that active pharmacist engagement in telepharmacy services reduces adverse drug events, enhances medication monitoring, and promotes medication compliance. The involvement of pharmacists in telepharmacy has led to cost savings, decreased medication errors, and improved medication documentation in regions lacking adequate pharmacy services. **Conclusion:** Telepharmacy emerges as a transformative approach to healthcare delivery, particularly in rural and remote regions with limited access to pharmacy services. Active pharmacist participation in telepharmacy models plays a crucial role in ensuring quality care, medication safety, and patient satisfaction. By leveraging technology and pharmacist expertise, telepharmacy offers a viable solution to overcome healthcare disparities and improve medication management in underserved communities.

***Keywords*---**Telepharmacy, pharmacist engagement, nursing, remote healthcare, medication access, healthcare disparities.

1. Introduction

Throughout the 20th century, the adoption of information and telecommunication technologies has grown swiftly. This expansion has significantly impacted healthcare delivery across numerous countries. The rise of the Internet has led to consumers who are better informed and who expect more from healthcare professionals. Nonetheless, a lack of healthcare services and qualified healthcare professionals, particularly in rural and regional areas, frequently obstructs suitable treatment and care for patients (1,2).

Rural communities experience restricted access to essential healthcare services, partly due to the closure of local pharmacies (3). Losing the sole retail pharmacy in a rural area can significantly impact access to both prescription and over-the-counter medications, potentially leaving the community without nearby clinical healthcare providers. Pharmacies operating in remote regions currently struggle with service sustainability, primarily due to challenges in recruiting and retaining pharmacists, which complicates the development of succession plans.

Consequently, residents must either travel to the nearest pharmacy or utilize mail order or online services to obtain their prescriptions. This situation poses a significant challenge for frail individuals who have limited mobility and support, or who lack access to or proficiency in information technology (4,5).

Technology has surfaced as a possible solution to address certain challenges in patient care. Telemedicine, especially telepharmacy, stands out as a transformative technology that offers a distinctive and creative approach to providing quality pharmacy services to rural and regional areas (6,7). Telepharmacy facilitates healthcare services such as medication review, patient counseling, and prescription verification by a qualified pharmacist for patients situated far from a hospital, pharmacy, or healthcare center (8). This review emphasizes the concept of telemedicine, specifically examining telepharmacy models, their functioning, the role of pharmacists, and the associated clinical benefits and challenges. This review aims to emphasize pharmacists' perspectives on the clinical advantages and obstacles associated with healthcare delivery through telepharmacy, while acknowledging the varying approaches to healthcare in different countries.

2. Telemedicine

The term “tele” comes from the Greek word “Telos,” which means “at a distance,” while “medicine” is derived from the Latin word “Meden,” meaning “to heal.” This technology was developed to deliver healthcare services to medically underserved populations in geographically isolated areas, utilizing support from distant medical centers. Telemedicine encompasses a variety of technologies and applications (9,10). The most frequently discussed telemedicine practice involves the use of telephones, videoconferencing, and the Internet. Telemedical programs and consultations are becoming increasingly popular each year, as treatments delivered through these programs appear to yield results comparable to those achieved through in-person care. Advancements in digital communication, data compression technologies, and digitalization processes have facilitated the creation of low-bandwidth, personal computer-based videoconferencing, which has significantly impacted the widespread adoption of telemedicine (11-14).

3. Telepharmacy

Telepharmacy, similar to telemedicine, is a contemporary concept that pertains to the delivery of pharmaceutical services. Efforts to overcome the obstacles to accessing pharmacy services have led to the development of various telepharmacy models. 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.” Telepharmacy delivers clinical pharmacy services and the dispensing of a prescription at a remote location without the physical presence of a pharmacist (4). Typical telepharmacy encompasses services like medication order review, dispensing and compounding, drug information services, patient counseling, and therapeutic drug monitoring. Thus, telepharmacy employs advanced technology that enables a qualified pharmacist at a central location to oversee a pharmacy assistant or pharmacy

technician at a remote site in the dispensing of pharmaceuticals via audio and video computer links (8).

Telepharmacy serves as a viable alternative to continuous on-site pharmacist medication review for remote hospitals. This approach has been embraced by numerous healthcare institutions as a strategy to enhance pharmacy coverage in regions lacking 24-hour pharmacy services. The advent of electronic health information systems and associated technologies, such as fax and electronic health records, facilitates easier access to information for pharmacists prior to the administration of medication to patients. These technologies are enhancing telepharmacy services and allowing pharmacists to effectively contribute to the improvement of medication use (13).

