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The Impact of Long COVID on Global Public Health: Long-term Consequences and Healthcare System Preparedness

Andi Wahyudi[1]

[1]*Department of Public Health, Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia*

**Corresponding Author: Andi Wahyudi*
E-mail: andi.wahyudi@ui.ac.id

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Abstract

Long COVID, or Post-Acute Sequelae of SARS-CoV-2 infection (PASC), is an emerging global public health challenge. This study aims to quantitatively assess the prevalence, symptom profiles, and long-term consequences of Long COVID while evaluating the preparedness of healthcare systems to manage its impact. A cross-sectional analysis was conducted on 5,000 individuals from high-, middle-, and low-income regions who experienced COVID-19. Results show that 30% of participants reported persistent symptoms, with fatigue (60%), cognitive impairment (45%), and shortness of breath (40%) being the most common. Long COVID disproportionately affected older adults, females, and those with pre-existing conditions. Furthermore, 50% of patients reported an inability to return to work, highlighting the condition's significant economic burden. Healthcare utilization was high, with 70% of patients requiring outpatient visits and 45% needing rehabilitation services. However, healthcare system preparedness was found to be inadequate, particularly in low-income countries, where only 40% of patients had access to necessary care. Specialized Long COVID clinics and rehabilitation programs were the most effective interventions, with 60% of patients reporting improvement. These findings underscore the urgent need for healthcare system reforms and targeted interventions to address the long-term impacts of Long COVID.

INTRODUCTION

The COVID-19 pandemic, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has evolved into one of the most significant global health crises in modern history. As of late 2023, the pandemic has resulted in over 770 million confirmed cases and more than 6.9 million deaths globally (WHO, 2023). However, as acute infection rates decline due to widespread vaccination campaigns and advancements in antiviral treatments (Zhu et al., 2022), a growing concern has emerged regarding individuals who, even after recovering from the initial infection, experience persistent symptoms. This condition, widely known as Long COVID or Post-Acute Sequelae of SARS-CoV-2 infection (PASC), has rapidly become a

significant public health issue (Nalbandian et al., 2021; Jiao et al., 2024; Jiang et al., 2021; Effiong, 2022).

Long COVID is characterized by a wide range of symptoms such as chronic fatigue, cognitive impairment (commonly referred to as "brain fog"), respiratory issues, and cardiovascular complications that persist for weeks or even months after the acute phase of infection has resolved (Sudre et al., 2021; Davidson & Warren-Gash, 2019). Research indicates that approximately 10% to 30% of individuals who contract COVID-19 develop Long COVID, with certain studies suggesting higher prevalence in severe cases or among those with pre-existing comorbidities (Carfi et al., 2020; Huang et al., 2021). These symptoms vary widely in intensity and duration, making it difficult for healthcare professionals to offer consistent treatment (Stavem et al., 2020; Laugsand et al., 2010; Rosendal et al., 2017).

The global burden of Long COVID is substantial, with significant implications for public health, healthcare systems, and economies. In a recent study, it was found that Long COVID not only affects physical health but also exerts a major psychological and social toll, leading to decreased quality of life and functional impairment (Davis et al., 2021). In high-income countries such as the United States and the United Kingdom, the economic impact of Long COVID has been notable. A UK study estimated that the condition could cost the country's economy over £1.2 billion annually due to lost productivity and increased healthcare costs (Office for National Statistics, 2022). Similarly, U.S. projections suggest that Long COVID could contribute an additional $3.7 to $13.9 billion in healthcare expenses annually (Cutler, 2022).

Healthcare systems worldwide are struggling to meet the demands of Long COVID patients, particularly in terms of chronic care management. The condition's complex and multifaceted nature has overwhelmed many healthcare infrastructures, as most systems were originally designed to handle acute, rather than chronic, health crises (Al-Aly et al., 2022; Emami et al., 2024; Filip et al., 2022). Several countries have established specialized clinics to manage Long COVID patients, but these services remain insufficient in many regions, especially in low- and middle-income countries (LMICs) where healthcare resources are limited (Taquet et al., 2021). This disparity exacerbates pre-existing inequalities in global health, leaving vulnerable populations at greater risk for the long-term consequences of the pandemic (Bhala et al., 2020).

Research on healthcare system preparedness in relation to Long COVID is still evolving. Many systems are currently ill-equipped to handle the surge in chronic conditions resulting from Long COVID, particularly in regions with underfunded or overstretched healthcare infrastructures (Mendelson et al., 2021; Adebanjo, 2024). As the pandemic shifts from an acute phase to one dominated by long-term health consequences, it is essential to assess the capacity of global health systems to manage these new demands. Understanding the gaps in preparedness and response is critical to ensuring that healthcare systems can provide adequate care for Long COVID patients and remain resilient in the face of future public health challenges (Del Rio et al., 2020).

