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Sistematik Derleme/ Systematic Review

Tele Intensive Care Nursing: A Systematic Review

Tele Yoğun Bakım Hemşireliği: Bir Sistematik Derleme

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ABSTRACT

Objective: This systematic review aims to examine studies related to tele-intensive care nursing services systematically.

Methods: The keywords "Tele-intensive care" and "Tele-nursing" were used during the research. A literature search was conducted from January 2015 to July 2023, including databases such as PubMed (n=84), Cochrane (n=56), Google Scholar (n=375), and Science Direct (n=50). A total of 565 studies were identified, and after applying inclusion and exclusion criteria, 6 studies with accessible full texts were included in the review. PRISMA reporting guidelines were employed in this systematic review.

Results: The literature review revealed a total of 6 studies (n:6) that met the research criteria. These studies had descriptive (n:4), qualitative (n:1), retrospective and prospective (n:1) designs and were published in 2016 (n:2), 2017 (n:3) and 2021 (n:1). The sample groups of these studies included nurses, patients or other healthcare professionals. The contents of these studies include the evaluation of nurses' perceptions, opinions, satisfaction or competencies in providing effective patient care regarding tele-intensive care.

Conclusion: The findings of the studies indicate that tele intensive care improves patient and healthcare worker satisfaction, facilitates consultations and transfer of patient information, and reduces the need for patient referrals to different hospitals.

Keywords: Medical technology, intensive care, tele-nursing, tele-intensive care, telemedicine.

ÖZ

Amaç: Bu sistematik derleme, tele yoğun bakım hemşireliği hizmetleri ile ilgili çalışmaları sistematik olarak incelemek amacıyla planlanmıştır.

Yöntem: Anahtar kelime olarak "Tele-yoğun bakım, Tele-hemşirelik" kullanılmıştır. Son dokuz yıla ait Ocak 2015-Temmuz 2023 literatürü taranmış, yapılan literatür taramasında Pubmed (n:84), Cochrane (n:56), Google Scholar (n:375), Science Direct (n:50) veri tabanları kullanılmıştır. Toplamda n:565 araştırmaya ulaşılmış olup dahil edilme ve dışlanma kriterlerinin uygulanmasının ardından tam metinlerine ulaşılabilen n:6 çalışma araştırmanın örneklemini oluşturmuştur. Bu sistematik derlemede PRISMA raporlama yönergeleri kullanılmıştır.

Bulgular: Yapılan literatür incelemesi sonucunda araştırma kriterlerini sağlayan toplam 6 (n:6) çalışmaya ulaşılmıştır. Bu çalışmalar tanımlayıcı (n:4), kalitatif (n:1), retrospektif ve prospektif (n:1) desene sahip olmakla birlikte, 2016 (n:2), 2017 (n:3) ve 2021 (n:1) yıllarında yayınlanmıştır. Bu çalışmaların örneklem gruplarında hemşireler, hastalar veya diğer sağlık çalışanları yer almaktadır. Bu çalışmaların içerikleri hemşirelerin tele yoğun bakıma ilişkin algıları, görüşleri, memnuniyetleri veya etkili hasta bakımı vermede yetkinliklerinin değerlendirilmesini içermektedir.

Sonuç: Tele yoğun bakım ile ilgili yapılmış olan araştırmalarda, bu uygulamanın hem hastaların hem de sağlık çalışanlarının memnuniyetini arttırdığı, konsültasyonları ve hasta bilgilerinin aktarılmasını kolaylaştırdığı, hastaların farklı hastanelere sevk edilmesini azalttığı görülmüştür.

Anahtar Kelimeler: Medikal teknoloji, yoğun bakım, tele hemşirelik, tele yoğun bakım, teletıp.