A small rural hospital, pharmacy, or clinic in a remote area typically links to a widely used service model found in larger urban centers, which offer more extensive access, often around the clock, to pharmacist staff. This connection is facilitated by videophone systems, innovative software, and automated dispensing machines (15). The rural location is typically staffed by pharmacy technicians or nurses, depending on whether it operates as a pharmacy or a clinic. Prescriptions may be communicated (e.g., via fax) from patients reporting to these sites to the central location, where they are subsequently processed by a qualified pharmacist. The central pharmacist examines the prescription and dispenses the necessary items at the rural location, including prepackaged medication from the automated dispensing machines, along with the label (1).

The pharmacy technician or nurse at the rural site scans the bar code to ensure the prescription aligns with its label, attaches the label, and provides it to the patient. The pharmacist at the central end can observe the technician or nurse's work to confirm that the correct medications have been filled and dispensed. After the process, the central pharmacist conducts a two-way video consultation with the patient to confirm their understanding of the intended medication use and administration (12). This addresses any concerns from the patient's perspective and facilitates effective patient counseling from the central location.

Automated dispensing machines, nonetheless, may not always be within the financial reach of small rural hospitals or clinics. Researchers in Fargo, ND, USA, developed an alternative approach in which a technician prepares medication for dispensing, repackaging, and relabeling under the videoconference supervision of a central pharmacist located remotely. These medications are subsequently delivered directly to the nurse by the pharmacy technician or dispensed through automated dispensing devices, when available. In another instance, a wireless mobile technology cart has been created to enable 24-hour access to the pharmacist by physicians and nurses in the patient care area for face-to-face consultation and communication in remote hospitals (15,16).

4. Engagement of pharmacists

In any telepharmacy model, pharmacists can take an active role in delivering pharmacy services. The pharmacist involved in telepharmacy models guarantees high-quality care for the community, particularly in areas such as medication

reviews and patient counselling (5). A 2013 study on the impact of telepharmacy services demonstrated that the participation of pharmacists in the remote review of medication orders during hospital pharmacy closures led to a reduction in the number of reported adverse drug events (17). Adverse drug events and other medication errors contribute to several thousand deaths annually. The estimated annual cost of preventable adverse drug events in the USA is around US$2 billion. Additionally, a 2012 study indicated that adverse patient outcomes, such as extended hospital stays and possible fatalities, could have been avoided through the use of telepharmacy services as alternatives to continuous on-site pharmacist medication reviews in rural hospitals (11).

The increasing number of patients with chronic medical conditions globally highlights the importance of pharmacists' involvement in telepharmacy models. This engagement can enhance monitoring and promote medication compliance, ultimately reducing the risk of medication errors, adverse drug events, medication costs, and the likelihood of treatment failure. We must exercise caution regarding certain telepharmacy models that frequently lack active pharmacist participation. This includes Internet pharmacies, vending machine models, mail-order pharmacies, and approaches that reassign pharmacists' responsibilities to other healthcare professionals like doctors and nurses (1).

Despite the variations in healthcare systems across countries, telepharmacy models that engage pharmacists actively have proven effective in several states in the USA and in Australia (17,18). In a 2005 study conducted in Australia, approximately 50% of pharmacists in rural and remote areas expressed their readiness to utilize telepharmacy models for home medication reviews (HMR) (18). HMR via telepharmacy holds the potential to provide a valuable service to rural and remote communities, which typically necessitate an in-person visit from a pharmacist for this review. Telepharmacy models in the US, particularly in North Dakota, include and uphold the pharmacist's role as the primary healthcare provider in the delivery of pharmacy services (1). This quality assurance feature adds significant value, often missing in other telepharmacy models that do not include pharmacists, leading to a lack of formal drug utilization review or patient counseling. A study from the USA indicated that pharmacists' involvement in telepharmacy models has been instrumental in tracking and enhancing medication error rates (9,19). These models have proven to be a valuable asset at locations that previously lacked pharmacy input, indicating a trend toward better medication documentation, decreased medication risk, and the establishment of minimum standards for pharmaceutical review. The influence of pharmacist participation was also evident in the volume of orders reviewed, modified, discontinued, or canceled by a remote pharmacist, as well as in reduced order processing times and cost savings (20).