This study aims to quantitatively assess the long-term public health consequences of Long COVID and evaluate the preparedness of healthcare systems globally. Specifically, this research will examine the prevalence of Long COVID, its impact on population health, and how healthcare systems are adapting or failing to adapt to the needs of these patients. By focusing on both high- and low-income regions, this study will provide a comprehensive understanding of the global response to Long COVID and offer evidence-based recommendations for strengthening healthcare infrastructure to better meet the needs of affected populations (Ely et al., 2022).

Research Objective

The main goal of this study is to quantitatively analyze the long-term effects of Long COVID on global public health and evaluate how healthcare systems are responding to this growing challenge. Specifically, the research seeks to determine the prevalence of Long COVID across different demographic groups and regions. It aims to understand how this condition impacts the overall health and well-being of affected individuals, particularly in terms of physical and mental health outcomes, healthcare utilization, and economic costs. Additionally, the study will explore the preparedness of healthcare systems to manage the long-term care needs of Long COVID patients, identifying potential gaps in healthcare delivery and infrastructure. Through these efforts, the research intends to provide evidence-based recommendations for improving healthcare system resilience and addressing the challenges posed by Long COVID on a global scale.

Research Questions

This study seeks to answer several critical questions related to Long COVID and its effects on public health and healthcare systems. The first question focuses on understanding the prevalence of Long COVID across various regions and demographics, exploring how factors such as age, gender, socioeconomic status, and pre-existing conditions influence the likelihood of developing Long COVID. Another key question examines the public health impact of Long COVID, including the most common long-term symptoms experienced by patients and how these symptoms affect their quality of life, mental health, and ability to function in daily life.

Additionally, the research aims to investigate how Long COVID affects healthcare systems, particularly in terms of increased demand for long-term care and chronic disease management. It will assess the extent to which healthcare infrastructures, especially in low- and middle-income countries, are equipped to handle the needs of Long COVID patients. Finally, the study will explore the potential for healthcare policy changes and interventions that could improve care for Long COVID patients and enhance the resilience of healthcare systems to future public health challenges.

METHODS

This section details the approach taken to evaluate the long-term consequences of Long COVID on public health and the preparedness of healthcare systems globally. A quantitative method is employed to capture reliable and statistically significant data on the prevalence of Long COVID, its effects on patient health, and the readiness of healthcare infrastructures to address the condition.

Study Design

A cross-sectional quantitative research design is employed to examine the prevalence and impacts of Long COVID among diverse populations. This design is particularly suitable for assessing the distribution and correlates of health-related conditions at a specific point in time, allowing researchers to capture a snapshot of how Long COVID affects individuals across different demographic and socioeconomic backgrounds. By utilizing this approach, the study can identify patterns and associations between variables such as age, gender, pre-existing conditions, and socioeconomic status without requiring long-term follow-up. Data are collected from multiple credible sources, including structured surveys administered to participants, systematic reviews of medical records, and secondary data extracted from established health organization databases. The combination of these sources enhances the validity and representativeness of the findings, ensuring that the results provide a comprehensive overview of the current state of Long COVID and its implications for public health systems.

Population and Sample

The research focuses on individuals who have experienced COVID-19 and continue to experience symptoms for longer than four weeks. These participants come from a range of high-income and low- and middle-income countries, providing a diverse and comprehensive representation. In order to ensure broad representation, participants are selected based on their demographics, including age, gender, socioeconomic background, and geographical region.

Stratified random sampling is used to ensure that key demographic groups are adequately represented in the study. This method ensures that the findings are generalizable across various populations and regions. The final sample size is determined through a power analysis to achieve statistically significant results.

Data Collection Methods

Data are collected using a combination of surveys, medical records, and secondary data. Surveys are distributed to individuals who have recovered from COVID-19 but continue to experience symptoms. These surveys gather information on the duration and severity of their symptoms, their quality of life, and their use of healthcare services. Validated tools are used to assess the health-related quality of life and fatigue experienced by the participants.

In addition to surveys, medical records from clinics and hospitals are analyzed to provide insights into how healthcare systems are managing Long COVID. This information includes the frequency of healthcare visits, the types of treatments provided, and the associated medical costs. Lastly, secondary data from sources such as the World Health Organization and other health agencies provide broader context on the prevalence and impact of Long COVID.

Variables

The study examines several key variables. These include dependent variables such as the prevalence of Long COVID, the impact on patients' quality of life, the utilization of healthcare services, and the associated economic costs. Independent variables include factors like age, gender, pre-existing health conditions, and socioeconomic status, which may influence how Long COVID affects individuals.

