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The Role of Telehealth Nursing in the Management of Chronic Diseases During Pandemics: Review of Efficacy and Outcomes

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Abstract

Background: The COVID-19 pandemic has significantly impacted healthcare delivery, necessitating innovative approaches to manage chronic diseases. Telehealth nursing has emerged as a crucial modality for providing care to individuals with chronic conditions, enabling safe and effective management while minimizing infection risks.

Methods: This systematic review and meta-analysis evaluated the effectiveness of telehealth interventions in managing chronic diseases such as hypertension, diabetes, and rheumatoid arthritis. A comprehensive literature search was conducted across multiple databases, including PubMed, Cochrane, and CINAHL, for studies published up to 2023. The review focused on telemedicine consultations and telemonitoring as primary intervention strategies.

Results: The review included 15 studies that assessed the impact of telehealth on chronic disease management. Findings indicated that telehealth interventions significantly improved clinical outcomes, including reduced systolic blood pressure in hypertensive patients and improved glycemic control in

diabetic patients, particularly after extended intervention periods. Telehealth also positively impacted medication adherence and emotional well-being in individuals with rheumatoid arthritis.

Conclusion: Telehealth nursing represents a valuable resource for managing chronic diseases, particularly during pandemics. It enhances patient engagement, facilitates timely interventions, and improves clinical outcomes. The study underscores the need for healthcare systems to integrate telehealth into routine chronic disease management practices to better support patients and optimize healthcare delivery.

Keywords: Telehealth nursing, chronic diseases, COVID-19, hypertension, diabetes.

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1. Introduction

Throughout the worldwide COVID-19 epidemic, telemedicine serves as a means to provide safe social distance, particularly for the long-term care and self-management of individuals with chronic illnesses [1, 2]. Telemedicine is a viable and reliable technology, that offers benefits in chronic illness treatment, including mitigating cross-infection risks among patients. Moreover, telemedicine is unrestricted by temporal and spatial constraints. Telemedicine facilitates communication and the dissemination of medical information between healthcare professionals and patients [3, 4].

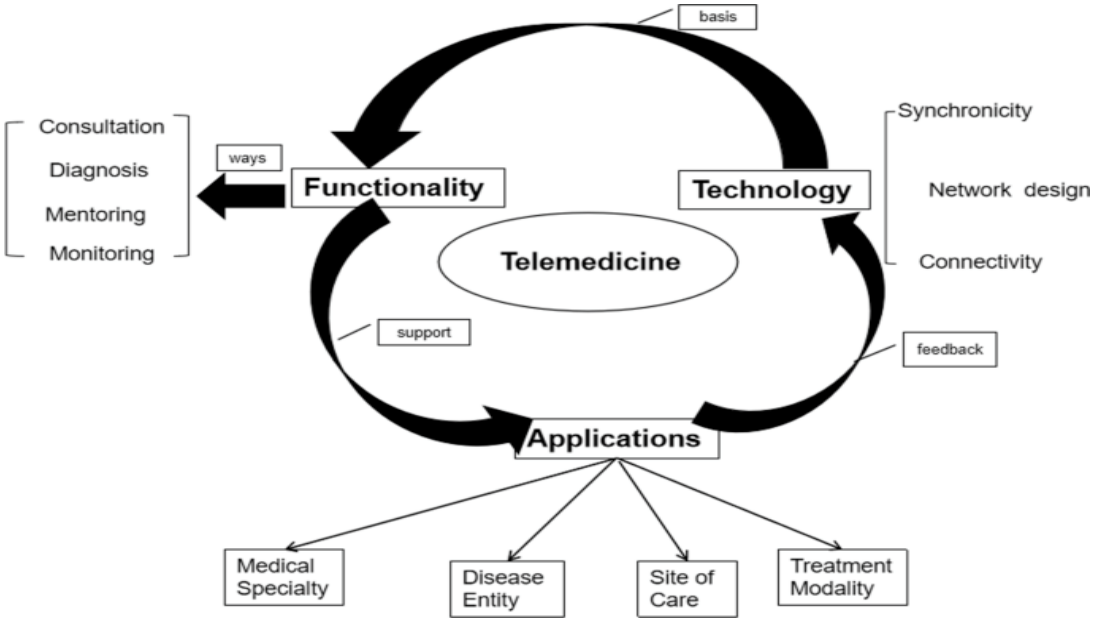

Figure 1. Diagram of the telemedicine concept.