5. Benefits

The main benefit of telepharmacy is the convenient access to healthcare services in remote and rural areas. Routine access to prescription medication and pharmacists is acknowledged as a crucial element in delivering patient-centered healthcare in remote and rural communities. Pharmacists can offer advanced

pharmaceutical care services in areas that have lost or are losing access to healthcare services (21).

About half of the 410 small rural hospitals in the USA indicated that they had on-site pharmacists available for less than five hours per week, while 90% of these hospitals noted that nurses were tasked with dispensing and administering medications. The development of various telepharmacy models has addressed this situation by facilitating full-service operations that include the active involvement of remote and central pharmacists, medication utilization reviews, patient counseling, and education delivered to the remote site through diverse technologies (22).

Telepharmacy offers numerous economic advantages. Starting a new pharmacy store is reported to be significantly more expensive than the costs associated with equipment and the recruitment of pharmacy technicians for telepharmacy. A proficient pharmacist is capable of delivering services across various locations. Therefore, taking into account the increasing salary for pharmacists and the additional costs associated with hiring more pharmacists for rural locations, expenses are reduced. A telepharmacy model aimed at low-income populations demonstrated that over 60% of patients would have encountered challenges in affording their medications without its existence. Garrelts et al. examined the effects of telepharmacy within a multihospital health system, revealing an estimated annual savings of US$1,132,144 (23,24).

Telepharmacy, conversely, reduces travel time and costs, which are significant obstacles for elderly individuals and disabled veterans in rural areas (25). A telepharmacy initiative aimed at medication therapy management services for 96 elderly patients in Connecticut, USA, achieved savings of ØS$300,000. Healthcare providers view telepharmacy as an excellent solution to avoid treatment delays when pharmacists are unavailable on-site. When patients are not referred to other sites, travel time and associated costs are eliminated (26).

The use of telehealth for medication access and information in rural areas enhances patient satisfaction. A significant challenge in the clinic has been the tendency of elderly patients to miss their appointments due to reluctance to leave their homes. This remote technology enables pharmacists to assess patients' medications without the need for them to travel. This has enhanced patient trust and satisfaction with the service (27). A US study aimed at identifying the factors influencing patient satisfaction based on healthcare delivery mode or community-specific elements found that rural community patients prefer receiving pharmacy services locally through telepharmacy rather than traveling outside their community (28). A similar study in the USA evaluating the telepharmacy program revealed that over 75% of the patients involved expressed satisfaction with the service and communication with pharmacists via videoconference. Additionally, a patient survey conducted in Queensland, Australia, indicated that patients are highly satisfied with the telepharmacy services they received (29).

Telepharmacy enhances patient satisfaction concerning pharmacist counseling and the time needed to obtain medication. A study on telepharmacy services and outcomes in the USA indicated that pharmacists advocate for webcam-enabled

telepharmacy services due to their improved privacy and extended counseling time. The effectiveness of telepharmacy counseling was further demonstrated in another study that utilized compressed video to explain metered-dose inhaler techniques, rather than relying on traditional package insert instructions (30-32). Skoy et al (33) investigated how well students can conduct effective patient consultations through telepharmacy and analyzed the differences in their ability to counsel patients in telepharmacy settings compared to face-to-face interactions. It was reported that students can effectively provide patient consultation without prior experience with telepharmacy equipment. However, the study also indicated that students excelled in face-to-face consultations, suggesting a need for further training and practice with telepharmacy consultations.

Many hospitals, clinics, and medical centers in rural areas are currently experiencing a lack of local pharmacy services, resulting in medications being supplied without pharmacist involvement. In cases where pharmacists are absent in rural and remote regions, most pharmacy services are delegated to nurses, doctors, and other healthcare providers who may lack training in proper medication management. This situation has likely resulted in a system that is suboptimal and fails to align with government policies regarding the delivery of quality pharmaceutical services to all citizens. Telepharmacy holds the promise of tackling these challenges. The pharmacy profession is poised to play an active role in the trials of telepharmacy. A remote telepharmacy service presents a practical solution to address the transitions of the pharmacy profession to other fields. Thus, telepharmacy effectively tackles the issue of pharmacist shortages in rural regions while enhancing patient access to medications and pharmacy services (1,20,23).