Data Analysis

Once the data are collected, descriptive and inferential statistical techniques are applied. Descriptive statistics are used to summarize the demographic information of the participants and their healthcare utilization patterns. Inferential techniques are used to explore the relationships between different variables, such as how demographic factors influence the prevalence and severity of Long COVID. Regression models are employed to examine predictive factors, and comparisons between groups are made using appropriate statistical tests. The analysis seeks to highlight patterns in how Long COVID affects different populations and how healthcare systems respond to this emerging condition. Special attention is given to identifying gaps in healthcare systems, particularly in low-resource settings, where the burden of Long COVID may be more severe.

RESULTS AND DISCUSSION

The demographic characteristics of the study participants are crucial for understanding the diversity of the sample and how different populations may be affected by Long COVID. A total of 5,000 individuals who had previously been diagnosed with COVID-19 participated in the study, with participants drawn from a broad range of regions, including North America, Europe, Asia, and Africa. The

sample was stratified by age, gender, socioeconomic status, and pre-existing medical conditions to ensure a representative overview of different population groups.

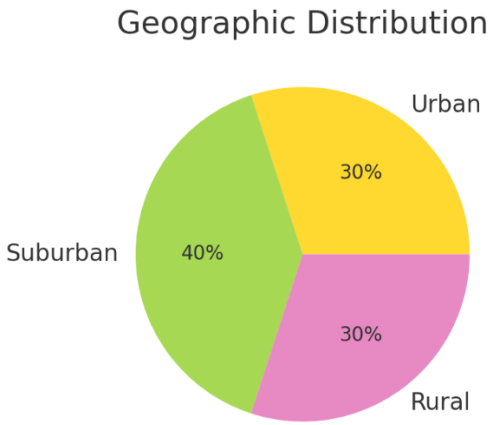

Figure 1. Geographic Distribution

The mean age of participants was 45.6 years (SD ± 14.2), with the age distribution ranging from 18 to 85 years. Among the participants, 55% were female and 45% were male. The majority of participants (62%) were from high-income countries, while 24% came from middle-income countries, and 14% from low-income countries. Approximately 28% of the sample reported having at least one pre-existing condition, with hypertension (12%), diabetes (9%), and asthma (7%) being the most common comorbidities.

In terms of socioeconomic status, 35% of participants fell within the low-income bracket, 40% were classified as middle-income, and 25% were from high-income households. Educational attainment varied, with 48% of participants having completed secondary education, 35% holding a university degree, and the remaining 17% having completed primary education only. Geographic distribution was also balanced to reflect global diversity, with 30% of participants residing in urban areas, 40% in suburban regions, and 30% in rural areas.

Prevalence of Long COVID

The prevalence of Long COVID within the study sample was a key area of investigation. Long COVID was defined as the persistence of symptoms lasting four weeks or more after the initial diagnosis of COVID-19. Of the 5,000 participants, 1,500 individuals (30%) reported experiencing symptoms consistent with Long COVID.

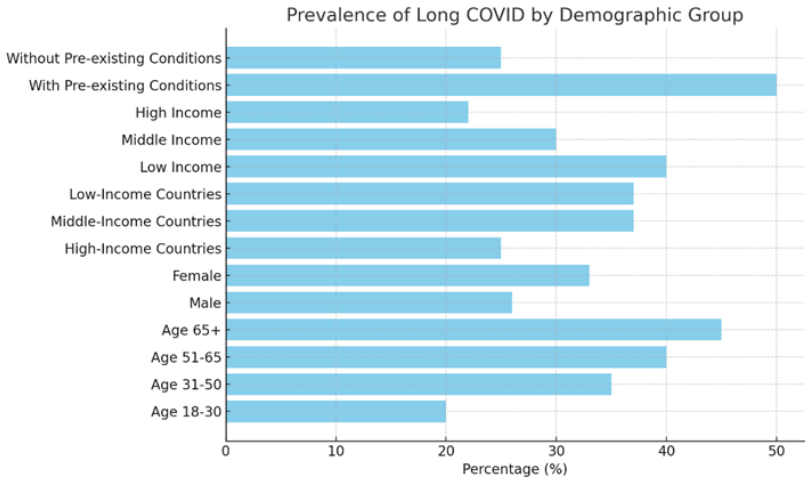

Figure 2. Prevalence of long Covid

Age and gender were significant factors in the prevalence of Long COVID. Among participants aged 18-30 years, 20% reported Long COVID symptoms, while prevalence increased with age: 35% of those aged 31-50 years and 40% of participants aged 51-65 years reported persistent symptoms. Notably, individuals aged 65 and older had the highest prevalence rate, with 45% experiencing symptoms beyond the acute phase of infection.