According to the American Telemedicine Association (ATA), telemedicine is an electronic medium for transmitting medical information and facilitating connections between patients and physicians in remote places [5, 6]. Telemedicine has three components: technology, functionality, and applications [7, 8]. Technology consists of three components for transmission and exchange: synchronization, network architecture, and connection. Synchronicity is integrated with time and technology via video conferencing, telemetry, remote sensing, and other forms of interactive health communication. The purpose of network design is to disseminate and exchange information. Both wired and wireless communication are consistently used. Telemedicine encompasses several functions, including consulting, diagnosis, coaching, and monitoring [9-11]. All strategies seek to facilitate the transfer of medical information and enable contact between patients and healthcare professionals. Telemedicine consultations involve patients engaging with specialists through video or chat, offering a more interactive and personalized experience tailored to individual patient needs [12, 13]. Telediagnosis, a prominent aspect of telemedicine, utilizes technology to transmit images and data for disease diagnosis, often eliminating the necessity for direct

clinical examinations. Tele-mentoring is employed in medical education to share knowledge and technology, such as fall prevention and infection control. Telemonitoring entails remote observation of patients' vital signs or disease indicators via mobile devices or computers, typically conducted by care providers in various locations. Applications serve as platforms for communication between patients and providers [14-16] (Figure 1).

Chronic disease is characterized by one or more of the following: permanence, residual disability, irreversible pathological changes, the necessity for specialized rehabilitation training for the patient, or the expectation of prolonged supervision, observation, or care for the patient [17]. Chronic illnesses significantly impact individuals' lives by diminishing quality of life, restricting mobility, inducing unpleasant emotions, escalating economic burdens, and increasing death rates [18]. In 2012, fifty percent of individuals in the United States had at least one chronic condition, and at least twenty-five percent had two or more. The 2015 World Health Organization (WHO) study indicates that chronic illnesses result in 38 million fatalities annually and have emerged as a public health concern [19-23]. Hypertension, diabetes, and rheumatoid arthritis are prevalent chronic conditions. Currently, at least one billion individuals globally suffer from hypertension, with projections indicating that 1.56 billion will be affected by 2025 [24]. Epidemiological survey data indicate that roughly 180 million individuals globally have diabetes, with projections suggesting this figure may double by 2030 [25]. The prevalence of rheumatoid arthritis among adults globally is 0.5%, and it has emerged as one of the ten most prevalent chronic illnesses in China. The prevalence of rheumatoid arthritis among people in the United States varies from 0.5% to 1.0% [6, 26]. Consequently, more emphasis should be placed on the previously stated disorders.

An increasing amount of research have focused on telemedicine for the treatment of chronic diseases. Nonetheless, there is little agreement about the impact of telemedicine on chronic illness management. The objective of this research is to evaluate and analyze the impact of telemedicine on the treatment of hypertension, diabetes, and rheumatoid arthritis by a systematic review and meta-analysis.

2. Methods

The literature search was conducted using the Cochrane, EBSCO, CINAHL, Medline, Web of Science, PubMed, and EMBASE databases. The article search period for each database spanned from its creation until 2023.

3. Methods of telemedicine intervention

Telemedicine consultations and telemonitoring are the predominant telemedicine intervention strategies used for patients with diabetes, hypertension, and rheumatoid arthritis. Nine papers used telemedicine consultation and telemonitoring as intervention approaches for patients with diabetes [28-36]. Han et al. investigated the impact of telemedicine consultations on diabetes care, revealing that patients' fasting blood glucose (FBG) levels decreased after a 12-month intervention [32]. Conversely, Sood et al. reported a divergent outcome, revealing that the HbA1c index did not enhance after a 14.8-month intervention using telemedicine consultation. This outcome was not statistically significant in comparison to the control group [33]. Ya-kun et al. demonstrated that telemonitoring as an intervention enhanced the FBG and HbA1c indices [34]. Lee et al. assessed the impact of telemonitoring combined with team-based care on diabetic patients, reporting improvements in glucose levels after 24-week and 52-week interventions [30]. Shea et al. used telemedicine consultation and telemonitoring as interventions for home unit management and nursing case management in diabetic patients. The findings indicated that the HbA1c levels of patients in the experimental group improved [35, 36]. Stelios et al. discovered that telemonitoring, which included a management and feedback system using transmitted data, enhanced HbA1c levels [28]. Lu et al. used telemedicine consultation as an intervention including pharmacy consultation, medication assessment, and therapy; they concluded that telemedicine consultation was a successful approach for patients with diabetes [37]. Hu et al. discovered that telemonitoring blood glucose levels may decrease the HbA1c index in diabetic patients [38].