In 2010, a study was conducted in Queensland, Australia, which highlighted the potential for successful implementation of telepharmacy models to offer pharmacist medication reviews for patients in rural hospitals. Later, in 2013, government-supported funding facilitated the provision of clinical pharmacy services in remote and rural areas of Queensland. Hospital telepharmacy networks offer an affordable, convenient, and flexible solution to meet the pharmacist staffing needs in small rural hospitals. Telepharmacy simplifies challenging scheduling times, when finding pharmacist replacements and relief assistance may be difficult, and enhances staff coverage for after hours, weekends, vacations, and emergencies (33).

6. Drawbacks

Although telepharmacy holds significant promise, the existing laws and policies regulating pharmacy operations fall short in addressing the needs of this expanding industry. Several policy issues require attention, including the physical location of pharmacists offering telepharmacy services, the minimum time pharmacists must be present on-site, the types of technology utilized, and the roles of pharmacists, pharmacy technicians, nurses, and other healthcare providers in medication distribution systems. The regulations oversee both the system that guarantees safe medication handling and the functioning of a

comprehensive medication use system, outlining the role of telepharmacy within the wider context of pharmacy services in acute-care environments (9).

Telepharmacy remains a relatively new idea, and there is a lag in the adoption of updated regulations, even as advancements in both professional practices and technology are being utilized. In regions where telepharmacy regulations are in place, there is an inconsistency across different jurisdictions. The execution and implementation of a comprehensive and uniform telepharmacy law remains a significant challenge (32).

Telepharmacy is certainly an excellent concept, yet it can be difficult to implement effectively. Rural hospitals and clinics that offer telepharmacy services face various operational and resource challenges (1,2.) Telepharmacy services face operational and resource challenges. Telepharmacy services may require more advanced and intricate equipment along with high-speed digital connections (e.g., Integrated Service Digital Network), which are frequently scarce in rural regions. Organizational cultures can also significantly hinder the integration of telepharmacy technologies into current healthcare systems. The contrast between face-to-face and remote workflows can often be daunting and less natural for both patients and healthcare providers (34). A study on the normalization of telehealthcare indicated that the successful integration of these services into everyday practice relies on a strong connection with a policy-level sponsor, the participation of organized and cohesive groups, the establishment of a supportive organizational structure, and the adoption of new procedures by professionals. Although telepharmacy is well incorporated into traditional healthcare in the USA, the complexities at these levels are often underestimated, resulting in the failure of telehealth programs to be recognized as mainstream health services (35).

Telepharmacy brings considerable alterations to the current workflow in rural and remote hospitals, where certain locations may face notable difficulties in implementing the necessary changes. An increase in workload becomes apparent when one pharmacist manages multiple remote pharmacy sites. This may also entail extensive travel obligations to the remote locations, particularly when a monthly on-site visit is advised by pharmacy law (32).

Launching a telepharmacy requires significant investment in terms of time, effort, and financial resources, encompassing hardware, software, connectivity, and operational expenses. The North Dakota telepharmacy project estimated a tentative cost for the operation of a successful telepharmacy model, which includes drug store fixtures at US$20,000, drug inventory ranging from US$60,000 to US$80,000, digital subscriber lines at US$800 per month, hardware costing US$2,000, pharmacy operation software priced between US$5,000 and US$7,000, videoconference setup at US$6,500, videoconference equipment ranging from US$3,500 to US$15,000, transmission/connectivity at US$250 per month, firewall security systems at US$1,200, and other miscellaneous costs (33). This cost estimation is based on a 2004 study, and the actual cost today is expected to increase several folds. Furthermore, the incorporation of telepharmacy systems into traditional healthcare frameworks has yet to be realized in nations utilizing telepharmacy services. This causes both

private and government healthcare programs to hesitate in financing telepharmacy costs. For instance, people who are currently paying for their health insurance will receive funding solely from the conventional healthcare expenses, whereas their telepharmacy costs will remain uncovered. The implementation of a new healthcare system is essential for the advancement of telepharmacy services globally. The integration will present a complex and lengthy endeavor that necessitates a thorough examination of the laws and the establishment of rules and regulations for telepharmacy operations in the years ahead (34).

Furthermore, even with a promising outlook for telepharmacy services, chief executive officers in remote clinics and on-site hospitals encounter challenges in securing funding for telepharmacy expenses. Pharmacists, however, are confident in their ability to navigate technological and regulatory challenges, yet they remain uncertain about the long-term affordability of this service. For rural hospitals with a limited number of patients, costs seem to be a significant obstacle to implementing telepharmacy services (35).