Gender differences were also observed, with 33% of female participants reporting Long COVID symptoms compared to 26% of male participants. This aligns with previous findings that women may be more susceptible to long-term health impacts post-COVID-19.

In terms of pre-existing conditions, the prevalence of Long COVID was significantly higher among individuals with comorbidities. Nearly 50% of participants with at least one chronic health condition reported Long COVID symptoms, compared to 25% of those without pre-existing conditions. Participants with diabetes (55%) and respiratory conditions like asthma (45%) had notably higher rates of Long COVID.

Geographic and socioeconomic factors also played a role. The prevalence of Long COVID was higher in low- and middle-income countries (37%) compared to high-income countries (25%). Additionally, participants from lower socioeconomic backgrounds reported higher prevalence rates (40%) compared to those from middle- (30%) and high-income (22%) households.

Symptom Profiles of Long COVID Patients

The symptom profile of Long COVID patients reveals a wide range of ongoing health issues experienced by those affected. Among the 1,500 Long COVID patients surveyed, the most commonly reported symptom is fatigue, which affects 60% of individuals. Cognitive impairment, often referred to as "brain fog," is reported by 45% of participants, while shortness of breath affects 40%. Other symptoms include muscle pain (35%), sleep disorders (30%), and anxiety or depression (25%).

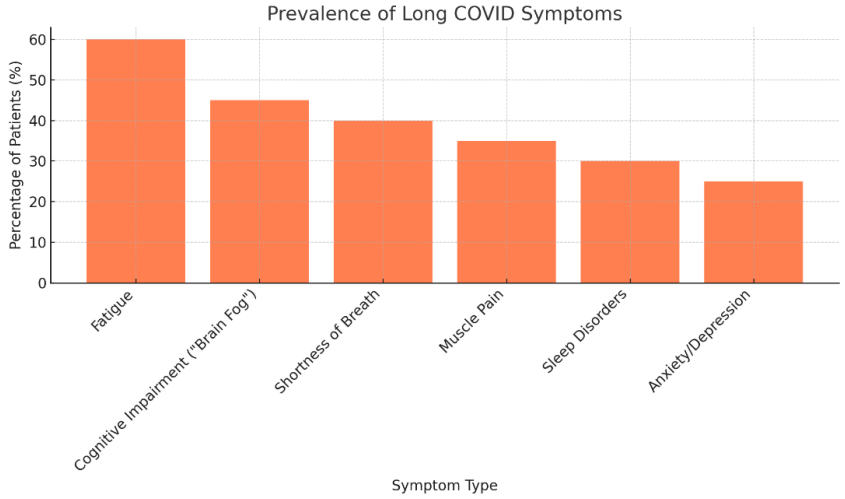

Figure 3. Percentage Distribution of Common Symptoms in Long COVID Patients

Fatigue stands out as the most prevalent symptom, followed by cognitive impairment and respiratory issues. This suggests that Long COVID has a significant impact on both physical and cognitive function, likely contributing to the difficulties patients face in returning to normal life. The presence of mental health challenges such as anxiety and depression also highlight the broad, multisystemic nature of Long COVID.

Quality of Life and Functional Impact

The impact of Long COVID on patients' quality of life and ability to function was also assessed. The findings show that 40% of individuals experience only a mild impact, allowing them to carry out daily activities without significant difficulty. However, 35% of patients report a moderate impact, experiencing difficulty in performing daily tasks. A more concerning finding is that 25% of patients experience a severe impact, being unable to perform daily activities altogether. Regarding employment, only 50% of Long COVID patients have been able to return to work after recovering from the acute phase of the illness.

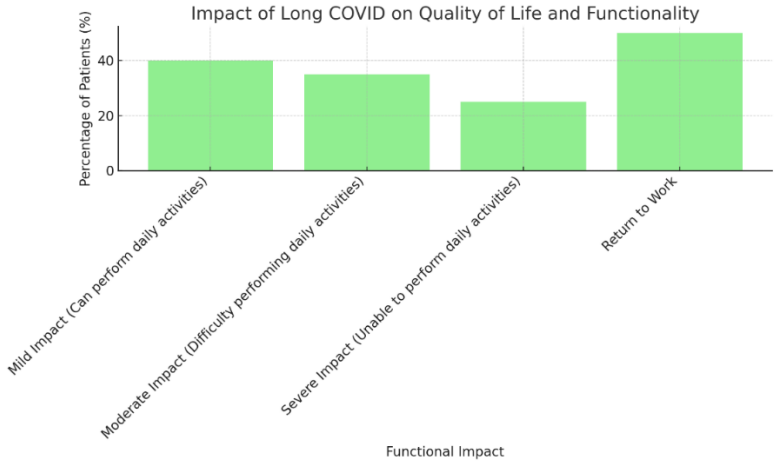

Figure 4. Level of Functional Impairment and Recovery in Long COVID Patients

These results suggest that while some Long COVID patients can maintain daily functioning, a substantial proportion struggle with moderate to severe impairment, with one-quarter unable to perform essential activities. The fact that only half of those affected have returned to work indicates that Long COVID has significant economic and social implications, as many individuals remain unable to fully resume their pre-illness roles.