Four papers detailed the use of telemedicine consultations and telemonitoring as therapies for patients with hypertension [34, 35, 38, 39]. In research by Jia et al., a total of 162 participants were recruited, with

the experimental group receiving telemedicine consultation as the intervention strategy. The patients had improved blood pressure after a 6-month intervention [39]. Further research examined the longevity of the intervention's impact on blood pressure, using home blood pressure telemonitoring in the experimental group. The findings indicated that a modification in blood pressure began after 12 months [40]. McManus et al. used telemonitoring of home blood pressure readings for the self-management of hypertension. It was discovered that it contributed to the reduction of blood pressure after 6 and 12 months [41]. Telemedicine consultation has been used as an intervention for individuals with rheumatoid arthritis [29, 31]. Ferwerda et al. conducted research assessing the impact of telemedicine consultations on individuals with rheumatoid arthritis. The findings indicated that telemedicine consultations lowered patients' anxiety and sadness [29]. Song et al. performed research to examine the effects of telemedicine on medication adherence and disease activity in patients with rheumatoid arthritis. Research indicated that telemedicine consultations did not alleviate patients' symptoms, however, they did increase drug adherence [31].

A total of fifteen papers regarding the use of telemedicine for illness management were included in the quality assessment of the literature [28-42]. Six out of fifteen papers pertained to diabetes, with outcome indicators including the HbA1c and FBG metrics. We further assessed the impacts of telemedicine management after 6 and 12 months of intervention [30, 32, 36, 37, 40, 42]. Four publications addressed hypertension, all using the same intervention duration. Consequently, these 10 studies were included in the meta-analysis [30, 32, 34-40, 42]. The last five papers were included in a systematic review as follows [28, 29, 31, 33, 41].

Six papers delineated the use of HbA1c and FBG as the main results [30, 32, 36, 37, 40, 42]. Elevated FBG is a possible risk factor for increased minor arterial stiffness and is associated with diabetes complications [43]. HbA1c, an indirect indicator of the average blood glucose concentration, represents the blood glucose levels over the preceding 2 to 3 months [44]. A meta-analysis of HbA1c was conducted based on the 6- and 12-month intervention periods [30, 32, 36, 37, 40, 42].

Four other publications addressed hypertension illness treatment [34, 35, 38, 39], using telemedicine as the predominant intervention approach. All studies used systolic and diastolic blood pressure as the main outcomes to indicate changes in blood pressure. Consequently, we performed a meta-analysis to evaluate the impact of the intervention.

4. Telemedicine consultations and telemonitoring

Telemedicine facilitates the long-term management and treatment of individuals with chronic illnesses using web applications or other telecommunication technologies, hence aiding in the preservation of safe social distancing. Telemedicine consultations and telemonitoring are prevalent telemedicine practices [43, 44]. Telemedicine consultations address the contemporary healthcare requirements of patients while exemplifying ease. Patients often express satisfaction with the service and possess the autonomy to choose the timing of consultations [10]. Telemonitoring lowers the frequency of visits and hospital admissions, hence optimizing the use of limited medical resources [45]. Numerous studies have validated that telemedicine technologies serve as advantageous medical resources, and telemedicine may facilitate fast adjustments to treatment plans [46]. Telemedicine has been regarded as a cost-efficient approach for long-term care [47]. Nonetheless, significant obstacles remain for patients who encounter difficulties and suffer fear while using a computer or mobile device for telemedicine, particularly among the elderly [48].

5. The length of telemedicine intervention in enhancing the HbA1c index in diabetic patients

HbA1c levels showed substantial improvement after 12 months of telemedicine intervention compared to 6 months, with the extended intervention positively influencing the regulation of HbA1c levels. The HbA1c index indicates the average blood glucose level over time and might fluctuate gradually. Consequently, an extended intervention time may be required for changes to manifest. The findings from the extended intervention period aligned with earlier research that reported elevated HbA1c variations with time [44]. This outcome paralleled that of Timpel et al., who saw a reduction in HbA1c after a long-term telemedicine intervention lasting up to 12 months [49]. A separate investigation also demonstrated a similar tendency.

A Spanish trial including 328 diabetes patients supplied the intervention group with a Tele assistance technology that sent blood glucose data in real-time and facilitated remote consultation. The control group was periodically monitored at their healthcare center; notably, one year later, researchers saw a substantial reduction in HbA1c levels in the intervention group compared to the control group [50].

Nonetheless, the findings of this research indicated that the change in FBG was not statistically significant after a 6-month telemedicine intervention. Taylor et al. have shown that the sensitivity of FBG levels for diagnosing diabetes is limited, with significant variations between populations [51, 52]. Furthermore, FBG must be assessed during a fasting period of 8 hours or longer. Due to significant fluctuations in FBG during the day and night, FBG levels obtained at the same time points should be compared. The literature considered in this analysis did not specify the timing of FBG measurement. Consequently, more study is required to ascertain the effect of telemedicine interventions on FBG levels.