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Introduction

Advancements in science and technology have influenced healthcare services, leading to the emergence of new practices such as telemedicine, telehealth, and tele-nursing. Telehealth applications utilize various tools such as video, mobile phones, the internet, and fax machines to transmit and record patient information and facilitate communication (Arpag and Kanan, 2019; Pazar et al., 2015). These applications enable both visual and auditory communication between patients and nurses. Additionally, healthcare professionals can collaborate with colleagues from different hospitals through telehealth applications, enhancing the quality of care provided to patients (Chandra et al., 2021; Leverone et al., 2021). This systematic review aims to examine studies related to tele-intensive care nursing services systematically. Telemedicine and telehealth applications facilitate access to healthcare in rural areas and support the care of isolated patients with contagious diseases (Parmar et al., 2015). The recent increase in global pandemics, such as the COVID-19 pandemic caused by the novel coronavirus, has highlighted the importance of implementing telehealth applications for remote patient monitoring and management (Coccolini et al., 2020; Siddiqui et al., 2017). Moreover, the incidence of conditions requiring intensive care, such as pneumonia, respiratory failure, shock, and multiple organ dysfunction syndrome, has increased, leading to a greater demand for intensive care services (Forrester et al., 2020; Sohrabi et al., 2020). To ensure the safety of healthcare personnel and provide quality care to patients, tele-intensive care (Tele-ICU) has been utilized (Coccolini et al., 2020; Siddiqui et al., 2017).

Tele-ICU, a remote monitoring technology, enables efficient utilization of intensive care resources. It provides 24/7 access to intensive care nurses through video equipment for personnel interaction, as well as tools for capturing and recording clinical data and real-time changes in patients' conditions. These technological components facilitate rapid patient assessment and the implementation of evidence-based care by physicians and nurses (Khunlertkit and Carayon, 2013). Tele-ICU is particularly recommended for elderly patients to ensure safer and more effective care (Hao et al., 2014). Although tele-ICU is a relatively new technology, its use in patient monitoring has been increasing in recent years (Haranath and Udayasankaran, 2020). To adapt to this growing application, nurses require specific qualifications, including at least five years of adult intensive care experience, preferably holding CCRN (Critical Care Registered Nurse) or CCRN-E certification, and Basic Life Support and Advanced Cardiac Life Support certification. Additionally, nurses should have a nursing degree and strong interpersonal communication skills (Senyuz and Senturk, 2017; Cloyd and Thompson, 2020). Tele-nursing in intensive care units (ICUs) offers numerous advantages. It enables 24/7 care provision, facilitates collaboration among healthcare professionals from different hospitals, improves patient safety and care quality, allows remote monitoring of ICU patients, enables quick access to patient records when necessary, reduces patient transfer time, improves efficiency with fewer healthcare professionals, and reduces hospital costs (Senyuz and Senturk, 2017). Nevertheless, it is important to note that this technology can have unintended consequences. While it improves resource utilization and enables rapid response to patient needs at a low cost, it can also lead to communication issues and conflicts, which may undermine trust between patients and nurses (Hoonakker et al., 2017; Trombley et al., 2018). Additionally, there are potential disadvantages such as disruptions due to power outages and challenges in ensuring patient record confidentiality (Senyuz and Senturk, 2017).

Further research is warranted to gain a more comprehensive understanding of the impact of tele-ICU on patient care processes and outcomes, . Although studies on this topic can be found in the literature, there is a lack of systematic reviews that include nurses and present collective findings. Therefore, this systematic review is designed to examine studies related to tele-intensive care nursing services systematically.

Methods

Study Type

This study is a systematic review that examines articles published between January 2015 and July 2023 related to tele-intensive care and tele-intensive care nursing.

Study Group

The sample of this descriptive study consists of original research conducted on tele-intensive care between January 2015 and July 2023. Keywords such as “Tele-intensive care, Tele-nursing” were used, and the search was limited to the past nine years to examine contemporary research. The literature search was conducted in databases

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including PubMed (n=84), Cochrane (n=56), Google Scholar (n=375), and Science Direct (n=50). A total of n=565 studies were found, and after applying the inclusionand exclusion criteria, six studies with accessible full-text articles were included in the review. The six studies included in the sample were systematically analyzed according to the PRISMA framework (Figure 1).

PRISMA is a guideline developed to standardize the conduct, reporting and evaluation of systemic reviews and meta-analyses. The PRISMA guideline provides a reporting template that includes a title, abstract, introduction, methods, results and discussion. It also details each stage of the systematic review process, including steps such as literature search, study selection, data extraction and synthesis of results (Nahcivan and Incirkus, 2018). In this systematic review, the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guideline was used to follow the planning, execution and reporting processes of the study.