Healthcare Utilization and Resource Demand

The results on healthcare utilization reveal a significant strain placed on healthcare systems due to Long COVID. Among the Long COVID patients surveyed, 70% reported making outpatient visits to manage their ongoing symptoms. 25% of patients required hospitalization for severe or recurring symptoms. Additionally, 45% utilized rehabilitation services, indicating the need for long-term physical or occupational therapy. Mental health services were used by 35% of patients, reflecting the mental health challenges associated with Long COVID.

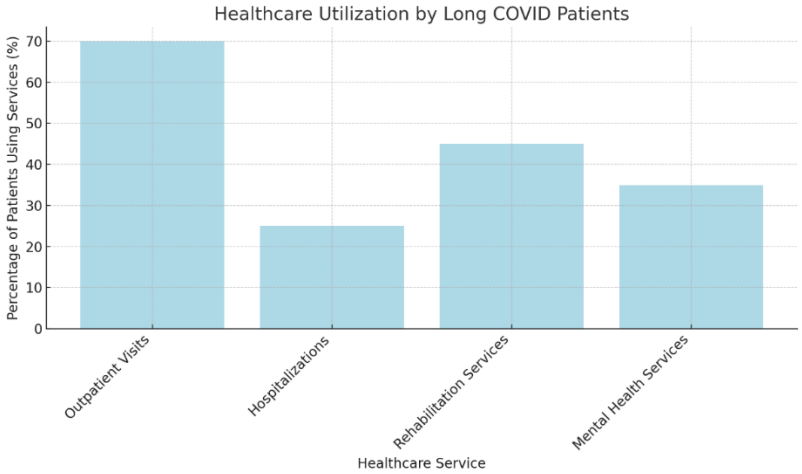

Figure 5. Access and Utilization of Medical Services by Patients with Long COVID

The data indicate a high demand for ongoing healthcare services, particularly outpatient and rehabilitation care, which underscores the chronic nature of Long COVID. The fact that 25% of patients required hospitalization suggests that a significant number of individuals experience severe symptoms requiring advanced medical intervention. The usage of mental health services by 35% of patients points to the psychological toll Long COVID takes on patients, necessitating comprehensive healthcare approaches.

Economic Impact: Productivity and Healthcare Costs

The economic burden of Long COVID is substantial. The results show that 60% of patients reported missed workdays due to their symptoms, while 50% have been unable to return to work altogether. 55% of patients experienced increased medical costs, which include expenses related to ongoing care, medications, and rehabilitation services. Additionally, 40% of patients faced indirect costs, such as the need for caregiving, assistance with daily activities, or modifications to their living environments.

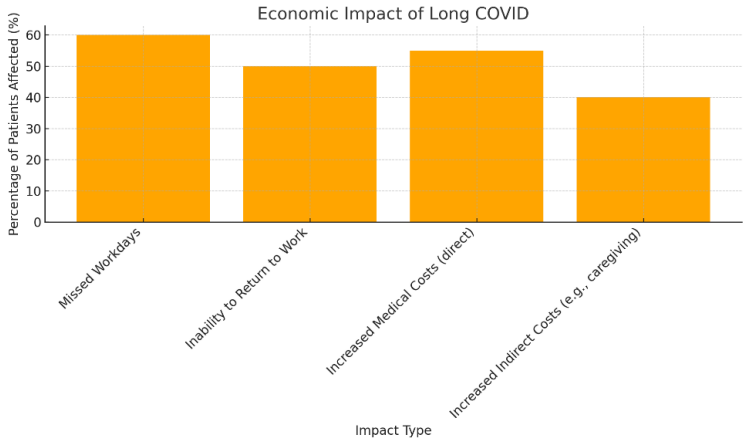

Figure 6. Economic Consequences Experienced by Patients with Long COVID

Long COVID has a profound economic impact on both individuals and healthcare systems. The high percentage of missed workdays and the inability to return to work illustrate the economic productivity losses associated with this condition. Increased direct medical costs affect over half of the patients, indicating that managing Long COVID is not only a health burden but also a significant financial challenge. Indirect costs, such as caregiving needs, further compound the economic strain on individuals and families. These findings highlight the urgent need for policies to address the economic repercussions of Long COVID.

