

## The Role of Telemedicine in Managing Patients During the COVID-19 Pandemic: A Systematic Review of Clinical Applications and Challenges

Nauval Lazuardi Pratama<sup>1</sup>, Fara Disa Durry<sup>2\*</sup>

### Corresponding Author

Fara Disa Durry

Faculty of Medicine Universitas Pembangunan Nasional “Veteran” Jawa Timur Rungkut Madya  
Nomor 191, Rungkut Kidul, Rungkut, Surabaya, Jawa Timur 60293

Tel/Fax: +6281259191991

E-mail: fara.disa.fk@upnjatim.ac.id

### ABSTRACT

The COVID-19 pandemic accelerated the adoption of telemedicine, improving access to remote healthcare, chronic disease management, and health education. However, its effectiveness varies, particularly for conditions requiring physical examinations. This review evaluates the role of telemedicine during the pandemic, its benefits and challenges, and the potential of a hybrid model integrating telemedicine with in-person visits. A systematic review was conducted using PubMed, Google Scholar, and ScienceDirect, analyzing studies from 2019 to 2024 on telemedicine use during the pandemic. Telemedicine improved accessibility and continuity of care but showed limitations in physical assessments. Among hemodialysis patients in the USA, only 10 out of 32 felt fully comfortable using telemedicine. In diabetes care in Italy, telemedicine users had better HbA1c control ( $7.1 \pm 1.2\%$  vs.  $7.3 \pm 1.3\%$ ;  $p < 0.0001$ ) but lower complication screening rates (retinopathy: 11.5% vs. 25.1%). Telemedicine also enhanced communication and improved health behaviors despite digital literacy challenges. Overall, telemedicine is effective for consultations and education but limited for physical assessments. A hybrid model may provide a more sustainable healthcare approach.

**Keyword :** Chronic disease management; COVID-19; digital health; hybrid healthcare; telemedicine

### Introduction

The COVID-19 pandemic has fundamentally changed day-to-day life, and this presents an unprecedented challenge to the public health sector.<sup>1</sup> Since December 2021, the Omicron variant has dominated South Asia. Most countries have recorded transmission rates below the outbreak threshold, except for the Maldives which experienced cases. This stable transmission rate indicates the transition of COVID-19 from a pandemic to an endemic, in line with the lifting of the health emergency status by WHO in May 2023.<sup>2</sup> Digitalization of healthcare services through telemedicine plays a role in controlling the COVID-19 pandemic by providing remote services to prevent the

spread of the virus.<sup>3</sup> Telemedicine is defined as the use of information and telecommunications technologies to deliver health services, including direct patient care, health education, and population health management.<sup>4</sup> The early use of telemedicine dates back to the 1990s. It has evolved tremendously since then. The COVID-19 pandemic swiftly influenced an upswing in the utilization of telemedicine.<sup>5</sup> When COVID-19 hit, the demand for telemedicine skyrocketed. On March 30, 2020, the US government through the Centers for Medicare & Medicaid Services relaxed regulations related to telemedicine, including removing geographic restrictions and expanding payment coverage. This prompted hospitals and clinics to quickly adapt, including in the field of radiation oncology, where 89% of facilities in the US began implementing telemedicine for patient consultations and follow-ups. This phenomenon is not only happening in the US but also globally. In Europe, 78% of oncology centers have started using telemedicine, while in an international survey, 80% of oncologists reported implementing it.<sup>6</sup> The purpose of this review article is to evaluate the role of telemedicine in patient management during the COVID-19 pandemic, analyze its benefits and challenges, and provide insights into its potential for integration into post-pandemic healthcare systems.

### **Material and Methods**

A systematic review was conducted using relevant studies from databases such as PubMed, Google Scholar, and ScienceDirect. Keywords included "telemedicine and COVID-19," "remote healthcare during the pandemic," and "telemedicine effectiveness in infectious diseases." Inclusion criteria focused on peer-reviewed articles published between 2019 and 2024 discussing telemedicine's role in patient management during the COVID-19 crisis. The collected data were synthesized to identify key themes and challenges in telemedicine adoption

### **Results and Discussion**

During the COVID-19 pandemic, telemedicine has played a critical role in various aspects of healthcare, especially in maintaining patient accessibility to medical care while reducing the risk of exposure to the virus. Several points regarding the review of primary research on the use of telemedicine are also included in the discussion section below.