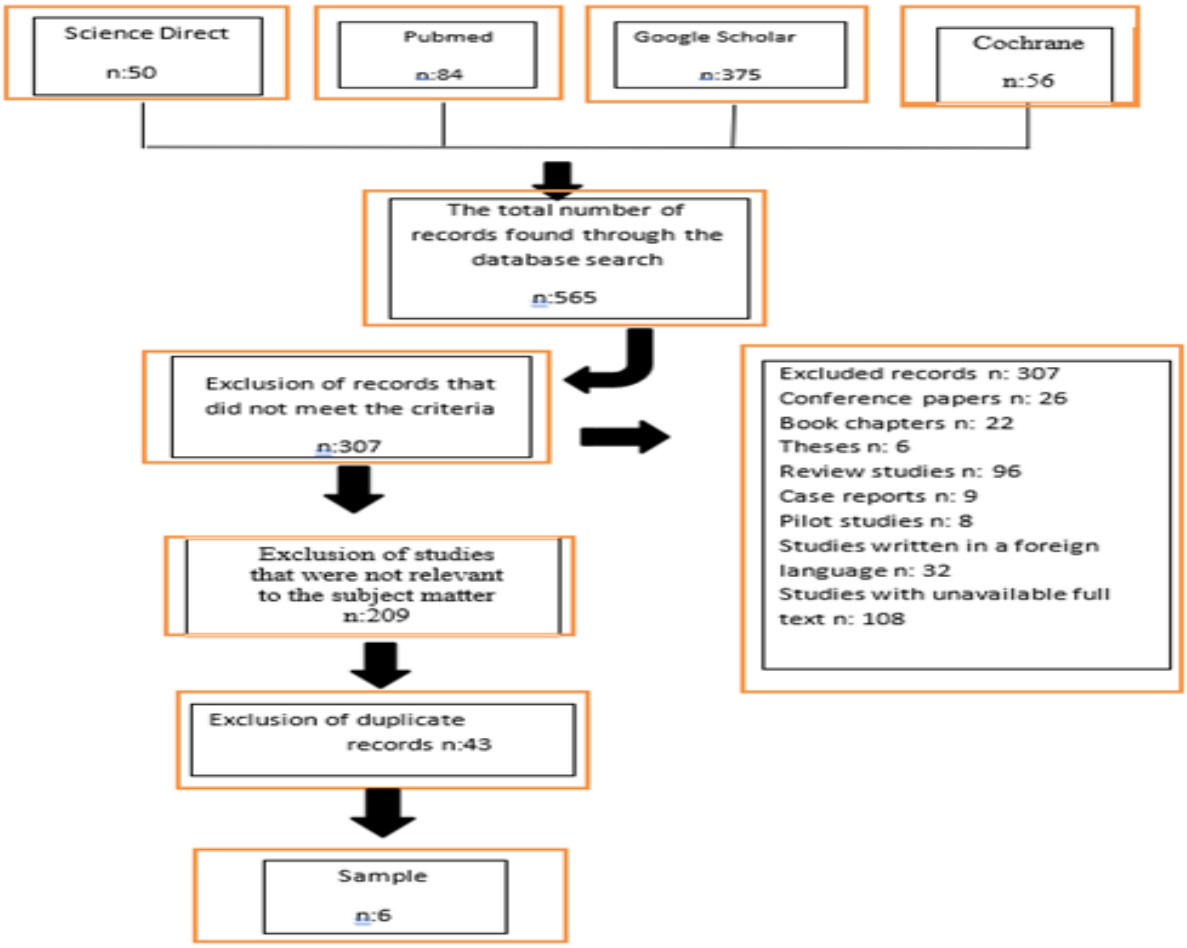

Figure 1. Research flowchart (PRISMA - Preferred Reporting Items for Systematic Reviews and Meta Analyses)

Inclusion criterias

-The studies had to be original research.

-The studies had to be full-text articles and accessible.

-The studies had to include tele-intensive care and nursing interventions in their content.