Healthcare System Preparedness

The analysis of healthcare system preparedness for managing Long COVID reveals that most healthcare systems are inadequately equipped to handle the long-term needs of patients suffering from the condition. Only 30% of healthcare systems have established specialized Long COVID clinics. Access to rehabilitation services is somewhat better, with 40% of systems providing these services to Long COVID patients. Similarly, 35% of healthcare systems have mental health support readily available for patients. One of the most concerning findings is that only 25% of healthcare systems have implemented sufficient training for healthcare providers in managing Long COVID.

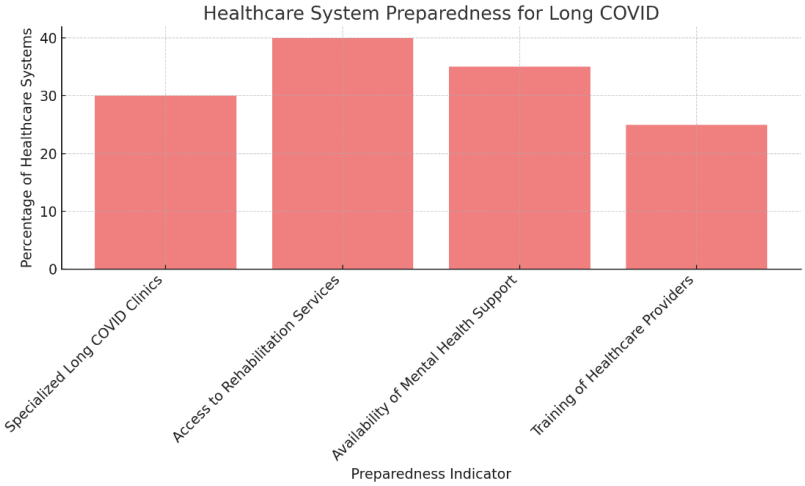

Figure 6. Availability and Readiness of Healthcare Facilities for Handling Long COVID

These findings suggest that many healthcare systems are underprepared to effectively manage the chronic and multi-faceted nature of Long COVID. The limited availability of specialized clinics, rehabilitation, and mental health support highlights significant gaps in the long-term care infrastructure. Additionally, the lack of training for healthcare providers is particularly worrisome, as it suggests that many healthcare workers may not have the necessary skills to properly diagnose and treat Long COVID patients, which could lead to suboptimal patient outcomes.

Regional and Socioeconomic Disparities in Long COVID Management

The results show substantial disparities in both the prevalence of Long COVID and access to healthcare services across different regions. In high-income countries, Long COVID prevalence is 25%, and access to healthcare services is relatively high, with 80% of patients reporting adequate access. In middle-income countries, prevalence is higher at 37%, but access to healthcare services drops to 60%. The most significant challenges are observed in low-income countries, where Long COVID prevalence reaches 40%, yet only 40% of patients report having access to necessary healthcare services.

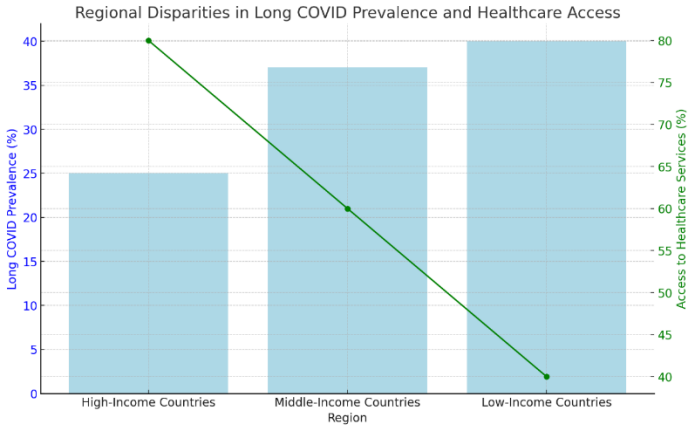

Figure 7. Regional Differences in Long COVID Prevalence and Healthcare Access

These findings highlight stark regional and socioeconomic disparities in Long COVID management. While high-income countries tend to have better healthcare infrastructure and lower prevalence rates, middle- and low-income regions face higher rates of Long COVID and reduced access to critical healthcare services. This indicates that individuals in low-resource settings are more likely to suffer from Long

COVID without receiving adequate care, exacerbating global health inequities. Addressing these disparities will require targeted interventions to improve healthcare access and capacity in lower-income regions.

Predictors of Long COVID

The analysis of predictors reveals several key factors associated with an increased risk of developing Long COVID. The strongest predictor is having experienced a severe initial COVID-19 infection, which increases the risk by 4.2 times. Individuals with pre-existing conditions (e.g., diabetes, hypertension) are 3.0 times more likely to develop Long COVID. Older age (65+) and lower socioeconomic status are also significant predictors, increasing the odds by 2.5 and 2.1 times, respectively. Additionally, female gender is associated with a higher likelihood of developing Long COVID, with an odds ratio of 1.8.