6. Systolic blood pressure improved during a 6-month telemedicine intervention in adults with hypertension

Substantial improvements in systolic blood pressure were seen after a 6-month strategy. Despite varying intervention durations described in hypertensive patients, the majority exhibited a substantial reduction in blood pressure after 6 months of telemonitoring [53-56]. Telemedicine produced beneficial outcomes in the treatment of patients with hypertension, particularly after a 6-month intervention. Consequently, telemedicine technology may assist physicians and nurses in the diligent, ongoing monitoring of patients with hypertension.

7. Telemedicine positively impacted individuals with rheumatoid arthritis

Rheumatoid arthritis is among the most common chronic inflammatory disorders. The principal symptoms of rheumatoid arthritis include rheumatoid nodules, lung involvement or vasculitis, and systemic comorbidities [57]. Individuals with rheumatoid arthritis have prolonged illness duration characterized by joint degeneration and functional impairment, ultimately resulting in adverse disease outcomes. Individuals with rheumatoid arthritis often endure psychological anguish, including anxiety and sadness, which significantly impact their everyday activities [58]. The approach for the prolonged care of rheumatoid arthritis patients via telemedicine has evolved incrementally. Utilizing telemedicine as the primary care approach for rheumatoid arthritis patients may enhance emotional well-being and foster adherence to drug regimens. Further research is necessary to validate the impact of telemedicine on the treatment of rheumatoid arthritis.

8. Conclusions

The findings indicated that telemedicine consultation and telemonitoring are the main techniques used for telemedicine intervention. This research demonstrated that telemedicine positively influenced the treatment of hypertension, diabetes, and rheumatoid arthritis, and helped reduce the systolic blood pressure of hypertensive patients after a 6-month intervention. Prolonged telemedicine sessions had a substantial impact on the control of HbA1c levels in diabetes patients. Consequently, telemedicine may significantly enhance the quality of illness management [59].

This study's findings suggest that telemedicine is a valuable resource for managing chronic conditions, including hypertension and diabetes. Telemedicine may enhance emotional well-being and foster medication compliance in individuals with rheumatoid arthritis. The findings suggest that a 12-month telemedicine intervention is advisable for diabetes individuals.

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دور التمريض عن بعد في إدارة الأمراض المزمنة أثناء الأوبئة: مراجعة الفعالية والنتائج

الملخص

الخلفية :أثر وباء COVID-19 بشكل كبير على تقديم الرعاية الصحية، مما استدعى ابتكار أساليب جديدة لإدارة الأمراض المزمنة. ظهرت التمريض عن بُعد كوسيلة حيوية لتقديم الرعاية للأفراد الذين يعانون من حالات مزمنة، مما يتيح إدارة آمنة وفعالة مع تقليل مخاطر العدوى.

الطرق :قامت هذه المراجعة المنهجية والتحليل التلوي بتقييم فعالية التدخلات الصحية عن بُعد في إدارة الأمراض المزمنة مثل ارتفاع ضغط الدم، والسكري، والتهاب المفاصل الروماتويدي. تم إجراء بحث شامل في الأدبيات عبر عدة قواعد بيانات، بما في ذلك PubMed و Cochrane وCINAHL، للدراسات المنشورة حتى عام 2023. ركزت المراجعة على استشارات الطب عن بُعد والمراقبة عن بُعد كاستراتيجيات التدخل الأساسية.

النتائج :شملت المراجعة 15 دراسة قامت بتقييم تأثير التمريض عن بُعد على إدارة الأمراض المزمنة. أشارت النتائج إلى أن التدخلات الصحية عن بُعد أدت إلى تحسينات كبيرة في النتائج السريرية، بما في ذلك انخفاض ضغط الدم الانقباضي لدى المرضى الذين يعانون من ارتفاع ضغط الدم وتحسين التحكم في نسبة السكر في الدم لدى مرضى السكري، خاصة بعد فترات تدخل طويلة. كما كان للتطبيب عن بُعد تأثير إيجابي على الالتزام بالعلاج والرفاهية العاطفية لدى الأفراد المصابين بالتهاب المفاصل الروماتويدي.

الخاتمة :يمثل التمريض عن بُعد موردًا قيمًا لإدارة الأمراض المزمنة، خاصة خلال الأوبئة. إنه يعزز مشاركة المرضى، ويسهل التدخلات في الوقت المناسب، ويحسن النتائج السريرية. تؤكد الدراسة على ضرورة دمج التمريض عن بُعد في ممارسات إدارة الأمراض المزمنة الروتينية لدعم المرضى بشكل أفضل وتحسين تقديم الرعاية الصحية.

الكلمات المفتاحية :التمريض عن بُعد، الأمراض المزمنة، COVID-19، ارتفاع ضغط الدم، السكري.