Exclusion criterias

-Studies written in languages other than Turkish or English.

-Studies that are not original research. This review excluded unpublished thesis studies, studies with inaccessible full texts, oral or poster presentations given at seminars, case reports, meta-analyses, or review articles.

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-Studies that were not conducted in an intensive care setting and did not involve nursing interventions.

Procedures

A systematic search was conducted using key terms across each database used in the study. To mitigate potential bias in the systematic review, the literature review, article selection, and data retrieval processes were carried out independently by the first and second researchers. Each stage underwent verification in a session attended by the third researcher, leading to a consensus being reached. The studies included in the systematic review were examined by the researchers. The studies that met the inclusion criteria were evaluated for suitability, and thus, these studies were included in the findings. A table was created by the researchers to evaluate the studies. The table includes information such as author(s), year of publication, study location, study type, sample, implemented interventions, and findings derived from the interventions (Table 1).

Ethical considerations

As the conducted research is a systematic review, no permission was obtained from any institution. All analyzed and utilized studies are appropriately referenced in the references section.

Table 1. Findings of the reviewed studies

Source	Year	Research Design	Research Location	Sample	Intervention	Evaluation
Kleinpell, Barden, Rincon, McCarthy, & Zapatochny Rufo	2016	Descriptive	43 Tele-ICU centers (multicenter)	n=117 nurses	Online survey to assess the impact and competencies of nurses working in tele-intensive care	Tele-ICUs were found to have positive effects on patient care, efficient use of time, and performance improvement. However, it was suggested that the competencies of nurses working in these units need to be enhanced.
Saghaeiannejad-Isfahani, Jahanbakhsh, Hejazi, & Talebkhani	2016	Descriptive	11 Tele-ICU centers (multicenter)	n=16 intensivist physicians, n=120 nurses	Survey to evaluate the implementation of Tele-ICU	It was suggested that resolving the financial resource issue is crucial for expanding Tele-ICUs. Additionally, creating electronic records and organizing courses for nurses to enhance knowledge were recommended.
Hoonakker, Pecanac, Brown, & Carayon	2017	Descriptive	5 Tele-ICU centers (multicenter)	n=110 nurses	Survey to assess nurses' satisfaction with Tele-ICU	Tele-ICU nurses expressed concerns about inadequate communication and resulting trust issues. It was concluded that Tele-ICU nurses face these challenges due to managing more patients.
Goedken, Moeckli, Cram, & Reisinger	2017	Qualitative	3 Tele-ICU centers (multicenter)	n=6 ICU managers, n=3 physicians, n=9 nurses, n=5 respiratory therapists, n=1 other	Semi-structured interviews to determine healthcare professionals' views on Tele-ICU	Healthcare professionals believe that Tele-ICU provides additional support in patient care and recommend increasing the implementation of tele-intensive care practices, especially in rural areas.
Panlaqui, Broadfield, Champion, Edington, & Kennedy	2017	Retrospective and Prospective	1 Tele-ICU center	n=525 patients	Retrospective and prospective analysis of patients' health records	It was concluded that Tele-ICU implementation resulted in a reduced need for inter-hospital transfers, without significant differences in mortality rates or length of hospital stay. It was also noted that Tele-ICU contributed to cost reduction and improved security of patient records.
Leverone et al.	2021	Descriptive	1 Tele-ICU center	n=7 doctors, n=10 respiratory therapists, n=10 nurses	Healthcare professionals rotated in Tele-ICU for 2 weeks. An online survey aimed to identify the positive and negative aspects of the method	Participants expressed that the Tele-ICU program would be highly beneficial in rural and underserved areas. They also reported that the program enhanced their ability to provide patient care with limited resources and positively contributed to team communication.