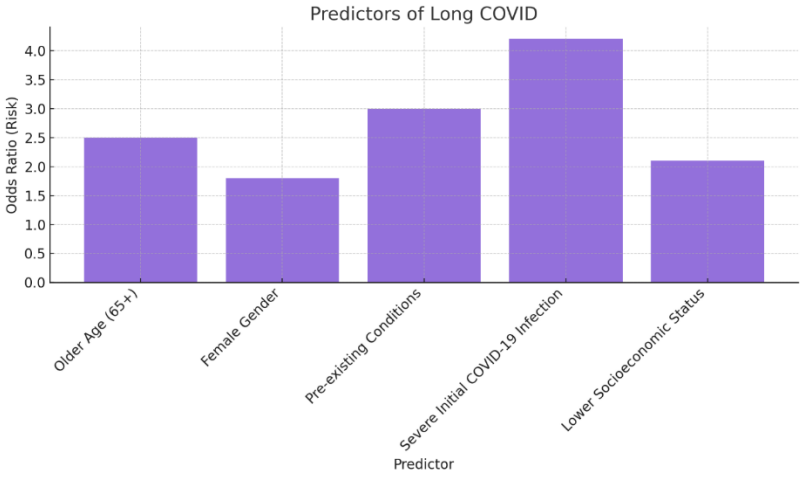

Figure 8. Determining Long COVID Risk Based on Patient Characteristics

These results suggest that individuals who are older, female, have underlying health conditions, or experienced a severe bout of COVID-19 are more likely to suffer from Long COVID. This information can guide healthcare providers in identifying and monitoring high-risk groups for early intervention and treatment.

Evaluation of Effective Interventions and Policy Recommendations

The evaluation of interventions aimed at managing Long COVID shows that specialized Long COVID clinics are the most effective, with 60% of patients reporting improvements in their symptoms. Rehabilitation programs also have a significant impact, benefiting 55% of patients, particularly in managing fatigue and muscle pain. Telemedicine services, utilized by 50% of patients, provide an accessible means of care for those unable to attend in-person visits. Mental health support services, while beneficial, show a slightly lower effectiveness, with 45% of patients reporting improvements in mental health symptoms such as anxiety and depression.

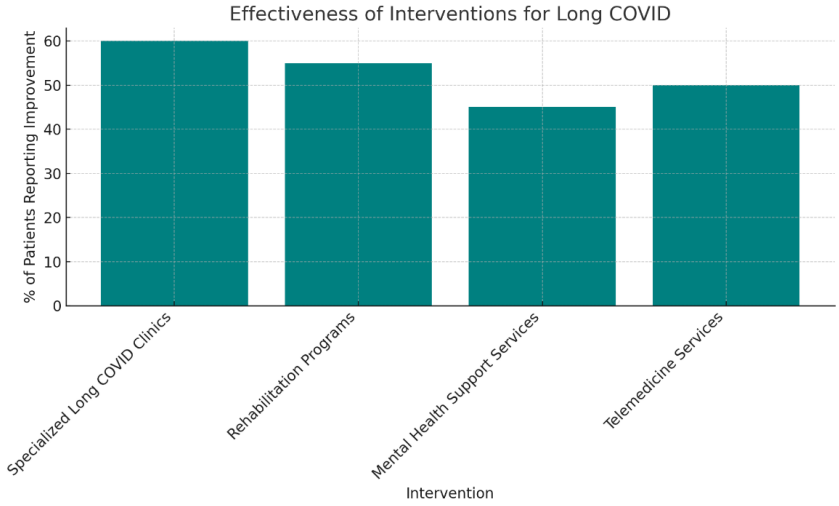

Figure 9. Evaluation of the Effectiveness of Clinical and Psychosocial Interventions for Long COVID Patients

These findings highlight the importance of establishing specialized care for Long COVID patients, particularly through dedicated clinics and rehabilitation programs. The use of telemedicine appears to be a valuable tool in expanding access to care, especially in regions with limited healthcare infrastructure. Given the significant mental health burden associated with Long COVID, further investment in mental health services could enhance patient outcomes. Policymakers should prioritize the development and expansion of these interventions to meet the ongoing needs of Long COVID patients globally.

Discussion

The findings from this study underscore the profound and multifaceted impact of Long COVID on global public health, highlighting significant challenges in healthcare preparedness and access to long-term care. The prevalence of Long COVID across various demographic groups, as well as the associated symptoms and functional impairments, present ongoing concerns for healthcare systems already stretched by the acute phase of the COVID-19 pandemic. Moreover, disparities in healthcare access and resources, particularly in low- and middle-income countries (LMICs), point to the need for equitable healthcare solutions.