In hemodialysis patient care, telemedicine is used to support medical consultations without the need for face-to-face meetings. A study involving 32 patients from underserved populations showed that most patients felt that telemedicine was helpful in reducing the risk of COVID-19 exposure, improving communication with their doctors, and providing a sense of security during the pandemic. However, only 10 of the 32 patients were completely comfortable with the system, while the others experienced difficulties in communication, limited physical interaction, and a sense of loss of personal connection with their doctors. This suggests that while telemedicine is useful in reducing the risk of infection, a hybrid approach that combines telemedicine and in-person visits is

still needed to improve satisfaction and effectiveness of care.<sup>7</sup>

In emergency departments (EDs) across the United States, Interpreter on Wheels (IOW) are being used to help patients with language barriers communicate with healthcare providers. The study found that IOWs were implemented in hospitals during the pandemic to expedite communication for non-English speaking patients, improve the accuracy of medical information, and reduce consultation times compared to traditional translation methods. However, challenges include limited access in some hospitals that do not yet have this technology and the readiness of healthcare providers to use it effectively.<sup>8</sup>

In health education, telemedicine was applied through telenursing for Multiple Sclerosis (MS) patients in Iran. A study involving 80 patients showed that the group receiving telemedicine education for 8 weeks experienced significant improvements in health behaviors, including adherence to diet, physical activity, stress management, and medication ( $p < 0.05$ ). However, challenges faced include lack of digital literacy, difficulty understanding online information, and limitations in direct interaction with health workers.<sup>9</sup>

In patients with type 2 diabetes (T2DM) in Italy, telemedicine allows remote monitoring with fairly good results. A study involving 46,424 patients who received telemedicine consultations compared with 364,898 face-to-face patients showed that telemedicine patients had lower HbA1c ( $7.1 \pm 1.2\%$ ) than face-to-face patients ( $7.3 \pm 1.3\%$ ;  $p < 0.0001$ ), indicating stable metabolic control. However, monitoring of complications decreased, such as retinopathy (11.5% vs 25.1%) and foot examinations (4.3% vs 14.3%). In addition, telemedicine patients received therapies such as metformin (67.9% vs 71.9%) and SGLT2i (13.2% vs 16.6%) less frequently, indicating possible limitations in optimizing treatment.<sup>4</sup>

### **Comparison of Telemedicine Effectiveness in Various Conditions**

The effectiveness of telemedicine during the pandemic varied depending on the medical condition. In chronic patients, such as hemodialysis in the US, telemedicine helped reduce the risk of infection, but only 10 out of 32 patients felt comfortable using it. Meanwhile, T2DM patients in Italy showed better HbA1c control ( $7.1 \pm 1.2\%$  vs  $7.3 \pm 1.3\%$ ;  $p < 0.0001$ ), but experienced decreased screening for complications such as retinopathy (11.5% vs 25.1%).<sup>4</sup>

In emergency departments across the US, Interpreters on Wheels (IOW) are speeding communication for non-English speaking patients, reducing misdiagnoses, and increasing efficiency of care, despite infrastructure constraints.<sup>8</sup>

In health education, telenursing for Multiple Sclerosis (MS) patients in Iran for 8 weeks improved adherence to diet, physical activity, and stress management ( $p < 0.05$ ), but low digital literacy was a barrier.<sup>9</sup> In general, telemedicine is effective for consultation and education services, but is still less than optimal for conditions that require physical examination. A hybrid approach (a combination of telemedicine and face-to-face) may be a better solution.<sup>10</sup>

### **Potential and challenges**

While telemedicine has been shown to be effective in increasing access to healthcare, a hybrid approach, combining telemedicine with face-to-face consultations, is considered more optimal in the long run. The hybrid model allows patients the flexibility of online services without sacrificing the quality of the physical examination needed for diagnosis and treatment.<sup>10</sup>

Globally, telemedicine adoption remains mixed. Of the 77 countries studied, 27 (13.8%) have reached an advanced stage of adoption, while the rest are still in the development stage. The US, UK, Australia and Japan have successfully integrated telemedicine into their healthcare systems, while India and other developing countries are experiencing increasing adoption despite still being limited by access and infrastructure.<sup>11</sup>

Key challenges in implementing hybrid models include inconsistent regulations, limited digital infrastructure, and resistance from some patients and healthcare workers. Therefore, investment in technology, healthcare worker training, and global regulatory standardization are needed to ensure that telemedicine remains sustainable and can be effectively integrated with conventional healthcare services.<sup>11</sup>

### **Conclusion**

Telemedicine has played a critical role in maintaining access to healthcare during the COVID-19 pandemic. Studies have shown that telemedicine is effective in medical consultations, health education, and chronic disease monitoring, especially in conditions that do not require in-person physical examinations. However, limitations in clinical examinations, misdiagnosis, and technological barriers remain challenges. A hybrid approach, combining telemedicine with in-person services, has emerged as a more optimal strategy. This model allows patients the flexibility of online services without sacrificing the important aspects of physical examinations. Globally, telemedicine adoption has been variable, with developed countries integrating it more quickly than developing countries that still face access and infrastructure constraints. Moving forward, investment in digital infrastructure, more flexible regulations, and training for health workers and patients will be key to ensuring that telemedicine remains sustainable and integrated with traditional healthcare systems.

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