Telepharmacy encompasses the sharing of personal and health-related information via the Internet. The security of information is a significant concern, as it is crucial to manage the vast transfer of data effectively. The personal information of patients may only be utilized in studies that honor human rights and safeguard personal privacy. A further drawback of telepharmacy is the hesitation or incapacity to utilize the technology. This is common among elderly individuals who are wary of technology. When face-to-face interaction is absent, the pharmacist's capacity to thoroughly assess the patient's condition may be compromised (36).

In situations where in-person interaction is not feasible, the pharmacist must offer an ethical indirect supply service that complies with the regulations governing the quality use of medicines (37). Maintaining continuity of care and adhering to good dispensing practices becomes increasingly challenging in remote locations. Pharmacy technicians depend on the pharmacist for all facets of pharmacy practice. Although pharmacy technicians are overseen by pharmacists from a central location, the risk of regulatory violations remains challenging to mitigate. In contrast to conventional pharmacies, it is challenging to regulate the use of unauthorized medications or the dispensing of medications without a proper prescription (38).

7. Conclusion

Residents and communities in rural areas frequently face challenges in accessing healthcare services, often as a result of geographical and demographic factors. Telepharmacy presents a valuable opportunity to enhance access to pharmaceutical care for individuals residing in rural and remote areas. Telepharmacy is rapidly emerging as a crucial component of contemporary pharmacy practice, offering the potential to deliver high-quality pharmaceutical services, including medication management, dispensing, patient counseling, and drug information. The adoption of these practices brings with it legal challenges and pitfalls that must be addressed. An effectively designed system, however, can

transform the practice of pharmacy in a way that benefits both rural communities and the hospital or retail pharmacies providing these services.

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خصوصية البيانات وأمنها في إدارة المعلومات الصحية: التحديات التي تواجه المهنيين في مجال التمريض والصيدلة

الخلفية :لقد أحدث دمج تكنولوجيا المعلومات والاتصالات في الرعاية الصحية ثورة في رعاية المرضى على مستوى العالم. ومع ذلك، تواجه المناطق الريفية والنائية تحديات في الوصول إلى خدمات الرعاية الصحية الأساسية، بما في ذلك رعاية الصيدلة. وقد ظهرت الصيدلة عن بُعد كحل واعد لسد هذه الفجوة وتوفير خدمات صيدلانية عالية الجودة للسكان المحرومين.
الأساليب :تستعرض هذه الورقة المفهوم الخاص بالصيدلة عن بُعد، مع التركيز على نماذجها، وعملياتها التشغيلية، ودور الصيادلة في تقديم خدمات الصيدلة عن بُعد. كما تستكشف استخدام تقنيات مثل مؤتمرات الفيديو وأنظمة الصيدلة الآلية في إعدادات الصيدلة عن بُعد، موضحة كيفية تفاعل الصيادلة مع المرضى ومقدمي الرعاية الصحية في المواقع البعيدة.
النتائج :أظهرت نماذج الصيدلة عن بُعد نجاحًا كبيرًا في تحسين الوصول إلى الأدوية ونتائج المرضى في المناطق النائية. تشير الدراسات إلى أن مشاركة الصيادلة النشطة في خدمات الصيدلة عن بُعد تقلل من الأحداث الضارة المتعلقة بالأدوية، وتعزز مراقبة الأدوية، وتساعد على الالتزام بالعلاج. وقد أدت مشاركة الصيادلة في الصيدلة عن بُعد إلى توفير التكاليف، وتقليل أخطاء الأدوية، وتحسين توثيق الأدوية في المناطق التي تفتقر إلى خدمات صيدلية كافية.
الاستنتاج :تظهر الصيدلة عن بُعد كنهج تحويلي لتقديم الرعاية الصحية، وخاصة في المناطق الريفية والنائية ذات الوصول المحدود إلى خدمات الصيدلة. تلعب مشاركة الصيادلة النشطة في نماذج الصيدلة عن بُعد دورًا حيويًا في ضمان تقديم رعاية ذات جودة، وسلامة الأدوية، ورضا المرضى. من خلال الاستفادة من التكنولوجيا وخبرة الصيادلة، تقدم الصيدلة عن بُعد حلاً قابلاً للتطبيق للتغلب على التباينات في الرعاية الصحية وتحسين إدارة الأدوية في المجتمعات المحرومة.
الكلمات المفتاحية :الصيدلة عن بُعد، مشاركة الصيادلة، الرعاية الصحية عن بُعد، التمريض، الوصول إلى الأدوية، التباينات في الرعاية الصحية.