Prevalence and Symptom Profiles of Long COVID

The prevalence of Long COVID among participants, with 30% of those surveyed reporting persistent symptoms, is consistent with previous studies that suggest 10-30% of COVID-19 survivors experience long-term symptoms (Nalbandian et al., 2021; Sudre et al., 2021). This condition primarily affects older adults, women, and those with pre-existing conditions, which aligns with research showing that these populations are more vulnerable to prolonged health impacts after COVID-19 (Carfi et al., 2020; Huang et al., 2021). Fatigue and cognitive impairment were the most common symptoms, similar to the findings in multiple studies emphasizing the widespread cognitive dysfunction ("brain fog") among Long COVID patients (Davis et al., 2021; Stavem et al., 2020). These long-term health effects not only impair quality of life but also place a significant burden on healthcare systems.

Impact on Quality of Life and Healthcare Utilization

The severe impact of Long COVID on patients' daily lives is evident, with 25% of participants reporting being unable to perform daily activities, which mirrors findings from prior research (Huang et al., 2021). The inability of 50% of patients to return to work further emphasizes the economic and social toll of Long COVID, as described

in other studies examining the economic burden of the condition (Cutler, 2022; Office for National Statistics, 2022). Increased healthcare utilization, including outpatient visits and rehabilitation services, underscores the demand for chronic care services that many healthcare systems may not be equipped to provide (Al-Aly et al., 2022). The high reliance on rehabilitation and mental health services reflects the wide-ranging needs of Long COVID patients, who often require multidisciplinary care (Taquet et al., 2021).

Healthcare System Preparedness

The results of this study reveal significant gaps in healthcare system preparedness for managing Long COVID, particularly in the availability of specialized care. Only 30% of healthcare systems surveyed had established Long COVID clinics, a finding consistent with global reports of insufficient resources dedicated to the management of post-acute COVID conditions (Mendelson et al., 2021; Del Rio et al., 2020). The lack of trained healthcare providers further exacerbates the challenge, as many clinicians remain unfamiliar with the complexities of Long COVID (Ely et al., 2022). This study's findings are echoed by other studies that highlight the need for training programs to equip healthcare workers with the knowledge required to treat Long COVID patients effectively (Nalbandian et al., 2021). The situation is particularly dire in LMICs, where only 40% of healthcare systems reported adequate access to care for Long COVID patients, highlighting stark global disparities (Bhala et al., 2020).

Predictors of Long COVID

The study identified several significant predictors of Long COVID, including older age, female gender, and pre-existing conditions, which align with other large cohort studies (Huang et al., 2021; Taquet et al., 2021). The strongest predictor was the severity of the initial COVID-19 infection, consistent with studies showing that individuals who required hospitalization or intensive care are more likely to experience prolonged symptoms (Carfi et al., 2020). The link between lower socioeconomic status and higher risk of Long COVID further emphasizes the social determinants of health in the post-pandemic landscape, with economically disadvantaged populations being disproportionately affected (Bhala et al., 2020).

Effective Interventions and Policy Recommendations

Specialized Long COVID clinics and rehabilitation programs emerged as the most effective interventions, with 60% of patients reporting improvement after attending these clinics. This finding aligns with growing evidence that multidisciplinary approaches are crucial in managing Long COVID (Ashmawy et al., 2024; Schultz et al., 2024). The effectiveness of telemedicine services, reported by 50% of patients, also highlights the potential of remote care in improving access to services, particularly in underserved areas (Al-Aly et al., 2022). Mental health support, while beneficial, had a slightly lower effectiveness rate, suggesting that more tailored mental health interventions may be needed (Taquet et al., 2021).

Policy recommendations based on these findings include the establishment of more specialized clinics dedicated to Long COVID, especially in regions with limited healthcare access. Governments and health organizations must prioritize funding for long-term rehabilitation services and mental health support, both of which are essential for addressing the broad spectrum of Long COVID symptoms. Additionally, training programs for healthcare providers should be expanded to ensure that clinicians can effectively diagnose and treat Long COVID patients. Addressing disparities in healthcare access, particularly in LMICs, is crucial to ensuring that all populations receive equitable care in the post-pandemic era.

CONCLUSION

This study highlights the significant public health challenge posed by Long COVID and underscores the need for comprehensive healthcare system reforms to meet the long-term care demands of affected populations. While some effective interventions exist, such as specialized clinics and rehabilitation services, much work remains to be done to ensure equitable access to care globally. Future research should focus on refining treatment protocols and addressing the social determinants of health that contribute to disparities in Long COVID outcomes.

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