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Results

A literature search identified a total of 565 studies. After applying the inclusion and exclusion criteria, six full-text studies were included in the sample. (Figure 1). It was determined that half of these studies were from the year 2017 (Goedken et al., 2017; Hoonakker et al., 2017; Panlaqui et al., 2017). The majority of the studies were conducted using a descriptive design (Hoonakker et al., 2017; Kleinpell et al., 2016; Leverone et al., 2021; Saghaeiannejad-Isfahani et al., 2016). It was observed that the studies were mostly multicentered (Goedken et al., 2017; Hoonakker et al., 2017; Kleinpell et al., 2016; Saghaeiannejad-Isfahani et al., 2016) (Table 1). As a result of the examination of the studies in the sample group, it was seen that tele-ICU provides additional support in patient care (Goedken et al., 2017; Kleinpell et al., 2016; Leverone et al., 2021; Panlaqui et al., 2017) and performance improvement (Kleinpell et al., 2016; Leverone et al., 2021; Panlaqui et al., 2017). Also, it is recommended to enhance the competencies of nurses working in Tele-ICUs (Goedken et al., 2017; Leverone et al., 2021) and to increase the implementation of tele-intensive care practices, especially in rural areas (Kleinpell et al., 2016; Saghaeiannejad-Isfahani et al., 2016).

In Kleinpell et al., (2016) study, which used two phases to evaluate nurses' perceptions of intensive care telemedicine and to identify nursing priority areas, it was observed that more than half of the participants stated that the use of tele-intensive care enabled them to complete their tasks faster, improved collaboration, work performance and communication, and was beneficial for nursing assessments. In the second phase of the same study, tele-ICU nurses listed 15 priority areas of care, including critical thinking skills, intensive care experience, skillful communication, and emergency patient care management.

In parallel to determining the positive effects of tele-intensive care nursing practice, it is equally important to determine the barriers faced when implementing this practice. Saghaeiannejad et al., (2016) found that the major obstacle to the setup and implementation of tele-intensive care is the high cost and resources. In the same study, lack of organizational, technical and infrastructure problems in network and internet communication in tele-intensive care applications were also found as effective barriers.

Looking at the levels of satisfaction and trust in tele-intensive care nursing practice, Hoonakker et al., (2017) revealed the importance of timeliness, accuracy and clarity of communication in their study, also Panlaqui et al., (2017) found a significant reduction in hospital transfer rates. Organizational culture and openness to change are also extremely important in the implementation of tele-intensive care nursing (Goedken et al., 2017). Leverone et al., (2021) determined that participants provided benefits such as access to expertise on mechanical ventilation and other aspects of intensive care, the ability to ask questions to the intensivist, and the ability to transfer between facilities in tele-intensive care practice.

Discussion

Intensive care units (ICUs) provide care for critically ill patients with one or more vital organs at risk. These critical patients may require continuous monitoring and are dependent on life support devices. Care in the ICU is provided by trained expert physicians and nurses. Tele-ICU is a system that allows a team of telemedicine intensivists and telemedicine nurses to access and remotely monitor the relevant patient data. This system enables accessing and monitoring multiple remote ICUs (Larinkari et al., 2016). It provides the opportunity to care for multiple patients simultaneously, thereby enhancing the effectiveness of nursing practices. Tuna et al., 2017 found that tele-nursing applications increase patient satisfaction. Similarly, Bikmoradi et al., 2016 concluded that tele-nursing applications enhance patient satisfaction by providing timely access to instructions from healthcare providers without limitations of time and location. Furthermore, Goedken et al., 2017 emphasized the usefulness of tele-ICU applications in enhancing patient care and collaboration among healthcare providers, especially in rural areas, to elevate the level of care. Similarly, Levenore et al., 2021 found that tele-ICU programs would be highly beneficial in rural and under-resourced areas. Following the implementation of an educational program related to tele-ICU, healthcare providers reported improved ability to provide care with limited resources and positive contributions to interprofessional communication. Tele-nursing enables effective care delivery, monitoring, and education for patients in geographically remote areas. On the other hand, tele-icu practice may lead to communication problems that may damage the trust between patients and nurses, technical infrastructure problems and high costs may negatively affect its functioning (Saghaeiannejad et

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al., 2016; Goedken et al., 2017; Hoonakker et al., 2017; Trombley et al., 2018).

Remote patient monitoring has proven advantageous not only in rural areas but also in the context of infectious disease outbreaks. With the increasing prevalence of outbreaks, healthcare workers face an increased risk of exposure to infected patients. Tele-ICU, telemedicine, and tele-nursing are essential applications that can be used to protect healthcare personnel (Gonzales-Zamora et al., 2020). Macedo et al., 2021 experienced tele-ICU services with 326 patients diagnosed with Covid-19. The results of the study showed that overall in-hospital mortality was highest in the first two months of the program, decreased in the third month, and remained steady in the fourth month. Furthermore, Shahin et al., 2019 found in their study that tele-ICU applications facilitated and expedited clinical decision-making for both bedside caregivers and remote monitoring team members. Rincon et al. (2011) found that a tele-ICU nurse-led process can lead to earlier detection of complex disease states such as severe sepsis and improve adherence to evidence-based practice bundles. Lilly et al. (2011) found that tele-ICU intervention with good staffing and implementation programs was associated with lower mortality and shorter length of stay. Marx et al. (2022) found that telemedicine facilitates direct interaction with intensivists or infectious disease specialists and creates value for critically ill patients by improving quality of care. Kleinpell et al., 2016 emphasized the positive effects of tele-ICUs on patient care, efficient time management, and improved healthcare provider performance. Fadaizadeh et al., 2018 aimed to provide effective care by implementing tele-ICU applications and tele-consultations, resulting in faster access to patients. The study revealed that physicians were satisfied with the practice, emphasizing the efficient use of time. Kahn et al., 2016 found a reduction in mortality rates for patients admitted to tele-ICU units. Panlaqui et al., 2017 concluded that although there was no significant difference in mortality rates with tele-ICU implementation, the need for transfers to other hospitals decreased. Pannu et al., 2017 demonstrated in their study that the tele-ICU unit led to a decrease in patient transfers to other hospitals, allowing patients to receive better care at a lower cost. Thus, tele-ICU enables more cost-effective and efficient patient care, resulting in increased satisfaction for both patients and nurses.

Conclusion and Recommendations

In conclusion, the implementation of tele-ICU has been shown to enhance both patient and staff satisfaction significantly. It facilitates documentation and transfer of patient information among healthcare providers, streamlines consultations, saves time, and reduces the need for patient transfers to other hospitals. It also has a positive impact on mortality rates. It is recommended to plan education programs to increase healthcare providers' knowledge about tele-ICU and enable them to effectively utilize its capabilities. Most of the studies conducted on this topic are review articles. It is recommended to conduct high-level original research and meta-analysis studies. In addition to all listed recommendations, it is also recommended to conduct studies on the opinions and feedback of patients regarding tele-ICU services, the cost-effectiveness of tele-ICU applications, and the development of tele-ICU planning and management strategies.

Limitations of the Study

The limitations of this study include the exclusion of studies conducted in languages other than English and Turkish, as well as the inability to examine studies in different languages. Four databases was used during the search process. The systematic review were not registered with PROSPERO before it was conducted.

Ethics Committee Approval: As the conducted research is a systematic review, no permission was obtained from any institution. All analyzed and utilized studies are appropriately referenced in the references section.
Peer-review: External referee evaluation.
Author Contributions: Idea/concept: CB, BT; Design: CB, BT; Consulting: CB, BT; Data Collection and/or Data Processing: CB, BT; Analysis and/or Interpretation: CB, BT; Source Search: CB, BT; Writing of the Article: CB, BT; Critical Review: CB, BT.
Conflict of interest: The authors declare that they have no conflict of interest.
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What did the study add to the literature?

- This study was designed and conducted as a systematic review. The results of the study demonstrate the increasing importance of telehealth applications, including tele-ICU. Tele-ICUs enable nurses to remotely access patient information.

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- The Covid-19 pandemic has highlighted the significance of tele-ICU applications. With tele-ICU, it is possible to remotely access the information of patients diagnosed with Covid-19 and monitor them, thereby reducing the risk of Covid-19 transmission to healthcare workers. Tele-ICUs play a crucial role in easily accessing patient information, monitoring patients, and ensuring staff safety.
- This systematic review will be an important resource and guide for researchers and clinical nurses working in this field, as it examines the current status and progress of tele-intensive care nursing and tele-ICU fields.

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